



REVIEW OF THE REPUBLIC OF KOREA'S NATIONAL STRATEGY FOR GREEN GROWTH

December 2009

**Prepared by the United Nations Environment Programme
as part of its Green Economy Initiative**

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Purpose of this report

This report is produced by the United Nations Environment Programme (UNEP) as part of its Green Economy Initiative. The purpose of this report is to present a review of the Republic of Korea's National Strategy for Green Growth announced in August 2008. The report also examines Korea's Green New Deal launched in January 2009 along with the Five-Year Plan for Green Growth released in July 2009.

The focus of the report is to examine strategies and policy goals set under Korea's green growth plan and how they would be pursued in the various sectors covered in the Five-Year Plan.

The objectives of the review are:

- 1) to explain a major change in strategic thinking and economic policy in the Republic of Korea, towards green growth;
- 2) to outline the plans that the Republic of Korea has put in place to achieve this vision;
- 3) to discuss the general approach and elements of the Republic of Korea's National Strategy for Green Growth relative to the issues outlined in UNEP's publication "Global Green New Deal: A Policy Brief", published in March 2009; and finally,
- 4) to provide policy advice and recommendations, drawing on international experience and input by relevant experts and stakeholders.

Acknowledgement

This report was prepared by the United Nations Environment Programme, as part of its Green Economy Initiative. The report benefited from consultations and communications with the Republic of Korea's Prime Minister's Office; the Republic of Korea's Presidential Committee on Green Growth; the Ministry of Environment; the Office of National River Restoration - Ministry of Land, Transport and Maritime Affairs; the Republic of Korea Chamber of Commerce and Industry; the Republic of Korea's Green Growth Forum. The report benefited also from communication, information and views provided by civil society groups in the Republic of Korea.

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The views and opinions expressed in this report are the sole responsibility of the authors, and do not necessarily reflect those of the institutions and individuals indicated above.

Foreword

On 15 August 2008, at a national address on the 60th anniversary of the Republic of Korea, President Lee Myung-Bak announced a “low-carbon, green growth” strategy as a new vision to guide the nation’s long-term development. Six months later, in January 2009, the Government of the Republic of Korea responded to the deepening recession with an economic stimulus package equivalent to US\$ 38.1 billion of which 80 per cent (the highest ratio among comparable packages from other G20 governments) was allocated to environmental themes such as fresh-water, waste, energy-efficient buildings, renewable energies, low-carbon vehicles, and the rail network.

Meanwhile, in March 2009, UNEP released a Policy Brief on a Global Green New Deal, encouraging governments to seize the opportunity presented by the massive fiscal response to the financial and economic crisis to direct public spending and private investment in green sectors such as green construction, renewable energies, sustainable transport, sustainable agriculture, and restoring ecological infrastructure, especially forests and freshwater bodies. The UNEP Policy Brief argued that an investment of 1 per cent of global GDP over the next two years could provide the critical mass of green investment needed to reduce carbon dependency and to seed a significant greening of the global economy. UNEP was pleased to observe that the Republic of Korea’s Green New Deal stimulus package exceeded the recommendations in its allocation of stimulus towards green infrastructure and lowering carbon dependency.

More recently, on 6 July 2009, the Republic of Korea announced a Five-Year Plan for Green Growth to serve as a medium-term plan for implementing the National Strategy for Green Growth over the period 2009-2013. With total funding of US\$ 83.6 billion, representing 2 per cent of GDP, this Five-Year Plan intends to turn the strategy into concrete and operational policy initiatives towards achieving green growth.

One of the interesting, but least reported, aspects of the current economic recovery efforts is that over two-thirds of global green stimulus has in fact been committed in Asia, led by China, the Republic of Korea, Japan and Australia.

By extending the Green New Deal into a full five-year development plan, the Republic of Korea has signalled that it believes that green growth is a strategy well beyond current economic recovery efforts, and that it wants to create a green economic future for the Republic of Korea. The Republic of Korea has committed itself to moving away from the traditional “brown economy” growth-at-any-cost model to a “green economy” model where long-term prosperity and sustainability are the key objectives. This commitment by the Republic of Korea has the potential of creating a domino effect on the other major Asian economies.

The Republic of Korea is more vulnerable than average to the effects of climate change, and more exposed than most to fossil fuel dependence. During 1912-2008, average surface temperatures in the Republic of Korea rose 1.74°C, which is above the world average. The Republic of Korea has shown the seriousness of its resolve on mitigation by announcing, unilaterally and, despite being a non-Annex I Party to the United Nations Framework Convention on Climate Change/Kyoto Protocol (i.e. not required to take on emissions reductions), a voluntary emission reduction targets. The Republic of Korea is 97 per cent dependent on fossil-fuel imports out of their total energy demand, and thus highly exposed to oil price shocks, as well as any secular rise in oil prices due to the observed peaking of oil. In their strategy now, the share of new and renewable energy

in total energy supply is planned to go up from 2.7 per cent (2009) to 3.78 per cent (2013), and more than doubling to 6.08 per cent (2020). UNEP encourages an even more aggressive target to improve the Republic of Korea's future energy security and to further support its strategy and plans for green growth.

Freshwater scarcity has long been, and still is, a critical challenge facing Korea. With global warming likely to continue, the levels of flooding and drought are expected to worsen. The large investment (US\$ 13 billion equivalent, or one-third of the fiscal stimulus) in the Four Major River Restoration Project has, among its five key objectives, securing sufficient water resources against water scarcity, implementing comprehensive flood control measures, and improving water quality whilst restoring the river-basin ecosystems. UNEP recommends that each of these objectives be pursued with due consideration of the environmental and cost effectiveness of options which are based on ecological restoration, as they not only addresses a vital ecological scarcity, do so at minimal risk, but could also serve as useful forms of adaptation to the onset of climate change.

UNEP encourages serious efforts to ensure environmental integrity of the green growth projects, in particular those that may present risks to sensitive ecosystems and biodiversity. To that effect prior and full environmental impact assessments should be undertaken, through effective and participatory processes to enhance public support.

The overview presented in UNEP's earlier "Interim Report" has been incorporated into this "Final Report" submitted by UNEP to the Government of the Republic of Korea. These reports were prepared to further UNEP's strategy of supporting the Republic of Korea and other governments to engender deep change which targets a "Green Economy": an Economy of Permanence, one which generates wealth and well-being, increases decent employment, reduces poverty and inequality, and does so without over-consuming natural capital or creating unacceptable ecological scarcities and climate risks.

Pavan Sukhdev

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Executive Summary

- Transforming the global economy away from dependence on fossil fuels and unsustainable use of the Earth's limited resources is not an option; it is a fundamental requirement for the survival of our economic and social systems in the 21st century.
- The Republic of Korea's National Strategy and Five-Year Plan for Green Growth represent a major attempt to fundamentally transform the country's growth paradigm from "quantitative growth" to low-carbon, "qualitative growth".
- The Republic of Korea's green growth strategy contains encouraging policy goals and targets to tackle climate change and enhance energy security, create new engines of growth through investment in environmental sectors, and develop ecological infrastructure.
- The commitment to spend 2 per cent of gross domestic product (GDP) over the next five years for investment in areas such as green technologies, resource and material efficiency, renewable energies, sustainable transport, green buildings and ecosystem restoration, is an effort to reorient and refocus investment in the environment that is remarkable even by OECD standards.
- The Republic of Korea responded to the economic crisis with a stimulus package that included a significant portion of green spending. The Republic of Korea has been particularly efficient in the actual disbursement of its fiscal stimulus, with almost 20 per cent of funds disbursed at the end of the first half of 2009, compared to 3 per cent for most countries.
- Beyond its policies at the national level, the Republic of Korea is demonstrating engagement and leadership at the international level by boosting global efforts towards achieving a green economy. The Republic of Korea was instrumental in the adoption of a Declaration on Green Growth by the OECD Ministerial Council Meeting on 25 June 2009. It is also playing a key role in promoting an East Asia Climate Partnership.
- However, there are several areas in which the Republic of Korea's green growth strategy could be further improved in order to be comprehensive and effective in its attempt to achieve a transformation to a green economy.

Climate Change

- Given its status as a non-Annex I Party to the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC), the Republic of Korea's announcement of a national mid-term target to reduce its greenhouse gas (GHG) emissions by 30 per cent by 2020 from its otherwise projected growth is very encouraging. While the nature and level of the carbon emission reductions that the Republic of Korea may have to undertake under the framework of global climate change negotiations is yet to be defined, it clearly appears that achieving the objectives of a low-carbon green growth will require an effort to reduce the carbon intensity of the Korean economy and the pace of growth of carbon emissions.
- Under the International Energy Agency's (IEA) reference scenario, which assumes that the level of growth in carbon emissions continues from the 2002 level, the Republic of Korea

would increase its emissions by close to 35 per cent in 2025, compared to less than 15 per cent for the whole of the OECD countries. In the low-emissions scenario, carbon emissions would grow by slightly less than 25 per cent in 2025, compared to 5 per cent for the whole of the OECD countries.

- The green growth strategy must be fully complemented with goals and targets to enable a low-carbon path of development. The Republic of Korea should consider the most ambitious greenhouse gas reduction effort possible, commensurate with the country's growing role as an economic power, and should aim to achieve greater convergence with comparable OECD member countries on GHG emission reduction and carbon intensity targets.
- The creation of a carbon emission trading scheme is an important step forward. But to be successful it should involve effective caps on emissions, a proper coverage of high-emission sectors, and mechanisms for allocation of emission permits that encourage mitigation efforts.
- The Republic of Korea should enhance its capacity to respond and adapt to climate change expected impacts such as sea level rise, flooding, and heavy rains and reduced forest density by carefully assessing the capacity of measures proposed under the green growth plan to achieve such objectives.
- In particular UNEP encourages ecosystem-based adaptation strategies, including through ecological restoration and riparian reforestation. Forests and wetlands that are natural to a large part of the Korean peninsula, and if properly conserved and made more resilient, could play important roles in climate change adaptation, through their 'ecological infrastructure' functions as natural defences against increasing hazards associated with climate change, such as storms, cyclones, flooding and sea-level rise.

Energy Efficiency

- Enhancing energy efficiency is particularly important given that manufacturing and energy-intensive industries remain predominant in the Korean economy. With the world's largest shipbuilding industry and the fifth largest steel production, industry in the Republic of Korea accounts for 42.5 per cent of GDP which is well above the 29 per cent OECD average.
- The 2006 OECD Review noted that "Korea is one of the few OECD countries, which has not improved its energy intensity (energy use per unit of GDP) relative to 1990". In its 2006 Energy Policy Review of Korea, the International Energy Agency noted that Korea's "current energy efficiency targets don't qualify as particularly ambitious".
- The new targets set under the green growth plan to enhance efficiency from 0.290 TOE/ US\$' 000 in 2013 and to 0.233 TOE/US\$' 000 in 2020 appear to be an improvement on the targets in the General Energy Conservation and Efficiency Improvement Plan adopted in 2004. In comparable terms, however, energy intensity remains slightly above that of most IEA member countries.
- The Republic of Korea should seek greater convergence with other OECD countries by gradually raising its energy efficiency targets, with a view to match at least the OECD average.

- The Republic of Korea should monitor voluntary agreements with industry, to ensure they achieve the expected targets, and consider alternative policies in case voluntary targets are not met.

Renewable Energy

- The Republic of Korea has daunting energy challenges. It is the world's fifth largest importer of oil (2007) and the second largest importer of coal (2008). The green growth plan to increase the share of new and renewable energy in total energy supply from 2.7 per cent in 2009 to 3.78 per cent in 2013 and 6.08 per cent in 2020, a doubling of the share of renewables in energy supply, is encouraging.
- The Republic of Korea's renewable energy ambition of 6.08 per cent in 2020 is a limited response to the country's serious energy security challenges. It appears to be an underperformance in comparison with many comparable developed and developing countries. UNEP encourages adoption of a more ambitious target to expand the share of new and renewable sources of energy, in order to meet the critical objective of reducing the country's energy dependence and energy-related carbon emissions.
- In defining future targets for renewable energy supply, the Republic of Korea could consider targets and approaches that have been proposed in other countries, and seek greater convergence with other OECD countries and non-OECD countries that have shown resolve with high targets on renewables.
- The Republic of Korea should ensure that further development of nuclear energy continues to remain in line with best international standards, and that transfer and export of nuclear energy technology contributes to enhancing the safety, stability and economic viability of nuclear power generation in other countries pursuing options of energy generation from nuclear technology.

Transport, Cities and Fuel Efficiency

- The transport sector accounts for 21 per cent of energy consumption in the Republic of Korea, with an annual average increase rate of 6.3 per cent. As the world's fifth largest car manufacturer, the country has an important role to play in enabling greater efficiency in the automobile industry and significantly reducing emissions from the transport sector.
- In the area of fuel economy, countries around the world, including OECD member countries and several other countries, have set fuel economy standards. While the targets and timelines vary, there is growing convergence towards a global average reduction of 50 per cent by 2050, which would be around 25km/litre. The Republic of Korea's target of 15.1km/litre by 2016, from 11km/litre in 2009, is generally in that direction.
- In promoting a technology and innovation-driven automobile industry, the Republic of Korea should formulate specific policies and measures to provide the physical, as well as policy, infrastructure in support of the development of a smart grid system by 2013 to encourage plug-in hybrid and electric vehicles.

- The Republic of Korea could further promote a modal shift by ensuring that non-motorized transport modes are encouraged through the integration of cycling lanes within the larger transport infrastructure, especially public transport, both in urban and rural areas.
- The Republic of Korea should evaluate its current efficiency standards for buildings in order to ensure that they are consistent with best practices of other OECD countries with a comparable climate_s and economic conditions. It should aim for standards and regulations to capture at least 30 per cent energy efficiency potential in its five-year plan or set other early targets to that effect.

Water and Ecological Infrastructure

- While the attempt of ecological restoration of four rivers (Han, Nakdong, Geum and Yeongsan) and their tributaries is commendable, its implementation must follow approaches that will result in effective “restoration” in order to achieve the important policy objectives pursued under this project.
- The approach proposed in the Four Major River Restoration Project relies primarily on technical and hard structure engineering solutions. Additionally, it will be essential to evaluate the full potential of and to employ natural processes of existing ecosystems which can provide many of the ecological infrastructure functions such as regulating water and addressing risks of flooding. Riparian reforestation can play an important role in that respect. The cost-effectiveness of such solutions which restore and use ecological infrastructure should be considered as a potential contribution towards “qualitative growth”.
- The Republic of Korea’s Five-Year Plan for Green Growth needs to give further consideration to the Principles and Guidelines for Wetland Restoration, adopted under the Ramsar Convention on Wetlands. These Principles and Guidelines stress that “to the extent that is possible, ecological engineering principles should be applied in preference to methods requiring hard structures or extensive excavation.”
- There should be a full assessment of the potential impacts of the project on biodiversity, in particular on wetlands, water quality and forest resources. In addition, UNEP encourages monitoring throughout the implementation process. Risks and challenges that may be created need to be carefully assessed, avoided or mitigated in an appropriate manner.
- Such assessment and monitoring should provide opportunities for public participation so as to generate greater public support for the policy objectives pursued under the Four Major River Restoration Project.
- The Korean Government should leave to itself all the various possible options in managing project implementation, including that of a progressive and “phased” implementation of the project with appropriate feedback loops based on monitoring, evaluation, checks and balances at the end of each phase.

Green Technologies

- Industry accounts for a large part of the Korean economy, in proportions that are much higher than in other OECD countries. A technological transformation that reduces the carbon-intensity of industry, in particular in Korea's manufacturing sector, must be a core component of a green growth strategy.
- The Republic of Korea should ensure that specific policy goals and targets are set for the greening of its existing manufacturing sector by reducing carbon and energy intensity, in addition to promoting the emergence of new green industries.
- Government support to the development of new and clean energy technologies should avoid "picking winners", to reduce the risk of creating industries that are built on artificial or economically unsustainable fiscal and pricing support.
- While mobilizing large sums for investment to promote the emergence of a new generation of green technologies, the Republic of Korea should also review other fiscal policies and measures to ensure that the economy pulls in the direction of "Green Growth". Green investment must be complemented by a more comprehensive reform of currently existing incentives and other support mechanisms in carbon and energy-intensive industries.

Policy and Fiscal Reforms

- Carefully tailored, time-bound and targeted fiscal and financial incentives are recognized as essential in facilitating the transition towards a green economy.
- Reforming energy pricing, the launching of a process towards creation of a carbon market, the adoption of tax reform that lowers the tax burden on consumption of low-carbon goods, and the promotion of investment in green sectors are important steps towards a green economy.
- The creation of enabling conditions for low-carbon green growth must, however, be comprehensive. It is essential that harmful policies, including harmful subsidies in energy, transport, agriculture and fisheries that not only lead to economic and market distortions, but also undermine a proper accounting for natural capital, are reformed across the entire economy, or at least be part of a long-term plan.
- In addition, fiscal and financial incentives need to be provided in ways that will not create further production and trade-related distortions at national and international level, so that new industries can be created on an economically and environmentally sustainable basis.

Institutional Process and Participation

- The inter-agency process led by the Presidential Committee on Green Growth is an innovative approach to planning that could allow better coordination of policy-making among ministries of finance, transport, energy, environment, land, and tourism so that investment decisions are guided by multi-sectoral processes.
- The effort to clearly link the Republic of Korea's Green Growth strategy with the design of the country's mid-term target for reducing greenhouse gas emissions offers a strategically

important opportunity for connecting growth and development policy with the necessity of tackling climate change. If successful, this would prove that changes in economic systems can simultaneously deliver prosperity and respond adequately to the challenge of climate change.

- At the same time, engaging the private sector and civil society as stakeholders and partners is fundamental. Civil society organizations in the Republic of Korea have been active participants in the debate on Green Growth either by voicing their concerns or by contributing to analytical thinking with a view to make a contribution to the formulation and implementing of green growth policies.
- The Republic of Korea should further promote a process of broad-based dialogue and consultation with a cross-section of all stakeholders in order to generate the necessary public support that could prove to be essential for the success of such transformational public policies.

Environmental Integrity

- Many of the projects envisaged in the green growth national plan will have profound environmental and socio-economic implications. In particular, as a major infrastructural project, the Four Major River Restoration Project has given rise to several concerns regarding its potential effects on the environment and ecosystems surrounding the rivers, biodiversity, wetlands and water quality.
- While pursuing Green Growth objectives, it will be essential to ensure environmental integrity of the various projects being considered, in particular those that may present risks to sensitive ecosystems and biodiversity. In that respect, it is essential that prior and full environmental impact assessments continue to be undertaken, and that all relevant experts and stakeholders are provided with an opportunity to participate effectively in processes of environmental impact assessment.
- The whole range of possible impacts of the Four Major River Restoration Project remains uncertain and may only be fully understood once the implementation of the project has started. Therefore the Republic of Korea should ensure that a mechanism of continuous monitoring of the project's effects on biodiversity, wetlands, water quality and other sensitive ecosystems is put in place and remains so throughout the period of the project.
- The Republic of Korea should ensure that the institutional processes for monitoring the environmental effects of the project allow for effective participation by relevant stakeholders, so that consensus can be created on the understanding of the nature of such impacts and ways to mitigate negative consequences.

Leanings for Other Countries

- Governments should carefully weight up the economic, social and environmental costs and benefits of different strategies and policy options, even when the primary motivation is to expand “green investments” as a means of achieving a more green economy. This is particularly important in times of economic crisis.
- Governments need to set clear and appropriate parameters and indicators in their pursuit of a green economic transformation, in order to ensure that their actions are guided by convincing sustainability goals and principles as well as environmental integrity. Such parameters and indicators should include, but are not limited to, measuring reduction in carbon dependency, reducing ecological scarcity, enhancing resource and material efficiency and decoupling growth and development from depletion of natural capital. Appropriate enhancements to the accounts of society may also be considered, in the form of adjustments to the System of National Accounts, to avoid over-dependence of accounting and reporting on the ubiquitous GDP yardstick which supports measurement of “quantitative” but not “qualitative” growth.
- A significant increase in public and private investment in green sectors such as clean technologies, renewable sources of energy, sustainable agriculture, green construction, sustainable cities and transport, and economical infrastructure is essential to jump start a significant process of change.
- However, targeted investment alone, without concomitant domestic and international policy reforms will not lead to the enabling conditions needed for the emergence of a green economy. Governments should embrace a comprehensive portfolio of policy measures that remove harmful policies across their economies, including unsustainable subsidises and other incentives to resource extraction and pollution in areas such as energy, agriculture, fisheries, forestry, mining and industry.
- Developing countries and emerging economies face specific challenges of achieving sustainable economic growth, and reducing poverty and enhancing well-being while moving their economies towards a green transformation. Balancing these equally important policy goals is at the core of the green economy.
- Launching a process of transformative change that is able to re-orient resource allocation and set a long-term vision towards a green and sustainable path of growth and development requires bold leadership.
- At the same time, building a solid foundation to such a process demands broad-based dialogue and effective participation and contribution by all relevant actors and stakeholders, in order to generate the necessary public support that can prove to be essential for the success of such bold and transformational public policies.

1 The Republic of Korea's National Strategy for Green Growth

From 1962 up until the mid-1990s, The Republic of Korea implemented regular five-year economic development plans based on theories of a quantitative growth paradigm. These economic plans were developed on the premise that labour and capital were key factors of production in a quantitative growth paradigm. Extensive growth in labour and capital made extensive growth possible, but this often had the unintended consequence of fuelling the conflict between growth and quality of life, and led to increased pollution and environmental deterioration.

The Republic of Korea's President Lee Myung-Bak announced a "low-carbon, green growth¹" strategy as a new vision to guide the nation's long-term development on 15 August 2008, during a national address on the 60th anniversary of the establishment of the Republic of Korea. The Korean government has presented its Green Growth Vision as an innovative development approach involving a fundamental shift in the country's growth paradigm, from "quantitative growth" to "qualitative growth". The new vision is based on a long-term strategy of green growth up to 2050, which is exercised in the course of the five-year national green growth implementation plans.

Under the new paradigm of qualitative growth, the essential factors of production are new ideas, transformational innovations and state-of-the-art technology. Economic growth based on these dynamics brings about substantially intensive, qualitative growth unlike the extensive quantitative growth of the past. This facilitates a mutually beneficial relationship between growth and the environment. The green growth strategy has three key objectives:

- 1) Creating new engines of a higher and sustainable growth path by developing low-carbon, environmentally-friendly industries;
- 2) Ensuring climatic and environmental sustainability; and
- 3) Contributing to the international negotiations to fight climate change.

The Republic of Korea is faced with numerous challenges and constraints that require reforms and innovative approaches in various areas of the economy and the environment. The Republic of Korea is the world's sixth largest importer of petroleum and the second largest importer of liquefied natural gas (LNG). Overall it imports 97 per cent of its total energy requirements. Given its very high energy import dependence, the country is particularly vulnerable to fluctuations in energy prices and supplies. In 2008, when oil prices reached almost US\$ 150 per barrel, Korea spent over US\$ 140 billion on imports of energy. This represented over one-third of the country's US\$ 400 billion revenues from exports, making it critical for the Republic of Korea to explore other sources of energy supply.

The rapid industrialization and urbanization has led to a significant pressure on the environment and natural resources such as forests and water resources, biodiversity and the urban environment. There is a need to alleviate such pressures on the environment by redefining growth strategies in ways that better integrate economic and environmental objectives.

The Republic of Korea's carbon emissions have increased significantly during the past 15 years, making Korea one of the countries with the fastest growth of carbon emissions. These causes and consequences of climate change require urgent responses both with regard to mitigation of, and

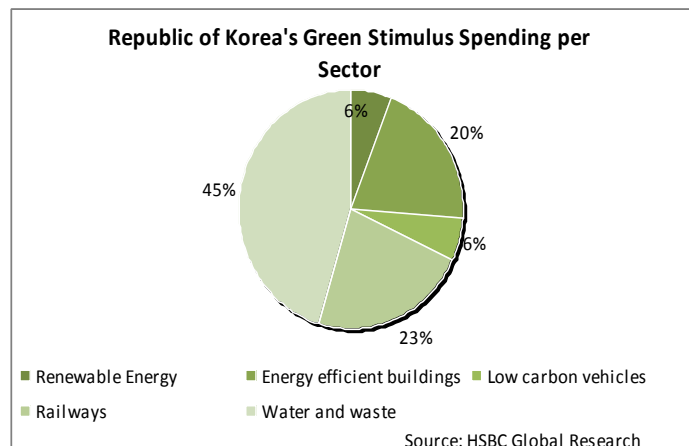
adaptation to climate change, including by injecting supplementary investments to lessen the damage caused by climate change.

In responding to these challenges, Korean leaders are focusing efforts on the development of environmentally-friendly industries and technologies in order to stimulate the economy through additional investment, innovation and employment generation, while having minimal adverse effects on the environment. This set of objectives provides the foundation for the green growth strategy which has been articulated through a substantial green stimulus package and a plan of action for the next five years.

1.1 Green Stimulus

The eruption of the financial and economic crisis in late 2008 resulted in a fall in the Republic of Korea's growth rate below 4 per cent in the fourth quarter of 2008. This is a significant reduction when compared to an average rate of growth of between 7 to 8 per cent in the last ten years.

The Republic of Korea launched a "Green New Deal" on 6 January 2009 as a means of stimulating job creation and revitalizing the economy. The stimulus package, which is comprised of a mix of financial, fiscal and taxation policies, amounted to a total of US\$ 38.1 billion, the equivalent of 4 per cent of Gross Domestic Product (GDP), to be implemented over the period 2009-2012. A total of US\$ 30.7 billion (about 80 per cent of the total stimulus package) was allocated to environmental themes such as renewable energies (US\$ 1.80 billion), energy efficient buildings (US\$ 6.19 billion), low carbon vehicles (US\$ 1.80 billion), railways (US\$ 7.01 billion) and water and waste management (US\$ 13.89 billion)².



The Green New Deal represented over 80 per cent of the total stimulus package³. A recent report noted that the Republic of Korea has been particularly efficient in the actual spending of its green stimulus, with almost 20 per cent of funds disbursed at the end of the first half of 2009, compared to only 3 per cent for most countries⁴.

In addition, the Korean Government introduced income and corporate tax cuts. Income tax was reduced by 2 per cent. The threshold of tax deductions was raised from 1 million to 1.5 million won (approx. US\$ 1,284 – 1,784). Corporate tax will also be reduced from 25 per cent to 22 per cent in 2009 and to 20 per cent in 2010 for large companies and from 13 per cent to 11 per cent in 2009 and to 10 per cent in 2010 for small and medium enterprises (SMEs)⁵.

These measures seem to have contributed to stimulating economic recovery. The Republic of Korea was one of the few member countries of the Organization for Economic Co-operation and Development (OECD) that registered a positive growth in the first quarter of 2009 (0.1 per cent). It recorded the highest growth rate in the second quarter (2.3 per cent)⁶.

The Korea Green New Deal represents a policy for creating jobs and revitalizing the economy. In the short-term, it aims to respond to the recent economic downturn, and in the mid- and long-term, to boost green growth⁷. The Korean Green New Deal will run through 2012, while the long-term strategy will continue to be pursued through five-year green growth plans; the first of which runs from 2009 to 2013.

1.2 Five-Year Plan for Green Growth

Beyond the green stimulus, the Republic of Korea appears to be making a major shift in orienting its economy towards a long-term strategy for green growth. In July 2009, the country adopted a Five-Year Plan for Green Growth (2009/2013) to serve as a medium-term plan for implementing a “low-carbon, green growth vision” announced a year earlier.

The Five-Year Plan encompasses a number of projects that were previously announced as part of the Republic of Korea’s Green New Deal. For instance, the Five-Year Plan integrates the Four Major River Restoration Project previously designated as the main project in the Green New Deal, as well as the “Strategy for New Growth Engines”, announced by the Korean Government on 13 January 2009. As such, the Five-Year Plan is an amalgam of several existing and newly designed projects on green growth, articulated as part of a mid- to long-term strategy.

In some respects, the Five-Year Plan has expanded the Korean Green New Deal in terms of overall government investment, the number of projects, and the set of policy and fiscal reforms envisaged. In other cases, it streamlined the number of existing projects thus focusing on projects the Korean Government deemed of primary importance, such as the promotion of green technologies.

The plan represents a guide for national policy directions for the green growth vision, specifying future action plans on investments, target goals for each year, including the role of the various actors and stakeholders, such as ministries, along with other government agencies in pursuing the green growth strategy. Under the plan, US\$ 83.6 billion, representing 2 per cent of GDP, will be spent in the area of climate change and energy, sustainable transportation and the development of green technologies (for details on the investment plan, see Annex 1).

The Five-Year Plan outlines a set of three strategies, ten policy directions and 50 core projects. The three strategies comprise measures for addressing climate change and securing energy independence; the creation of new growth engines; and the improvement of the quality of life. Legislators in Korea have been considering a “Basic Law for Green Growth”, a bill currently in the legislative process, which will provide the legal basis for Korea’s green growth strategy.

Strategies	Policy directions
Measures for climate change and securing energy independence	Reduce carbon emissions
	Decrease energy dependence and enhance energy self-sufficiency
	Support adaptation to climate change impacts
Creation of new growth engines	Develop green technologies as future growth engines

	Greening of industry
	Develop cutting-edge industries
	Set up policy infrastructure for green growth
Improving quality of life and strengthening the status of the country	Green city and green transport
	Green revolution in lifestyle
	Enhance global cooperation on green growth

Spending on the green growth plan is expected to stimulate production worth 182 to 206 trillion won (US\$ 141.7 billion to US\$ 160.3 billion) during 2009-2013 with a yearly average production inducement of 36.3 to 41.2 trillion won. This production inducement corresponds to 3.5 to 4.0 per cent of estimated 2009 GDP. The value-added inducement is calculated at 75.0 to 94.9 trillion won (58.4 billion to US\$ 73.9 billion) over the five years, with a yearly average of 15.0 to 19.0 trillion won (US\$ 11.7 billion to US\$14.8 billion). These estimates are based on two scenarios developed by the Presidential Committee on Green Growth, using input-output tables⁸ to calculate the expected macro-economic gains from the country's five-year green growth plan.

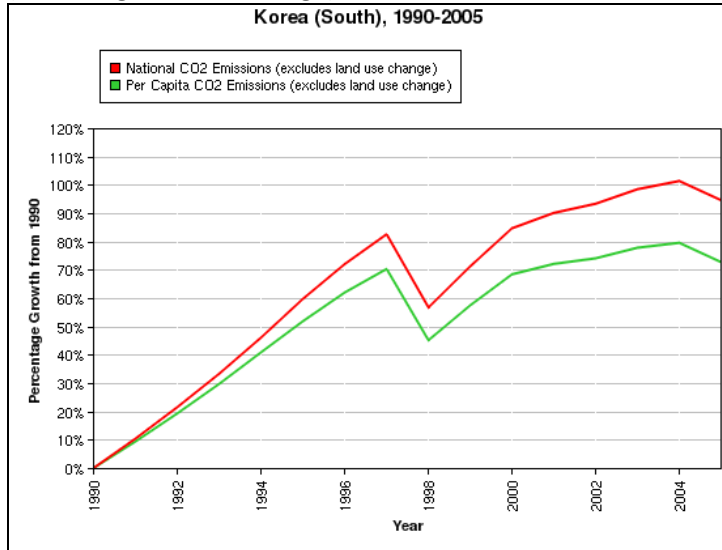
Through the implementation of the Five-Year Plan, the Korean government expects to create jobs in green industries for 1.56 to 1.81 million people during the five years, with a yearly average of job creation of 312,000 to 362,000 jobs. In the design of the 50 projects included in the 5-year plan, there appears to be a strategy focusing first on large infrastructural projects such as the Four Major River Restoration Project, which are expected to provide employment opportunities for the category of workers in sectors that were hit hardest by the global economic downturn. It is planned that investment will then be directed into the high-technology sectors (the 27 core technologies), which should provide future engines of growth for the country, making use of its highly-educated work force.

Indicator/period	Economic gains					
	Production inducement (US\$ Billion)		Value-Added inducement (US\$ Billion)		Job creation (thousand people)	
	Case 1	Case 2	Case 1	Case 2	Case 1	Case 2
2009-2013	141.4	160.3	58.4	73.9	1,561	1,805
Yearly average	28.3	32.1	11.7	14.8	312	362
Ratio of Yearly Average to GDP (%) **	3.5*	4.0*	1.5*	1.8*	34.4**	39.8**
* Estimated 2009 GDP = 1,029.5 trillion won (= US\$801.0 Billion)						
** Number of unemployed in 1 st quarter 2009 (908,000)						

2 Key Aspects of the National Strategy and Five-Year Plan for Green Growth

2.1 Climate Change

Figure 2: National and per capita CO₂ emissions, 1990-2005 (excluding land use change)



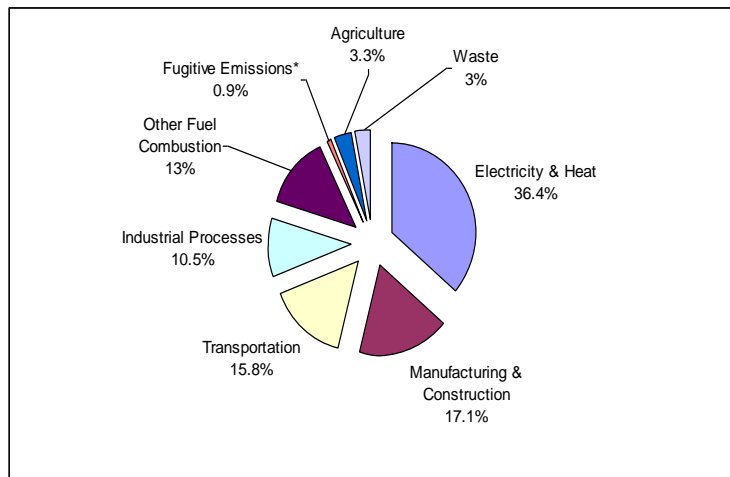
Source: World Resources Institute. The Climate Analysis Indicators Tool (CAIT).

Achieving an effective mitigation of greenhouse gas emissions and strengthening the capacity to adapt to climate change are two key aspects of the Republic of Korea's strategy for green growth. Throughout 1912-2008, the average surface temperature in Korea rose by 1.74°C, which is above the world average. Moreover, for the last 40 years, the sea level around Korea rose by 22 cm, which is three times higher than the global average sea level rise.

The Republic of Korea's carbon emissions both in total and per capita doubled between 1990 and 2005, making it the fastest growing source of emissions in the OECD.

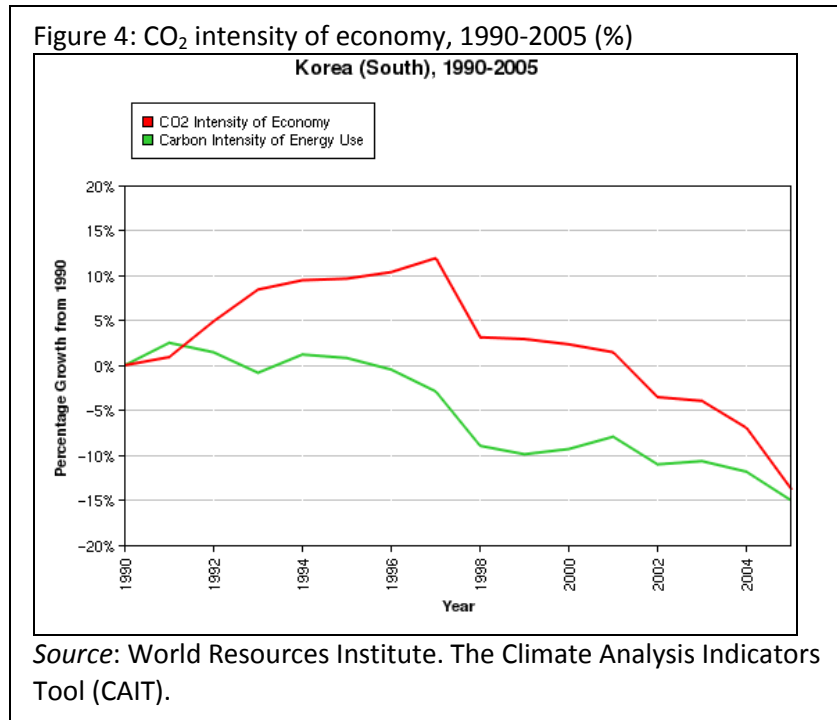
On a sectoral basis, the Republic of Korea's greenhouse gas emissions are concentrated in electricity and heat, manufacturing, transportation, and industrial processes. Energy-related emissions from all sectors cumulating to 456.6 Mt CO₂e in 2005, account for the bulk of GHG emissions (see Figure 3).

Figure 3: GHG Emissions by Sector in 2005 (CO₂, CH₄, N₂O, PFCs, HFCs, SF₆, excludes land use change). *: N₂O data not available.



Source: Based on data from Climate Analysis Indicators Tool (CAIT) Version 6.0. World Resources Institute, 2009.

The Presidential Committee on Green Growth estimates that under a business-as-usual scenario, the Republic of Korea’s carbon emissions are estimated to increase by 30 per cent by 2020. Korea is also highly vulnerable to the effects of climate change.



The carbon-intensity of the Korean economy has declined noticeably since 1997, but remains relatively high in comparison with other OECD member countries.

The Republic of Korea is a non-Annex I country, and as such is not bound by mandatory greenhouse gas reduction obligations under the Kyoto Protocol. However, as a growing economy and a member of the OECD, Korea is increasingly regarded as having an important role to play in the global effort to mitigate climate

change.

The OECD 2006 Environmental Performance Review of Korea stressed that the Republic of Korea’s carbon dioxide (CO₂) emissions as well as its use of energy, pesticides and fertilizers are among the highest in the OECD relative to GDP or area⁹. The Review recommended that the Republic of Korea 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”.

2.1.1 Green Growth plans and objectives

At the G-8 extended summit held in Toyako, Hokkaido, Japan in July 2008, President Lee Myung-bak indicated that Korea would announce its mid-term emissions reduction goal in 2009. Korea announced on 4 August 2009 that it would voluntarily reduce its carbon emissions by 2020, from the 2005 level, using a target from three options: Keeping the growth of future emissions within 8 per cent, a stabilisation to 2005 levels or a decrease by 4 per cent from the 2005 level of GHG emissions. The Presidential Committee on Green Growth indicated that under these scenarios, the country’s emissions would be reduced by 21, 27 and 30 per cent, compared to projected growth in 2020¹⁰.

Box 1: Korea's 2020 midterm greenhouse gas (GHG) mitigation target

Scenario 1: 21 per cent reduction from BAU (8 per cent increase from 2005 level)

- Achieved through implementation of measures with short-term cost but potential long-term benefits.

Scenario 2: 27 per cent reduction from BAU (Return to 2005 level)

- Implementation of additional measures from scenario 1, which have a mitigation cost of less than 50,000 WON (approx. US\$ 28) per ton of CO₂.

Scenario 3: 30 per cent reduction from BAU (4 per cent reduction from 2005 level)

- Implementation of aggressive measures with high mitigation cost.

Notes:

Korea's 2005 GHG emission = 594 MtCO_{2e}

BAU = Business as Usual

Not including offsets from forest management

On 17 November 2009, the Presidential Committee on Green Growth announced a decision taken at a cabinet meeting presided over by President Lee Myung-bak to adopt the most ambitious of the three options considered, that is a 30 per cent reduction of future emissions.

Along with a mid-term mitigation goal, climate change initiatives laid out in the five-year green growth plan include the adoption of a legal and regulatory framework, carbon emissions trading, the creation by 2010 of a national GHG inventory report system, in addition to public awareness. Other measures announced include the adoption of new auto emission standards, a waste-to-energy programme to reduce greenhouse gas emissions from waste materials, promoting low-carbon transportation, the introduction of light-emitting diodes (LEDs); stricter heat insulation standards for buildings, and development of carbon capture and storage (CCS) technologies. A Basic Law on Low-carbon and Green Growth, which is currently being reviewed by the Korean parliament, will provide the basic legislation for Korea's green growth strategy, including countermeasures on climate change.

The carbon market is projected to be a major policy tool for greenhouse gas reductions in Korean Plan. It is further expected that the growing carbon market will create an innovative business environment for domestic and international industries. While the creation of a local carbon market in 2010 is seen as an essential element in the climate response strategy, details of the carbon market, including the auctioning and/or pricing of carbon emissions permits, and industries to be covered under the scheme, are yet to be defined.

Forests cover more than two-thirds of Korea's land surface. The potential for reducing emissions from the forest sector is expected to be enhanced from 1.452 billion CO₂ ton to 1.613 billion CO₂ ton in 2013. The Five-Year Plan also incorporates provisions for aid for forest projects in the Democratic People's Republic of Korea.

The establishment of a “Carbon Point System” will reward achievement at reducing carbon emissions or the purchase of low-carbon products with “carbon points”, which can be exchanged for discounts at public facilities. In October 2008, the Korean Ministry of Environment also kicked off a public awareness campaign entitled “Green Start Movement”. The initial participants in the programme were officials from governmental agencies, local administrations and civic groups. The Ministry seeks to expand the movement among the general public.

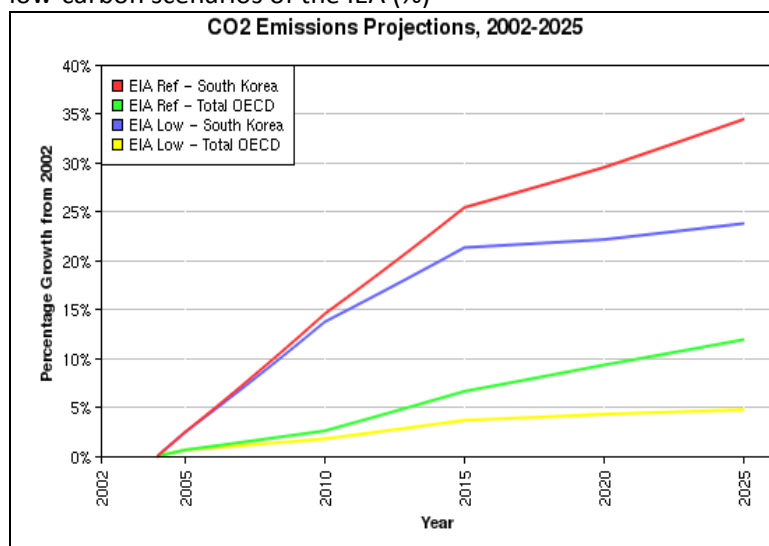
The Five-Year Plan includes measures to undertake climate change risk assessment and develop action plans to prepare for the likely impacts of climate change on infrastructure, health, water management, agriculture, biodiversity and housing, and options for dealing with them. Efforts will focus on improving the validity of climate change forecasting.

Securing water resources is a critical dimension of climate change adaptation objectives. In that respect, around 20 billion cubic meters will be secured by 2013, as part of the Four Major River Restoration Project (see discussion below). Ecological defence systems will be developed through the setting up of forest protection and forest ecosystem management programmes. The Republic of Korea aims to increase the capacity of national forest resources from 862 million cubic meters to 953 million cubic meters in undertaking the forest protection and forest ecosystem management programmes.

2.1.2 Review

Given its status as a non-Annex I country to the Kyoto Protocol to the UNFCCC, the Republic of Korea’s announcement of a national mid-term climate change mitigation target is a voluntary step that is very encouraging. The Korean Government made it explicit that its carbon emissions reduction target is not conditional to the outcome of the United Nations Climate Change Conference in December 2009. It is a “unilateral and voluntary mitigation action to be undertaken without any foreign support.”¹¹

Figure 5: Projected growth in CO₂ emissions under reference and low-carbon scenarios of the IEA (%)



Source: World Resources Institute. The Climate Analysis Indicators Tool (CAIT).

Although the nature and level of the emissions reduction that Korea may have to undertake under the framework of global climate change negotiations are yet to be defined, it appears clearly that achieving the objectives of a low-carbon green growth will require an effort to reduce the carbon intensity of the Korean economy and the pace of growth of carbon emissions.

In 2004, Korea recorded a 105 per cent increase in its carbon dioxide emissions

compared to the level of the 1990s; a rate second only to China's. Future emissions are expected to keep growing fast. Both in the reference scenario and low-emission-scenario, projections by the International Energy Agency indicate that the growth of carbon emissions in Korea will remain well above that of the average in the OECD countries. Under the reference scenario, which assumes that the level of growth in carbon emissions continues from the 2002 level, Korea would increase its emissions by close to 35 per cent in 2025, compared to less than 15 per cent for the whole of the OECD countries. In the low-emissions scenario, the Republic of Korea's carbon emissions would grow by slightly less than 25 per cent in 2025, compared to 5 per cent for the whole of the OECD countries (see Figure 5). This makes it even more urgent and challenging to reduce GHG emissions, in order to achieve convergence with other OECD countries.

There is growing convergence of views that achieving a global reduction target that would limit the global temperature increase since pre-industrial times below 2°C – the threshold beyond which irreversible and possibly catastrophic changes become far more likely – is essential. Parties to the UNFCCC and the Kyoto Protocol have announced emission reduction targets that are being considered as negotiations proceed. The EU has announced reducing its overall emissions to at least 20 per cent below 1990 levels by 2020, and expressed readiness to scale up this reduction to as much as 30 per cent under a new global climate change agreement if other developed countries make comparable efforts. The global effort to tackle climate change is guided, among others, by the principles of common but differentiated responsibilities and respective capabilities. As a result, the same level of emission reduction undertaken by Annex I Parties may not be demanded of countries such as the Republic of Korea. Nonetheless, it is clear that the more ambitious the target, the greater the contribution will be in responding to the urgency of action on climate change. Climate change poses serious challenges to Korea's own future development, prosperity and security against natural disasters and other climate risks that warrant the utmost attention to reduce greenhouse gas emissions.

The Korean Government has stated that its 30 per cent GHG emissions reduction goal represents the highest reduction target recommended by the Inter-governmental Panel on Climate Change (IPCC) for developing countries. Nonetheless, the Korean Government recognizes that indicators such as economic growth, population growth, and assumptions on oil prices used to project future emissions under a reference scenario by 2020 may need to be adjusted to reflect changes in actual conditions by 2020. It is accordingly putting in place an inventory of emissions to ensure accuracy of data.

On 9 November 2009, the Special Committee on Countermeasure against Climate Change of the Korean parliament passed the bill on the Basic Law on Low-carbon and Green Growth. The bill includes a system of mandatory reporting of carbon emissions by all carbon and energy-intensive industries. It provides a basis for the creation of a carbon trading system. The Basic Law mandates a cap on emissions, but leaves out the operational structure, the method of allocation of emissions permits, the sectoral coverage and other details for implementing laws to decide.

The creation of a carbon emissions trading scheme is an important step forward. But its effectiveness will depend on the actual cap on emissions, the mechanism for allocation of emissions permits, and the sectoral coverage. In particular, whether the power generation sector, the steel and automobile industries and other high-emission sectors are covered or not, and modalities of granting them emission allowances, are likely to be determinant. For example, the potential that an increased share of renewable energy will lead to lower CO₂ emissions can easily

be diffused by a carbon trading scheme that allows power plants to receive free allowances or to operate under a very loose “cap” on emissions.

As a non-Annex I Party to the Kyoto Protocol Korea is not bound by mandatory annual reporting and annual review of GHG emissions under the Kyoto Protocol national greenhouse gas inventory system. However, as for all non-Annex I Parties to the Kyoto Protocol, Korea is compelled to produce periodical reporting as part of national communications. A further step forward to the creation of a national GHG inventory system would be to consider articulating it on measurable, reportable and verifiable basis under existing or future global reporting schemes of the UNFCCC and Kyoto Protocol.

The Five-Year Plan identifies adaptation to climate change as a key priority for Korea. A significant portion of the funds set for adaptation to climate change will be used as part of the Four Major River Restoration Project (discussed below). For Korea and other countries in Asia, sea-level rise and associated flooding are among the most serious risks posed by climate change. The fourth assessment report by the IPCC indicates that for one metre sea-level rise with high tide and storm surge, an estimated 2,643 km² or about 1.2 per cent of the total area of the Korean Peninsula could face inundation. Measures to respond to sea-level rise could take the form of protection, accommodation and retreat. As substantial socio-economic activities and populations are currently highly concentrated in the coastal zones, protection should remain a key focus area in Asia. The report suggested that coastal protection constructions in Asia for 5-year to 1,000-year storm-surge elevations need to be considered.

A number of measures proposed under the Four Major River Restoration Project are meant to provide such defences. At the same time, forests and wetlands that are prevalent in a large part of the Korean peninsula could play important infrastructural functions and provide natural defences against sea-level rise and flooding. As a result of global warming, the coverage of broad-leaved Korean pine forests is projected to decrease by 20 to 35 per cent, which may affect the capacity of forests to remain as effective natural defences against future climate impacts. This makes it critical that protection of forests be strengthened as expected effects of climate change will reduce forest density in parts of the country.

The implementation of ecological restoration, through reforestation, including riparian reforestation can significantly enhance resilience. The review of a large number of restoration projects under the UNEP-led study on The Economics of Ecosystems and Biodiversity (TEEB) suggests that through ecological restoration, resilience improvements can be found in three significant areas of adaptation: (1) freshwater security; (2) food security (both artisanal fisheries and small farms productivity); and (3) natural hazard risk management (cyclones, storms, floods, droughts)¹².

2.1.3 Recommendations

- Given its current level and fast pace of growth of carbon emissions, added to the country’s vulnerability to the effects of climate change, the Republic of Korea should consider the most ambitious emissions reduction target possible as a contribution to a global mitigation effort.
- The green growth strategy must be fully complemented with goals and targets to enable a low-carbon path of development. The Republic of Korea should aim to achieve greater

convergence on GHG emission reduction and carbon intensity targets with comparable OECD member countries.

- The creation of a carbon emission trading scheme is an important step forward. But to be successful it should involve effective caps on emissions, a proper coverage of high-emission sectors, and mechanisms for allocation of emission permits that encourage mitigation efforts.
- The Republic of Korea should enhance its capacity to respond to climate change effects such as sea level rise, flooding, heavy rains and reduced forest density by carefully assessing the capacity of measures proposed under the green growth to achieve such objectives.
- In particular UNEP encourages ecosystem-based adaptation strategies, including through ecological restoration and riparian reforestation. Forests and wetlands that are prevalent in a large part of the Korean peninsula, if properly conserved and made more resilient, could play important infrastructural functions and provide natural defences against sea-level rise and flooding.

2.2 Energy Efficiency

A successful execution of the green growth strategy, such that it delivers low-carbon growth entails a decoupling of economic growth from carbon emissions and intensive-energy use. This, in turn, requires significant reductions in the carbon-intensity and the energy-intensity of growth. Korea faces challenges in that regard, given that despite important progress in the past several years, energy-intensity remains high in comparison with other OECD countries. The 2006 OECD Review noted that “Korea is one of the few OECD countries, which has not improved its energy intensity (energy use per unit of GDP) relative to 1990”.

2.2.1 Green Growth plans and objectives

The Five-Year Plan involves measures targeting high-emission industries, through a “negotiated agreement” between the government and large energy-consuming companies in order to reduce energy consumption. In the transport sector, there will be new standards to increase the fuel efficiency standard for automobiles and institute a reporting system on transport companies with high-energy consumption (further discussed in section 2.4 below). A ban on incandescent lights, which are considered to have a low energy performance, will be introduced by 2013 in order to promote the diffusion of compact fluorescent light bulbs (CFLs) which are 3 to 5 times more energy-efficient.

The electricity pricing system will be changed into a cost-based electricity pricing system. It is expected that the change in pricing will give a strong signal to corporate and household energy users which may translate in important behavioural change and energy savings.

At the same time, there appears to be an attempt to minimize the effects of energy pricing on lower-income households, with an objective of reducing the number of households whose energy expenditure is worth 10 per cent of their total revenue from 7.3 per cent of total households in 2009 to 5.0 per cent in 2013.

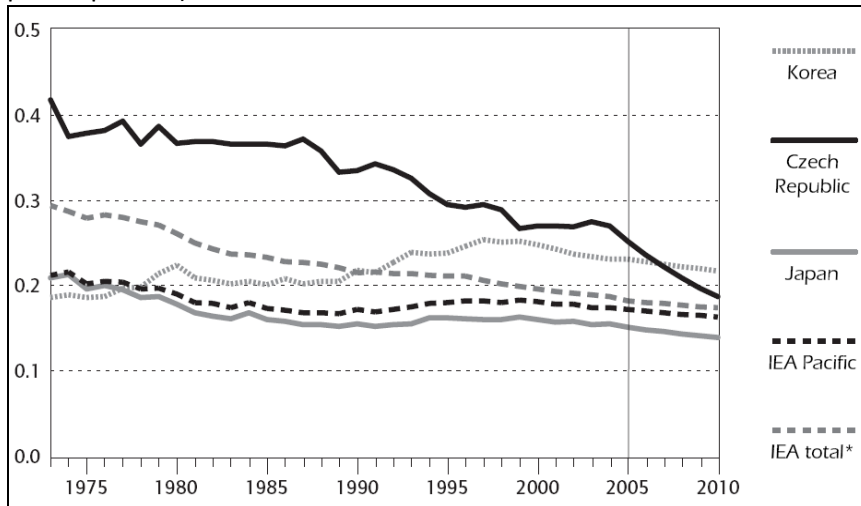
Overall, this set of measures for the development and dissemination of hybrid electric vehicles, the adoption of stringent standards on fuel efficiency, energy conservation and green buildings,

and the promotion of investment in energy conservation facilities should increase total energy efficiency from 0.317 ton of oil equivalent TOE/US\$' 000 in 2009 to 0.290 TOE/ US\$' 000 in 2013 and to 0.233 TOE/ US\$' 000 in 2020.

2.2.2 Review

Enhancing energy efficiency is particularly important given that manufacturing and energy-intensive industries remain predominant in the Korean economy. With the world's largest shipbuilding industry and the fifth largest steel production, industry in Korea accounts for 42.5 per cent of GDP which is well above the 29 per cent OECD average.

Figure 6: Energy Intensity in the Republic of Korea and in other Selected IEA Countries, 1973 to 2010 (TOE/US\$' 000 at 2000 prices and purchasing power parities)



*excluding Luxembourg and Norway throughout the series, as forecast data are not available for these countries.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2006; *National Accounts of OECD Countries*, OECD Paris, 2006; and country submissions (IEA, *Energy Policies of IEA Countries: The Republic of Korea*, 2006, Figure 8).

In 2004, the Korean Government established the General Energy Conservation and Efficiency Improvement Plan, which set the objective of enhancing energy intensity and energy efficiency so that Korea's energy intensity is improved from 0.359 TOE/US\$' 000 in 2004 to 0.328 in 2007, and then to 0.294 by 2012. In its 2006 Energy Policy Review of Korea, the International Energy Agency noted that Korea's

"current energy efficiency targets don't qualify as particularly ambitious"¹³.

The new targets set under the Five-Year Plan to enhance efficiency from 0.290 TOE/US\$' 000 in 2013 and to 0.233 TOE/US\$' 000 in 2020 appear to be an improvement on the targets in the *General Energy Conservation and Efficiency Improvement Plan*. In comparative terms, however, energy-intensity will remain slightly above that of most IEA countries.

The banning of inefficient light bulbs is in line with policies that are being implemented in a number of countries around the world. Measures to phase out incandescent lights have already been announced in countries such as Australia (by 2010), the Philippines (by 2010), and the member countries of the European Union (by 2012). In Denmark, the ban became operational as of October 2009.

The focus of the effort to reduce energy intensity in the industrial sector will depend of the effectiveness of implementing voluntary agreements with industry. Whereas such an approach is not new in Korea, having been practiced in the past, more stringent monitoring may be required as Korea is in the process of setting measurable carbon reduction goals at the international level. This will make it necessary for the country to ensure that objectives and targets are met within the timeframe indicated, and that measures to reward compliance or otherwise sanction non-compliance are also part of the policy approach.

The experience with collective voluntary approaches in the OECD countries suggests that failing such a stringent approach, “negotiated agreements” may lead to significant problems of free-riding, as firms manage to avoid the imposition of mandatory targets while maintaining a status quo on their emissions and energy-intensity.

Reforming energy prices so that they reflect true market costs is a natural complement to setting standards and targets on energy efficiency. The energy pricing reform discussed below will therefore play an important [part](#) in advancing the effort on efficiency improvement.

With the expected structural changes in the Korean economy, if the Five-Year Plan and longer-term vision on green growth prove to be successful, Korea may benefit from a lower share of energy-intensive manufacturing in the economy and the growing importance of the service sector and technology-intensive industries.

2.2.3 Recommendations

- Korea should consider greater convergence with other OECD countries by gradually raising its energy efficiency targets, with a view to match at least the OECD average.
- Korea should monitor voluntary agreements with industry, to ensure they achieve the expected targets, and consider alternative policies in case voluntary targets are not met.
- It should ensure that energy prices in all sectors reflect costs and eliminate any harmful subsidies.

2.3 Renewables and Nuclear Energy

Korea has daunting energy challenges. It is the world’s fifth largest importer of oil (118 Mt of imports in 2007 and second largest importer of coal (100 Mt of hard coal imports in 2008)¹⁴. Given its high energy import dependence, Korea is seeking to increase its generation of new and renewable sources of energy through target setting and regulator measures.

2.3.1 Green Growth plans and objectives

Under the Five-Year Plan, the share of new and renewable energy in total energy supply is expected to increase from 2.7 per cent in 2009 to 3.78 per cent in 2013 and 6.08 per cent in 2020. A significant part of this increase is expected to come from waste and biomass energy together with nuclear energy.

In 2006 the amount of waste generated daily in Korea was some 320 thousand tons. Currently, energy generated from waste accounts for 76 per cent of the renewable energy in Korea. The

government plans to expand this potential through a “waste and biomass energy development project”, which relies on waste-to-energy, agriculture- and ocean- oriented biomass, low-carbon green village construction, and forest biomass. Korea plans to install a total of 48 environment facilities to create energy from 3.86 million tons of waste by 2013. Another 17 facilities will be set up to absorb the residual heat from incinerating sites. The government also plans to develop a comprehensive system to process waste resources from industry by 2011. Technologies existing in the chemical industry will be used to foster the development of renewable energy.

Nuclear energy has been an important source of energy supply in Korea. Under the green growth strategy, Korea seeks to further develop its nuclear technology and even to export nuclear power plants from 2013. The country will gradually increase the proportion of nuclear power facilities in power generation from 24 per cent in 2009, to 27 per cent in 2013, and to 32 per cent in 2020.

Apart from these technological options and targets, measures are being considered to create economic incentives and regulatory standards that will create a market for demand and supply of renewables. These include economic incentives to increase the use of solar energy in homes and small buildings. The government plans to build one million energy-saving green homes and to refurbish one million existing houses using new and renewable energy.

Other targets include building fourteen “Environment Energy Towns” in eight areas nationwide by 2020. Such towns will employ efficient use of waste resources, green power, and biomass. In small regional communities, a total of 800 low-carbon green villages are expected to be built.

On the regulatory side, a renewable energy portfolio standard (RPS) will be introduced in 2012, which will make it mandatory for utility companies to produce 3 per cent of their electricity from renewable sources in the next three years, increasing to 10 per cent in 2020. This new renewable portfolio standard is expected, through mandatory requirements, to heighten renewable energy supplies in the Republic of Korea. Along with the RPS, there is a plan to establish a renewable energy certification (REC) system to enable the issuance and trade of certificates between the RPS obligators.

By 2030, a smart grid system will be established comprising a network of electric power suppliers that incorporates advanced control and communication control systems to efficiently manage power production and distribution. The information technology-based network would lead to more efficient overall energy production and consumption. Furthermore, it would allow renewable energy sources with variable production rates like solar and wind energy to be better utilized and make a larger contribution to energy supply. This system is expected to drastically reduce CO₂ emissions and contribute to enhancing energy security.

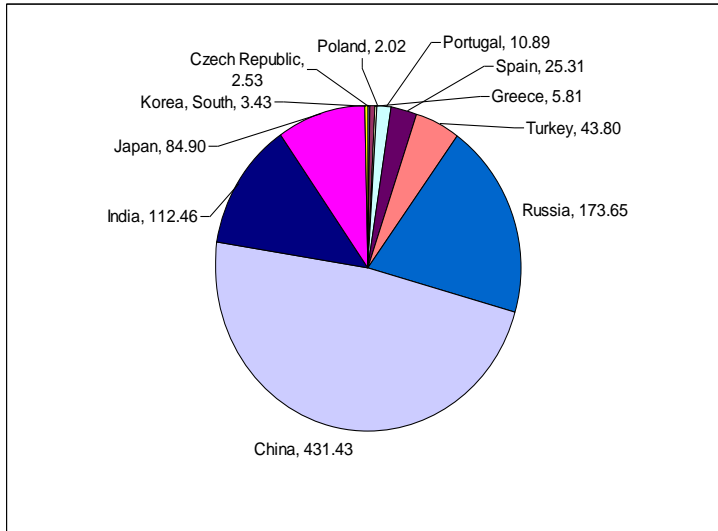
2.3.2 Review

The new targets for renewable energy generation in the Republic of Korea are an important step forward in reducing the country’s reliance on fossil energy and energy import-dependence. Increased use of clean energies will also be critical in order to reduce carbon emissions in the industrial and residential sectors.

Measures to improve energy and material efficiency, by converting waste into energy and expanding the potential in energy generated from biomass appear to be encouraging, given that

these two sub-sectors have shown a potential to increase energy generation from renewable sources. Together with hydroelectricity, they made up the bulk of renewable energy generation, accounting for 95 per cent in the share of renewable energy in 2005.

Figure 7: Net hydroelectric power generation, 2006 (Bn Kw/h)



Source: Energy Information Administration, International Energy Annual 2006.

However, despite the importance of hydroelectricity in the Republic of Korea's renewable energy supply, the volume of hydroelectricity generation remains relatively low when compared with the installed capacity in many other developed and developing countries (see Figure 7). In its search for new and cleaner sources of energy, the Republic of Korea could further expand its potential to generate electricity from hydropower.

The Five-Year Plan for Green Growth should provide a valuable opportunity for setting an ambitious target in that respect.

Nuclear energy is expected to play a greater role in the Korean energy mix. Korea is the world's fifth largest producer of nuclear electricity, accounting for 5.3 per cent of global production, and ranks fourth in the world in terms of percentage of nuclear in total domestic electricity generation (33.6 per cent in 2007)¹⁵. In its 2006 energy policy review of the Republic of Korea, the International Energy Agency concluded Korea's nuclear energy industry is a model for other countries, noting that the nuclear energy regulatory framework implemented by Korea is comprehensive and in line with best international practices.

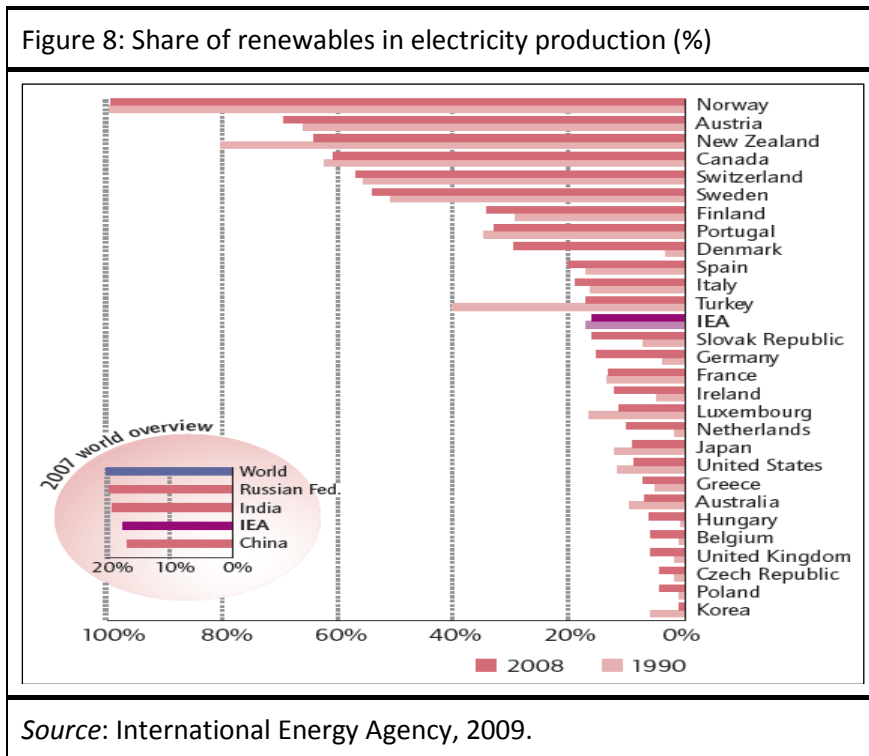
Overall, nuclear power generation is expected to increase in most OECD countries, as a result of policies to address climate change and enhance energy security. The IEA projects in its 450 Scenario that nuclear power along with renewable energies will have increased shares in the total global energy mix by 2030. The Korean green growth plan seeks not only to increase energy generation from nuclear sources, but also expand the country's stance in the global nuclear industry, by further developing and exporting technology.

While Korean authorities consider the use of nuclear power as necessary to respond to urgent energy needs, a number of environmental and social concerns arise with regard to the development of nuclear energy. They range from safe disposal and storing of nuclear waste to general social safety concerns. The specific procedures for further developing nuclear energy should carefully consider these issues and devise ways to address them in an effective manner.

New measures to regulate energy pricing and creating incentives for clean energy generation are important steps in creating an environment conducive to behaviour change and investment in clean energy. The introduction of a renewable energy portfolio standard could be instrumental in that respect. While a large number of countries, including almost all developed countries and countries in transition have adopted feed-in tariffs (in existence in Korea since 2003), fewer countries have adopted RPS at a nation-wide level (although RPS exists at the state level in many countries, such as the United States).

In 2002, the Republic of Korea adopted a fixed minimum price for renewable energy, which contributed to increase renewable energy use. The experience of other countries suggests that guaranteeing a minimum price to producers, at least for a given period of time, can act as a powerful driver for investment in renewable energies. However, the new RPS to be introduced in 2012 does not seem to provide a minimum price guarantee for renewable energy producers, which could limit enthusiasm and confidence by potential investors in renewable energy generation.

Despite a doubling of the current share of renewable energy in its total energy supply, the Korean green growth plan on renewable energy does not appear to be particularly ambitious. The 2006 OECD Review remarked that Korea’s second national energy plan stipulated a growth of 3.1 per cent a year from 2002-2011 and envisaged only limited changes in the energy mix (with only 5 per cent for renewable energies by 2011).



With a target of achieving 3.78 per cent share of renewable energies in 2013 and 6.08 per cent in 2020, the Republic of Korea is underperforming in comparison with many comparable developed and developing countries. Its renewable energy ambition for 2020 is well below targets of 20 per cent set in China or 15 per cent in Poland and similar targets announced in many other

comparable developed and developing countries.

In 2008 the Republic of Korea had the lowest share of electricity generated from renewable sources among IEA countries. In fact, the share of renewable in electricity production declined in 2008, compared to 1990.

The Republic of Korea's strategy for green growth appears to be a step in the right direction. However, the specific targets and goals for developing renewable sources of energy are short of the ambition of creating a green economy, given the country's heavy reliance on fossil energy and significant degree of energy import dependence.

2.3.3 Recommendations

- The Republic of Korea's renewable energy ambition of 6.08 per cent in 2020 is a limited response to the country's serious energy security challenges. It appears to be an underperformance in comparison with many comparable developed and developing countries. UNEP encourages a more ambitious target to expand the share of new and renewable sources of energy, in order to meet the critical objective of reducing the Republic of Korea's energy dependence and energy-related carbon emissions.
- In defining future targets for renewable energy supply, the Republic of Korea could consider targets and approaches that have been proposed in other countries, and seek greater convergence with other OECD countries and non-OECD countries that have shown resolve with high targets on renewables.
- The Republic of Korea should ensure that further development of nuclear energy [continues to](#) remain in line with best international standards, and that transfer and export of nuclear energy technology contributes to enhancing the safety, stability and the economic viability of nuclear power generation in other countries pursuing options of energy generation from nuclear technology.

2.4 Transport, Cities and Fuel Efficiency

The Intergovernmental Panel on Climate Change (IPCC) has indicated that the global vehicle fleet's fuel economy needs to improve by 50 per cent by 2050 to stabilize emissions from road transport¹⁶. The Global Fuel Economy Initiative (GFEI) launched by UNEP, together with the International Energy Agency, FIA Foundation and the International Transport Forum, seeks to double the fuel economy, in line with IPCC and G8 recommendations. As the world's fifth largest car manufacturer, the Republic of Korea has an important role to play in enabling greater efficiency in the automobile industry and significantly reducing emissions from the transport sector.

2.4.1 Green Growth plans and objectives

The Five-Year Plan sets regulatory standards on fuel efficiency and GHG emissions from the transport sector that will require a redesign of cars to either drive 17 kilometres per litre or cut greenhouse gas emissions below 140 grams per kilometre between 2012 and 2015. The average fuel efficiency [is](#) 11km per litre and emissions [are](#) 210 grams per kilometre. [Fuel efficiency](#) will be raised to 15.1 km per litre by 2016. [New](#) fuel efficiency and emission rules will be applied to 30 per cent of automobiles sold in 2012, rising to 100 per cent by 2015.

Efforts are being made to develop renewable transport fuels. In this regard Korea plans to adopt a renewable fuel standard (RFS), which will make it mandatory for transport fuel suppliers to

provide bio-diesel, bio-ethanol, and bio-gas for automobiles. Fuel suppliers will have to supply 3 per cent of their transportation fuel from bio-diesel sources by 2012, and 7 per cent in 2020.

An investment of 25.3 trillion won (US\$ 19.7 billion) in green cities and further development of railway and other means of mass transport are expected to increase the role of public transportation to 55 per cent of total transport use by 2013. The passenger transport load of trains is set to increase from 19 per cent in 2009 to 30 per cent in 2013.

Bicycle use will be promoted with the construction of 3,114 km of additional bicycle lanes nationwide from 2009 to 2018. About 1,700 km of bicycle lanes will be constructed along the waterfront pavements of the four major rivers. It is anticipated that this would increase the use of bicycles from 1.5 per cent in 2009 to 5 per cent of the modal split in 2013.

2.4.2 Review

The transport sector accounts for 21 per cent of energy consumption in Korea, with an average increase rate of 6.3 per cent. The number of vehicles is at 17 million, and increases by 13 per cent a year¹⁷. Policies and measures to enhance sustainability in the transport sector are therefore critical to promoting green growth.

In July 2006, the Korean government set long-term sectoral energy consumption reduction goals of reducing emissions by 7 per cent in the transport sector and by 6 per cent in the building sector by 2020, as compared with projected emissions¹⁸. The Five-Year Plan is seeking to expand that effort with additional strategies and standards in the transport and construction sectors.

The effort by the Korean Government to orient its car industry into technology, rather than cost-driven, competition is considered to be an important strategic direction. As the fifth largest car manufacturer, expanding investment in the development of low-carbon vehicles such as hybrid electric vehicles and electric vehicles should be a high priority in Korea. Around US\$1.80 billion was allocated to the promotion of low carbon vehicles in the Korean stimulus plan. For achieving a sustained transformation and realizing the full potential of greening the automobile industry, specific policies and measures will need to be defined, including the development of a smart grid system by 2013 as well as specific policies and measures to encourage plug-in hybrid and electric vehicles.

In the area of fuel economy, countries around the world, including OECD member countries and several other countries such as China, have set fuel economy standards. While the targets and timelines vary, there is growing convergence towards a global average reduction of 50 per cent by 2050, which would be around 25km/litre. The Republic of Korea's target of achieving 15.1km/litre by 2016, from 11km/litre in 2009, is generally in that direction. The new mandatory fuel efficiency standards for vehicles appear to be comparable with those of the United States and already stricter than those applied in a number of other OECD countries, including Australia and Canada.

There appears to be an effort in modal shift towards non-motorized transport systems with the construction of over 3000 km worth of cycling lanes. Non-motorized transport facilities such as cycling lanes need to be integrated into a larger network of non-motorized transport, public transport and private vehicle use in order to be effective. A significant segment of bicycle lanes, 1,700 km, are planned to be built along the waterfront pavements of the four major rivers. While

this can promote sustainable forms of transportation in recreational activities, the larger potential, in particular for mitigating climate change, lies in a cycling network that allows users to use bicycles instead of personal cars for commuting for work, schooling and other urban mobility uses. Without the integrated planning of cycling lanes within the larger transport infrastructure, the full potential of promoting low-carbon transportation may not be realized.

The retrofitting of the existing buildings stock has proved to be an effective way of reducing energy consumption in the residential sector and improve material efficiency while providing opportunities for new employment. In Germany, for instance, a programme on retrofitting the existing housing stock to improve energy efficiency has succeeded in retrofitting over 200,000 apartments, creating 25,000 new jobs and sustaining 116,000 existing jobs. In its stimulus package, Korea has allocated US\$ 6.19 billion to improving energy efficiency in buildings. The development of green buildings is also part of the 27 priority green technologies (discussed below).

This important volume of investment could be complemented with a systematic adoption of all common technologies, such as insulation, which can reduce energy use in buildings with an estimated 30 per cent at a net negative life cycle cost. Experience from around the world indicates that, due to the fragmentation of the building sector, economic incentives are comparatively ineffective as compared to “command and control” measures such as green building standards and utility-demand control programmes. The Republic of Korea could consider adopting relevant standards and regulations to capture at least 30 per cent energy efficiency potential in its five-year plan or set other early targets to that effect.

2.4.3 Recommendations

- In promoting a technology and innovation-driven automobile industry, Korea should formulate specific policies and measures to provide the physical, as well as policy, infrastructure in support of the development of a smart grid system by 2013 to encourage plug-in hybrid and electric vehicles.
- The Republic of Korea could further promote a modal shift by ensuring that non-motorized transport modes are encouraged through the integration of cycling lanes within the larger transport infrastructure, especially public transport, both in urban and rural areas.
- The Republic of Korea should evaluate its current efficiency standards for buildings in order to ensure that they are consistent with best practices of other OECD countries with [comparable](#) climates and economic conditions. It should aim for standards and regulations to capture at least 30 per cent energy efficiency potential in its five-year plan or set other early targets to that effect.

2.5 Water and Ecological Infrastructure

Amid rapid economic growth and high population densities, Korea continues to face challenging water-related issues. A 2006 Environmental Performance Review of Korea undertaken by the OECD¹⁹ concluded that much work must still be undertaken to reach the country’s water quality objectives for rivers and reservoirs. In 2004, approximately one-third of the 194 river sections achieved their planned quality targets. Biochemical oxygen demand remains the primary focus of these management efforts, while heavy metals and persistent contaminants have so far received

little attention. Moreover, the protection of aquatic species and biodiversity has been largely ignored. “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 scarcity is another challenge facing the Republic of Korea. Water scarcity becomes most acute when one considers demand and supply in the context of future socio-economic and natural changes that may occur. The socio-economic factor with the greatest potential impact is population growth; the natural factor of greatest concern is climate change.

With global warming likely to continue, levels of flooding and drought are expected to worsen. In Korea, it is expected that the level of precipitation during the summer months will increase with almost no change of level in the winter. As temperatures are also projected to rise with global warming, more severe droughts may occur in the winter. Significant funds have been spent in repairing water-related damages, some of which could have been saved by investing in disaster prevention measures.

2.5.1 Green Growth plans and objectives

In response to these challenges, the Five-Year Plan includes a project on the restoration of the Republic of Korea’s four major rivers. The Four Major River Restoration Project was first announced as part of the “Green New Deal” policy launched in January 2009. It was later included in the Five-Year Plan released in July 2009, and its funding, a total of 22.2 trillion won (US\$ 17.3 billion), is reflected in the Five-Year Plan total investment.

The Four Major River Restoration Project concerns not only the four main rivers – Han, Nakdong, Geum and Yeongsan – but also a number of related projects on estuaries. The overall project consists of three sets of projects: 1) Main projects – the Han, Nakdong, Geum and Yeongsan rivers development projects; 2) projects on the 14 tributaries of the four major rivers; and 3) refurbishment for other smaller-sized waterways. The Four Major River Restoration Project has five key objectives: 1) securing abundant water resources against water scarcity; 2) implementing comprehensive flood control measures; 3) improving water quality and restoring ecosystems; 4) creation of multipurpose spaces for local residents; and 5) regional development centred on rivers.

The project aims to secure adequate water supplies by creating reservoirs for about 1.3 billion cubic meters of water. This will entail the construction of 16 new movable dams and reservoirs that can house an additional 800 million cubic meters of water, raising the crest of 87 existing dams, which will provide 250 million cubic meters of water for irrigation, and two small and medium-sized multi-purpose dams that will supply at least 200 million cubic meters of water.

Pre-emptive measures are proposed against the risk of repetitive floods due to climate change. Such measure will include a large-scale dredging of the floodway, the strengthening of levees against floods, the installation of a flood gate, the construction of two multi-purpose dams, and the development of three retention ponds that will provide 920 million cubic meters of flood control volume.

The project seeks to achieve, by 2012, a 90 per cent increase in water quality (BOD less than 3ppm) by expanding sewage treatment facilities and establishing green algae reduction facilities.

In terms of adaptation strategies to climate change and sea level rise, federal and local governments are to maintain adequate salinity concentration to protect drinking water supply and other water usage.

An Eco-river Restoration Programme (ERP) initiated in 2008 is being implemented in the context of the Four Major River Restoration Project. One of the ultimate goals of the programme is to restore indigenous and endangered aquatic species and maintain the quality of water and ecosystems. The other national programme to restore freshwater ecosystems is to develop an aquatic ecosystem-monitoring network. Since 2007, preliminary field surveys have been conducted at more than 540 locations. More than 929 km of national streams will be restored as part of the Four Major River Restoration Project. A follow-up project will be planned by 2010 to restore more than 10,000 km of local streams. More than 35 riparian wetlands will also be reconstructed. Riparian areas will be afforested or reforested, and will also be used for biomass production.

In order to monitor water quality of the four rivers, Korea's Ministry of Environment is expanding the existing Tele-Monitoring System (TMS) to 105 large wastewater treatment plants and about 150 medium-sized plants.

Finally, the project seeks to support regional economic development through the creation of multipurpose spaces for cultural and touristic activities near rivers which are expected to contribute to job creation and local economic revitalization.

The implementation of the project follows three phases. In phase 1, approximately 16.9 trillion won (US\$ 13.1 billion) will be spent on the "main project" dredging operations, and building dams and reservoirs on the four major rivers. Most of the main projects are planned to be completed by 2011. However, projects for dams and reservoirs for irrigation will be completed by 2012. In phase 2, another 5.3 trillion won (US\$ 4.1 billion) will be invested on improving water flow and sewage systems of tributaries of the four major rivers. Projects for the development of Sumjin River and other tributaries to the four rivers would be completed by 2012. Phase 3 will include refurbishment plans for smaller-sized waterways and development of cultural and tourism resources near rivers. The Ministry of Culture, Sports and Tourism (MOCT) will be involved in these projects.

The Office of National River Restoration under the Ministry of Land, Transport and Maritime Affairs is the lead agency for the project. In the implementation of the project, the office will operate in cooperation with the Ministry of Culture, Sports and Tourism, the Ministry of Agriculture, Fisheries and Food, and the Ministry of Land, Transport and Maritime Affairs.

Overall, it is expected that the project will create 340,000 jobs and generate an estimated 40 trillion won (US\$ 31.1 billion) of positive economic effects.

2.5.2 Review

The Four Major River Restoration Project which concerns the four major rivers – Han, Nakdong, Geum and Yeongsan –and also the estuaries of the rivers is a major attempt at securing abundant water resources; creating systems for flood control; improving water quality and restoring ecosystems; and creating opportunities for rural development. As one of the largest ecological infrastructural projects undertaken in Korea in recent years, the Four Major River Restoration

Project has been subject to much debate and controversy, despite the important policy and environmental challenges that it attempts to respond to.

Challenges facing Korea in relation to climate change and its impact on rainfall, flooding and water are indeed serious. The capacity to respond to such challenges will depend on the development of physical infrastructure as well as the adoption and implementation of policy measures that have been suggested by earlier policy reviews on Korea, such as the OECD Environmental Review mentioned above.

The OECD Environmental Review noted that water infrastructure in rural areas lags behind densely populated urban areas. The impact of intensive agriculture on water quality and quantity has not been sufficiently brought under control. In order to face the long-standing and intense pressure on its water resources, the Republic of Korea may consider adopting integrated urban water management systems, such as rainwater harvesting, reuse of “grey water” and retention of storm water.

One of the objectives of the Four Major River Restoration Project is to secure 1 billion cubic meters of extra water to meet the country’s current and future needs, including through retention of storm water and the building of new reservoirs and dams. However, there are questions about the technical basis for the urgency of building more than eight dams on the river's mainstream in order to provide the additional 1 billion cubic meters of extra water that the Four Major River Restoration Project seeks to achieve. According to Korea’s National Water Resources Plan (2006-2020), the main water resources management plan produced every 10 years, there will be 11 million cubic meters of surplus water in the Nakdong River basin in 2011. While rapid changes brought about by climate change, including the risks of water shortage, make it clear that water quantity will increasingly be an issue to address, the economic and financial costs, the potential environmental and social consequences of such a large scale project call for caution.

The recurrence of flooding has significant costs to the Korean economy. The annual flood damage was estimated at 170 billion won (US\$ 132.3 million) in the 1970s. It reached 2.7 trillion won (US\$ 2.1 billion) in 2009. Korea currently spends an average of 5.3 trillion won (US\$ 4.3 billion) as annual investment in flood prevention and recovery expenses.²⁰ In order to weather expected climate irregularities, substantial revisions in current water control policies will likely be necessary.

Solutions proposed in the Four Major River Restoration Project rely largely on technical and physical infrastructural options. In addition to these, it will be essential to consider natural processes and existing conditions which can provide many of the ecological infrastructure functions that contribute to regulating water and addressing risks of flooding.

The Principles and Guidelines for Wetland Restoration, adopted under the Ramsar Convention on Wetlands (Resolution VIII.16)²¹ provide useful guidance to a successful restoration that warrants careful consideration in the context of the Republic of Korea’s Four Major River Restoration Project.

These Principles and Guidelines stress that “to the extent that is possible, ecological engineering principles should be applied in preference to methods requiring hard structures or extensive excavation”. For example, wetlands that surround significant land areas along Korea’s four main

rivers can play a critical role in flood control, water supply and water purification that need to be given due consideration in the process of planning and implementation of the project. The Principles and Guidelines further note that "the maintenance and conservation of existing wetlands is always preferable and more economical than their subsequent restoration".

An effective way to ensure that the Four Major River Restoration Project gives pre-eminence to the principles of ecological restoration is to clearly set goals and objectives that recognize that wetlands and other ecosystems surrounding the Republic of Korea's four main rivers perform multiple functions. Such functions include the "conservation of biodiversity, provision of reliable food resources, fresh water supply, purification, flood control and recreation".²² The objectives set for the Four Major River Restoration Project appear to be very much in line with these functions, therefore providing opportunities to employ engineering techniques and natural processes in a complementary manner.

South Korea hosted the 10th Meeting of the Conference of the Contracting Parties to the Ramsar Convention on Wetlands (Ramsar COP10) in 2008. At the Ramsar conference, the Contracting Parties adopted the Resolution X.19 "Wetlands and river basin management: consolidated scientific and technical guidance" asking Contracting Parties to integrate wetland conservation and wise use into river basin management, and Resolution X.24 on "Climate change and wetlands" asking Contracting Parties to make every effort to consider the maintenance of the ecological character of wetlands in national climate change mitigation and adaptation policies. These need to be further considered in the process of planning and implementation of the Four Major River Restoration Project.

The construction of levees and dams on rivers to improve flood control, if not carefully done, may affect the ability to sustain such ecological services and functions. With large-scale dredging involved in the building of water reservoirs, it is important that water processing plants are equipped with effective filters for pollutants, such as nitrogenous or phosphorous compounds, in order to ensure that the water retained in the reservoirs does not suffer from eutrophication.

International experience with dam construction and dredging and a large part of the academic literature suggest that these activities can result in ecological degradation of rivers, rather than "restoration". Potential impacts include simplification of channel forms and resultant loss of habitat, water quality degradation resulting from "dead zones" in deeply excavated reaches of channel, effect on migratory fish species, loss of lateral connectivity between channel and floodplain, loss of channel bed gravels needed for fish spawning and invertebrate habitats, channel incision and resultant loss of bars/bed complexity and undermining of bridges and other infrastructure²³.

It is expected that the implementation of the Four Major River Restoration Project will cause the displacement and relocation of certain farms situated along the river basin. It is planned that the Ministry of Land, Transport and Maritime Affairs will establish and operate compensation centres along the four rivers to pay compensation for the riverside farmlands that will be displaced as a result of the project.

With regard to its design and implementation process, the Four Major River Restoration Project appears to have suffered from changes in budgeting, and alteration of the schedule of implementation and assessment of its potential social and environmental consequences. These

have led to criticism on the grounds that the project was not effectively and thoroughly planned. The initial budget of 14 trillion Won announced in January 2009 was increased to 22 trillion Won a few months later. The additional resources were to address risks of water pollution that may result from [reservoir](#) construction. The 8 trillion additional funding was raised by Korea Water Resources Corporation by issuing bonds. This process has created a sense of precipitation and lack of proper [advance](#) planning in certain parts of civil society.

According to the Korean Government's plans, the total funding of the project was increased to factor in [the additional](#) cost of the project on the estuaries to the four rivers. In fact, most of the flooding that occurred in Korea takes place along small rivers and tributaries, which make it even more urgent to focus on these, rather than on the four main rivers. In addition, there are views in Korea that the four main rivers already have strengthened river banks that provide sufficient protection.

These various concerns could be addressed by further taking into account the Principles and Guidelines for Wetland Restoration, which can be of relevance to the socio-economic factors relating to the Four Major River Restoration Project. The Principles and Guidelines suggest that "higher priority should be given to implementation of restoration projects that have public acceptance and active stakeholder involvement, that contribute to sustainable development, and that have some assurance of availability of the resources needed for realization."

2.5.3 Recommendations

- [While the attempt of ecological restoration of four rivers \(Han, Nakdong, Geum and Yeongsan\) and their tributaries is commendable, its implementation must follow approaches that will result in effective "restoration" in order to achieve the important policy objectives pursued under this project.](#)
- The approach proposed in the Four Major River Restoration Project relies primarily on technical and hard structure engineering solutions. The approach proposed in the Four Major River Restoration Project relies primarily on technical and hard structure engineering solutions. Additionally, it will be essential to evaluate the full potential of and to employ natural processes of existing ecosystems which can provide many of the ecological infrastructure functions of forests and wetlands such as regulating water and addressing risks of flooding. Riparian reforestation can play an important role in that respect. The cost-effectiveness of such solutions which restore and use ecological infrastructure should be considered as a potential contribution towards "qualitative growth".
- The Republic of Korea's green growth plan needs to give further consideration to the Principles and Guidelines for Wetland Restoration, adopted under the Ramsar Convention on Wetlands. These Principles and Guidelines stress that "to the extent that is possible, ecological engineering principles should be applied in preference to methods requiring hard structures or extensive excavation."
- There should be a full assessment of the potential impacts of the project on biodiversity, in particular on wetlands, water quality and forest resources. In addition, UNEP encourages monitoring throughout the implementation process. Risks and challenges that may be created need to be carefully assessed, avoided or mitigated in an appropriate manner.

- Such assessment and monitoring should provide opportunities for public participation so as to generate greater public support for the policy objectives pursued under the Four Major River Restoration Project.
- The Korean Government should leave to itself all the various possible options in managing project implementation, including that of a progressive and “phased” implementation of the project with appropriate feedback loops based on monitoring, evaluation, checks and balances at the end of each phase.

2.6 Green Technologies as Future Growth Engines

Technology is a crucial factor in promoting green growth. In the Korean green growth strategy, the development of green technologies is conceived as the pillar of the country’s economic transformation in the medium- to long-term, after a first phase of investment in large infrastructure projects as part of the Green New Deal.

2.6.1 Green Growth plans and objectives

The technology component of the green growth plan was derived from a “Strategy for New Growth Engines” announced by the Korean Government on 13 January 2009. The “Strategy for New Growth Engines” was reclassified as a part of the five-year green growth plan, focusing on 27 core technologies, which the Korean Government considers as having the potential to provide new engines for growth to the Korean economy.

These 27 technologies are divided into four categories in terms of Korea's potential market capability and technological sophistication – (1) technologies for short-term intensive investment, (2) technologies for mid-term intensive investment, (3) technologies for long-term intensive investment, and (4) technologies for long-term gradual investment.

To achieve this technological transformation, a substantial investment plan has been put in place, covering phases from research and development, deployment to commercialization of the technologies. A total investment of more than 2.8 trillion won (US\$2.2 billion) is earmarked to fund research and development for the green technology projects up to 2013.

Sector	27 Core Technologies	
Climate change	1. Monitoring and modelling for climate change	(4)
	2. Climate change assessment and adaptation	(4)
Energy source technology	3. Silicon-based solar cells	(1)
	4. Non silicon-based solar cells	(4)
	5. Bio-energy	(4)
	6. Light water reactor	(1)
	7. Next-generation fast reactor	(3)
	8. Nuclear fusion energy	(3)
	9. Hydrogen energy R&D	(3)

	10. High-efficiency fuel cell	(3)
Efficiency improvement technologies	11. Plant growth promoting technology	(3)
	12. Integrated gasification combined cycle	(3)
	13. Green cars	(2)
	14. Intelligent infrastructure for transportation and logistics	(4)
	15. Green city and urban renaissance	(3)
	16. Green building	(3)
	17. Green process technology	(2)
	18. High-efficiency light-emitting diodes / Green IT	(1)
	19. IT-combined electric machines	(3)
	20. Secondary batteries	(2)
End-of-pipe technology	21. CO ₂ capture, storage and processing	(3)
	22. Non- CO ₂ processing	(2)
	23. Assessment of water quality and management	(2)
	24. Alternative water resources	(2)
	25. Waste recycling	(2)
	26. R&D in monitoring and processing for hazardous substances	(3)
R&D in Virtual Reality	27. Virtual reality	(2)
(1) Technologies for short-term intensive investment; (2) Technologies for mid-term intensive investment; (3) Technologies for long-term intensive investment; and (4) Technologies for long-term gradual investment.		

Projects in the area of information technology (IT) will contribute to enhancing the use of IT in the economy and society. Investment in such projects will amount to about 4.2 trillion won (US\$ 3.3 billion) by 2013. The Presidential Committee on Green Growth estimated that the projects would generate 7.5 trillion won (US\$ 5.8 billion) in production, create 52,000 jobs during 2009-2013, and reduce 18 million tons of carbon emissions in 2013.

The “greening” of key industries in the Korean economy is another important aspect of the envisaged technological shift. This involves a transformation of production processes in the steel, fibre and textile, petro-chemistry, and the shipbuilding industries to increase resource and energy efficiency. The Korean Government is focusing its efforts in this regard on investment in research and development and facility upgrades.

By 2013, the Republic of Korea foresees building “Green Industry Complexes”, which will mainly use waste resources, green power, biomass, and other new and renewable energy sources. Finally, the Korean Government will encourage green partnerships between large and small and medium-sized companies. It is envisaged that this green partnership between the large companies and SMEs will help accelerate the development of advanced technologies for fuel efficiency and emissions reduction.

There appear to be a major effort at to develop a set of cutting-edge technologies, which have the potential to promote growth in service industries and minimize impact on environment and natural resources. These include robotics, Advanced Nano Products (ANP), IT-convergence high-tech products, biomedicines, and the telecommunications and information technologies and broadcasting services. Over the next five years, a total of 10.9 trillion won (US\$ 8.5 billion) will be invested to cultivate development of these industries. In the area of telecommunication and broadcasting services, the Korean Government expects to increase the amount of exports more than two-fold from US\$ 52 billion in 2008 to US\$ 123.7 billion in 2013.

2.6.2 Review

Industry accounts for a large part of the Korean economy, in proportions that are much higher than in other OECD countries. A technological transformation that reduces the carbon intensity of industry, in particular in Korea's manufacturing sector, must be a core component of a green growth strategy. There appears to be an approach relying on quick-return technologies, including those able to deliver end-of-the-pipe solutions to pollution and carbon emissions. At least 10 out of 27 core technologies identified are energy, material and process efficiency improvement technologies. Many of these are specific to the automobile sector, including investment in the development of electric cars and intelligent infrastructure for transportation and logistics.

In the development of new and renewable energy technologies that are dearly needed to reduce the country's reliance on fossil energy, the Republic of Korea appears to be putting a clear emphasis on nuclear, solar photovoltaic and bioenergy technologies. There is a key question with regard to the effectiveness of government picking of "winners", as opposed to a neutral approach to supporting innovation that allows competition among various technologies based on their technical potential and economic costs and benefits. For example, silicon-based solar cells and non-silicon based solar cells figure among those technologies that will receive support for further development. In its 2006 review of Korea's energy policies²⁴, the International Energy Agency remarked that support provided for the development of solar photovoltaic through a feed-in-tariff that was more than six times that of wind. The consequence is that such unequally distributed incentives for different renewable energy technologies create an industry with artificial support mechanisms that may be unsustainable in economic terms.

It is not self-evident to what extent some of the technologies included in the list of 27 core technologies qualify as "green technologies", when referring to parameters such as climate change or carbon and energy-intensity. Certain technologies, including information technologies, virtual reality, and the development of a medicinal service industry, should therefore be presented in the context of a broader policy objective of promoting desirable qualitative growth and further diversification of the Korean economy into the knowledge-intensive economy, as against a "green economy" per se.

A clear linkage between investment in the development of green technologies, and the phasing out of support and subsidies to fossil-based and energy-intensive technologies may need to be considered to ensure a consistent approach to technological transformation. To that effect, fiscal reforms that previous reports by UNEP and other institutions have called for, need to be reaffirmed (see section on fiscal and policy measure below).

The Republic of Korea's Green New Deal was announced as an immediate response to the economic downturn of 2008-2009, with the objective of reviving the economy and generating employment in the short-term through large projects such as the Four Major River Restoration Project. Green New Deal projects would create employment in environment-related construction and manufacturing sectors estimated at 920,000 jobs, 68.8 per cent of which would be for manual workers²⁵. The promotion of green technologies, on the other hand, is intended to create employment for technical and professional workers over the long-term, as Korea seeks a structural transformation of its economy in which green technologies serve as an engine for growth and development.

Overall, the development of green technologies is expected to generate 481,000 jobs by 2012 and 1.18 million jobs by 2020. Green technologies are projected to reduce 130 million tons of carbon dioxide emissions by 2020, which corresponds to around a quarter of the country's total GHG emission of 594 MtCO_{2e} in 2005.

2.6.3 Recommendations

- The Republic of Korea should ensure that specific policy goals and targets are set for the greening of its existing manufacturing sector by reducing carbon-intensity and energy-intensity, in addition to promoting the emergence of new green industries.
- Government support to the development of new and clean energy technologies should avoid picking winners, and hence reduce the risk of creating industries that are built on artificial or economically unsustainable fiscal and pricing support.
- While mobilizing large sums for investment to promote the emergence of a new generation of green technologies, the Republic of Korea should also review other fiscal policies and measures to ensure that the economy pulls in the direction of "Green Growth". Green investment must be complemented by a more comprehensive reform of currently existing incentives and other support mechanisms in carbon and energy-intensive industries.

3 Policy and Fiscal Reforms

In March 2009, UNEP released a report on the "Global Green New Deal"²⁶, which benefited from contributions from several intergovernmental and civil society organizations and experts. The report underscored the central importance of reform in the international and domestic policy architecture, in order to provide the enabling conditions for the emergence of a green economy. It recommended domestic policy reforms to substantially reduce perverse subsidies (e.g. fossil fuels) and instead to create positive fiscal and other incentives and appropriate taxes to encourage a greener economy. Domestic reforms were also discussed in order to deal with some common issues in land use and urban policy, public transport, and the pricing of carbon.

The Global Green New Deal report encouraged governments and other decision makers to seize the historic opportunity presented by the financial and economic crisis by refocusing public spending and private investment in green economic sectors, such as green construction, renewable energies, sustainable transport, and water management. The report argued that an investment of 1 per cent of global GDP (i.e. approximately US\$ 750 billion) over the next two years could provide the critical mass of green infrastructure needed to reduce carbon dependency and to generate a significant greening of the global economy.

3.1 Green Growth plans and objectives

The Republic of Korea's green growth strategy includes a range of measures towards policy, regulatory and fiscal reforms aimed at supporting a transition to a green economy. The Five Year Plan attempts to provide policy signals on effective control of carbon emissions. It contains measures to enhance energy and resource efficiency and to address ecosystem degradation. Climate change mitigation and adaptation, energy security, resource efficiency and waste management, water supply and water quality, flood control, and green technological innovation would be some of the measurable outcomes, were the plan to be successfully implemented.

The Korean Government has committed to injecting into the greening of its economy a total of 107.4 trillion won (US\$ 83.6 billion) between 2009 and 2013. This represents 2 per cent of the Korean GDP and is twice the amount of investment suggested in the UNEP report.

The investment plan for green growth projects was developed in close collaboration with relevant government agencies, in particular the Korean Ministry of Strategy and Finance. The Ministry of Finance has given assurance that funding for green growth projects will be given priority over other funding, to ensure swift implementation²⁷.

Carefully tailored, time-bound and targeted fiscal and financial incentives are recognized as essential in facilitating the transition towards a green economy. A range of incentives are to be offered for private sector investments. These include tax benefits to corporate and individual investors, the issuance of long-term and low-interest green bonds and savings, and the creation of a green fund aimed at facilitating access to credit by small and medium-sized enterprises. Individual investors will also be given tax exemptions on their interest income from "green bonds" and other financial products to be issued by banks. Credit guarantees for green projects will increase from 2.5 trillion won (US\$ 1.9 billion) in 2009 to 7 trillion won (US\$ 5.4 billion) in 2013. In addition, the government seeks to mobilize investment from pension schemes and to launch a green private equity fund.

3.2 Review

The OECD's 2006 Environmental Performance Review of Korea noted that environmental expenditure in Korea – covering expenditure for pollution abatement and control, public water supply and nature protection – reached over 2 per cent of GDP, "a relatively high level by OECD standards". The 2 per cent of GDP announced for the green growth plan represents a good indication of an effort to mobilize a sizable amount of resources for investment in green sectors.

There are preliminary indicators that the Korean private sector is supportive of these initiatives. A survey of 300 Korean companies undertaken by the Federation of Korean Industries revealed that 70 per cent of the companies supported the green growth strategy and expected the strategy to improve the economy. Moreover, 41.4 per cent of the surveyed firms expressed a willingness to make investments in green growth projects. Similarly, the Korean Chamber of Commerce and Industry (KCCI) has, in general, expressed support for the government's road map²⁸.

The fiscal measures and incentives designed in green growth plan are instrumental in mobilizing green investments and can be expected to yield environmental benefits that would contribute to addressing national and global environmental challenges, while enhancing the quality of life and well-being of the Korean people. The large amount of investment in the green growth strategy is a

significant re-orientation of resource allocation that can be questionable on several grounds, including those of opportunity costs of using public finance in this area as opposed to investing in other areas of public policy.

The Korean Presidential Committee on Green Growth estimated that spending US\$ 83.6 billion on the green growth plan is expected to stimulate production worth between US\$ 141.7 billion and US\$ 160.3 billion during 2009-2013 and create between 1.56 and 1.81 million jobs. Given these broad measurements, a number of questions arise about the cost and benefits to the economy, society and the environment of different policy choices and investment decisions. For instance, there have been questions on the scale of the Four Major River Restoration Project or the options being considered for the generation of new and renewable sources of energy. The green growth plan would have benefitted from a more detailed economic evaluation and comparison of policy options in order to provide a stronger rationale on the socio-economic costs and returns.

Policy and fiscal measures contained in the green growth plan are encouraging, but they need to be complemented with further reforms, particularly in sectors that consume natural capital and contribute to ecological scarcity. Korea's indicators of carbon and energy remain among the highest in the OECD. While important efforts are being made, and further action proposed, to enhance energy efficiency, these need to be completed with reforms of energy pricing, subsidies and taxation. The green growth plan envisions a reform of pricing to reflect full cost, which represents a step forward. However, there does not appear to be a major attempt at reforming energy subsidies that keep distorting energy markets. A UNEP report noted that a reform of energy subsidies, as well as of the system of energy taxation could yield environmental gains with minimal potential adverse social and economic effects²⁹.

As in other OECD countries, the share for agriculture in the Korean economy decreased from 9 per cent of GDP in 1986-88 to below 3 per cent of GDP in 2006-2008. However, it remains among the countries with the highest rate of producer support as a percentage of GDP within the OECD (nearly three times the average percentage of support in the OECD)³⁰. Korea's CO₂ emissions and use of energy relative to its GDP and land area are among the highest in OECD member countries, while its use of pesticides and chemical fertilizers are the highest among OECD countries. Agricultural subsidies not carefully targeted may continue to sustain unsustainable forms of production and run counter to the social, economic and environmental policy goals of the [Green Growth](#) strategy.

Subsidies in the fishery sector continue to be a matter of concern. The 2006 Review by the OECD noted that the doubling of budgetary transfers to fishery policies since 2000 was mainly to preserve the marine environment. A recent Review of Fisheries in OECD Countries Policies found that half of transfers in 2004 (US\$ 562 million) were used for fisheries infrastructure, such as the improvement of fishing ports; 10 per cent for resource enhancement; 10 per cent for the improvement of fish farms; and 10 per cent for the modernisation of fish markets³¹. However, it is also understood that in certain cases, fisheries subsidies meant for environmental conservation purposes may directly or indirectly contribute to over-capacity and over-fishing and should therefore be designed and implemented with caution.

In addition, where countries have succeeded in establishing effective fishery management regimes at the domestic level, distant fishing, in which Korea is involved through access arrangements to other countries' marine areas, presents a risk that excess capacity, which is in part sustained by subsidies to the sector, may be transferred to other fishing grounds that often lack such effective

management regimes. The net effect is growing pressure on global fishing stocks that inhibit efforts to achieve a sustainable state of fishing at the global level.

3.3 Recommendations

- Carefully tailored, time-bound and targeted fiscal and financial incentives are recognized as essential in facilitating the transition towards a green economy.
- Reforming energy pricing, the launching of a process towards creation of a carbon market, the adoption of tax reform that lowers the tax burden on consumption of low-carbon goods, and the promotion of investment in green sectors are important steps towards a green economy.
- The creation of enabling conditions for low-carbon green growth must, however, be comprehensive. It is essential that harmful policies, including harmful subsidies in energy, transport, agriculture and fisheries that not only lead to economic and market distortions, but also undermine a proper accounting for natural capital, are reformed across the entire economy, or at least be part of a long-term plan.
- In addition, fiscal and financial incentives need to be provided in ways that will not create further production and trade-related distortions at national and international level, so that new industries can be created on an economically and environmentally sustainable basis.

4 Institutional Process and Participation

The Republic of Korea has formulated its green growth strategy by relying on an institutional approach that leverages on existing as well as new structures within government. There is an ongoing effort to involve other actors in the private sector, academia and civil society; as well as measures aimed at fostering education, awareness and behavioural change among the general public.

4.1 Green Growth plans and objectives

The planning and formulation of the Republic of Korea's green growth strategy and its five-year plan has brought about an inter-agency process that involves all government ministries. The Presidential Committee on Green Growth, established in 2008, is a fundamental pillar of this institutional set-up. With representatives from all government ministries, the private sector, academia and civil society, the Committee has met four times since its creation and before the release of the Five-Year Plan for Green Growth.

At each ministry, a Chief Green Officer, generally at Director-General level, is the designated focal point for interacting with the Committee. Korea Environment Institute, Korea Institute for Industrial Economics and Trade, Korea Institute of Public Finance, and scholars from economics and environment circles participated in the formulation of Korea's green growth strategy.

A set of policy measures is also targeted at stimulating participation by the general public in the achievement of the green growth objectives. There are educational programmes focusing on providing information and awareness that could lead to behavioural change such as changes in daily consumption patterns. Measures in this area include the expansion of a "carbon labelling system" started in January 2009 and the launching of a new "green lifestyle index".

Box 2: Carbon labelling system in Korea

Since July 2008, the Korean Ministry of Environment has conducted a pilot project of carbon labelling on ten categories of products in order to promote low-carbon consumption. The carbon-labelling scheme was fully launched in January 2009. The purpose of the scheme is to show the overall amount of carbon dioxide and other greenhouse gases associated with the life-cycle of a product including production, distribution, use and disposal. Korea's Eco-Product Institute under the Ministry of Environment is in charge of the certification of low-carbon products. Manufacturers apply for the certification on a voluntary basis.

The Republic of Korea has adopted a green procurement law (the Green Consumption Enhancement Act) to increase the consumption of environmentally-friendly products by central and local government agencies. Private consumption of eco-friendly products is promoted through a "Carbon Point System", which grants "carbon points" to consumers purchasing low-carbon products. Carbon points can then be exchanged for concessions at public facilities. As consumers are made more aware of the environmental implications of their consumption patterns by means such as carbon-labelling schemes, the Republic of Korea expects to double the share of its eco-friendly agricultural products from 4.5 per cent in 2009 to 10 per cent in 2013.

4.2 Review

In the follow-up to the United Nations Conference on Environment and Development, held in Rio de Janeiro, Brazil, in 1992, and the adoption of Agenda 21, Korea established a Presidential Committee on Sustainable Development. The Committee included representatives of government, the private sector, academia and civil society. It was seen as an innovative approach to promote multistakeholder involvement in the formulation and implementation of environment and sustainable development policies and was heralded by the United Nations in its review of the implementation of Agenda 21.

The new Presidential Committee on Green Growth is structured following a relatively similar model. There is an indication that this policy and institutional process has contributed to streamlining government action. Green growth related projects that were planned under the different ministries were integrated in ways that will enable focused policy direction and provision of financial and fiscal support in a more effective manner. For example, the Korean Ministry of Strategy and Finance reported that in 2008, 267 green growth-related projects were submitted by 20 ministries and offices, with a total budget of 148 trillion won. The green growth planning process resulted in packaging these projects into nine core projects and 27 related industries that form the [Green Growth](#) plan.

Beyond central government agencies, there appears to an effort to promote green growth at the local level. Local governments in the Republic of Korea are developing their respective five-year plans on green growth, which would translate the national plan into local implementation. It is expected that through such plans, local authorities will be able to tailor green growth projects to the needs and priorities of their constituencies³².

A series of presentations and public hearings were undertaken to introduce the green growth strategy to the Korean public. The general public and consumers can be significant drivers of change that should be actively engaged in the implementation of the green growth strategy.

Nonetheless, concerns have been raised by certain groups about the need to increase the level of interaction with experts and stakeholders in civil society to benefit from their views and perspectives on green growth projects. Certain environmental groups in the Republic of Korea have voiced concern that the three largest environmental organizations in Korea are not represented in the Presidential Committee on Green Growth, and that there is only one representative from an environmental organization on the committee of 47 members.

4.3 Recommendations

- The inter-agency process led by the Presidential Committee on Green Growth is an innovative approach to planning that could allow better coordination of policy-making among ministries of finance, transport, energy, environment, land, and tourism so that investment decisions are guided by multi-sectoral processes.
- The effort to clearly link the Republic of Korea's Green Growth strategy with the design of the country's mid-term target for reducing greenhouse gas emissions offers a strategically important opportunity for connecting growth and development policy with the necessity of tackling climate change. If successful, this would prove that changes in economic systems can simultaneously deliver prosperity and respond adequately to the challenge of climate change.
- At the same time, engaging the private sector and civil society as stakeholders and partners is fundamental. Civil society organizations in the Republic of Korea have been active participants in the debate on Green Growth either by voicing their concerns or by contributing to analytical thinking with a view to make a contribution to the formulation and implementing of green growth policies.
- The Republic of Korea should further promote a process of broad-based dialogue and consultation with a cross-section of all stakeholders in order to generate the necessary public support that could prove to be essential for the success of such transformational public policies.

5 Environmental Integrity

Many of the projects envisaged in the green growth national plan will have profound environmental and socio-economic implications. In particular, as a major infrastructural project, the Four Major River Restoration Project has given rise to several concerns regarding its potential effects on the environment and ecosystems surrounding the rivers. Concerns have been raised about potential risks to biodiversity and wetlands that may result from the large-scale dredging and building of the dams. It is also feared that the construction of dams may affect water quality as water flow may be slowed and that construction work may create suspended particles in the water.

5.1 Green Growth plans and objectives

The Korean Government initiated an environment impact assessment of the green growth projects, led by the Ministry of the Environment. For projects that have particularly significant impacts on the environment, as mandated by Korean laws and regulations, a prior environmental review and an environmental impact assessment is required for each project prior to its implementation. Central and local governments have the responsibility to commission such impacts assessments, which must be reviewed and approved by the Korean Ministry of Environment.

On November 6, 2009, Korea's Ministry of Environment announced the completion of the Environmental Impact Assessment of the Four Major River Restoration Project. The assessment was initiated in July 2009 by the project executor which is the Regional Construction Management Administration, an agency of the Ministry of Land, Transportation and Maritime Affairs. The Regional Construction Management Administration produced a draft Environmental Impact Statement (EIS), which outlined the proposed activities, project areas, existing environmental conditions. It analysed and assessed alternative plans, and made a preliminary estimation of environmental impacts and options for mitigation.

The draft EIS was then submitted to the Regional Basic Environmental Offices, under the authority of the Ministry of Environment, acting as "consultation agencies". These consultation agencies entrusted the Korea Environment Institute (KEI), a specialized review agency, to examine the content of the statement.

The EIS served as a basis for consultation with relevant government agencies and the general public, a process led by the Regional Basic Environmental Offices. The Regional Environmental Offices collected opinions from residents and communicated to the Regional Construction Management Administration to provide response and mitigation measures. Based on the result of these consultations and comments from KEI, the Korean Ministry of Environment entered into consultation with the Ministry of Land, Transportation, and Maritime Affairs, acting as approval agency. [This process lead to a final EIS.](#) The conclusions of the EIS are summarized under four categories: ecosystem, the natural environment, water quality, and others.

On **ecosystems**, the assessment identified around 68 legally designated protected species and natural treasures that may be concerned by the Four Major River Restoration Project. It is planned that during the winter time when migratory birds arrive, the intensity of the construction work will be reduced. In addition, green belts will be constructed to provide additional habitats for animals to live in a natural environment. Other mitigation measures to be undertaken include the setting-up of places for laying eggs and sheltering for wild animals by creating habitats with natural stones and caves.

A monitoring of the potential impacts of the Four Major River Restoration Project on legally designated protected species will be implemented regularly over the next three years from the start of the construction work and after the completion of construction. The Ministry of Environment will devise other countermeasures that may be warranted as a result of such monitoring.

With regard to the **natural environment**, the EIS mainly addressed potential risks to wetlands that surround the four rivers. It was found that out of 100 wetland sites located in the project area, 54 wetlands may be directly or indirectly affected by the project. These 100 wetlands cover a total area of 68,267,960 square metres, of which 8,550,949 square metres, or 12.5 per cent of the total area, will be affected by the project.

To minimize the project's impact on wetlands Korea's Ministry of Environment undertook a selection of wetlands of high value that must to be preserved intact, and those wetlands that rather require an effort to minimize potential effects of the project. Accordingly, the wetland at Dalseong (upper stream of Nakdong River) and Gapno, Parkjingyo wetland (lower stream of Nakdong River) are to be preserved in part by adjusting the dredging boat for river channels. The sedimentary river island and sandbar at Haepyong wetland in the upper stream of Nakdong River, where migratory birds inhabit, are scheduled to be preserved. For the wetland at Jangam and Woeam (Keum River) measures will seek to minimize the project impacts.

Part of the wetland areas that are likely to be affected are proposed to be compensated for through the construction of man-made wetlands at 84 sites in total. Namhan river (17 sites), Geum river (8 sites), Nakdong river (11 sites), Yeongsan river (48 sites). For example, in the case of the lower stream of the Nakdong river, the development of new wetland areas in 11 sites will result in an increase of it total dimension to 921.1 thousand m², which is 2.1 times the area likely to be affected as a result of the project (427.5thousand square metres).

Table 4: Environmental Impact Assessment of the Four Major River Restoration Project on wetlands

	Wetland		Degree of impact	
	Number of wetlands	Area (m ²)	Number of wetlands	Area (m ²)
Total	100	68,267,960	54 (54.0%)	8,550,949 (12.5%)
Namhan River	20	38,291,027	13 (65.0%)	1,470,923 (3.8%)
Nakdong River	38	22,832,325	21 (55.2%)	5,675,565 (24.8%)
Geum River	10	329,250	2 (20.0%)	10,000 (3.0%)
Yeongsan River	32	6,815,358	18 (56.3%)	1,394,461 (20.5%)

With respect to **water quality**, Korea's National Institute of Environmental Research, which was entrusted with an assessment of water quality, concluded that water quality will generally be improved as a result of the project. It has been estimated that pollution from mud that may occur during the construction phase will not lead to weighted density (by standard of dry season) of more than 10 mg/litre. In the case that floating matters exceed 15 mg/litre it is planned that the construction period and intensity will be adjusted and that additional pollution reduction facilities will be installed.

The effect of potential mud pollution is further mitigated by keeping an interval of at least 2 kilometres between dredging sites during the construction phase. The flow of water is expected to be enhanced through the installation of a bottom water displacement facility, an underwater triggering device using bio-oxidation for sewage disposal, and photovoltaic water circulatory system. Such a combination is suggested as a scheme for water quality management at the vertical upper stream of a reservoir for irrigation. There will be a real-time monitoring of water

quality through an automatic measuring sensor, so that additional countermeasures can be undertaken if needed. In prevention of potential water pollution incident, such as unexpected leakage of oil, preventive equipment of water pollution is due to be placed around construction sites.

The Ministry of Environment has the responsibility to ensure follow-up and implementation of the conclusions of the environmental impact statement. In that process, the existing Environment Evaluation Board will be transformed into a Post-management Investigation Commission after a re-composition of its membership. The Environment Evaluation Board is composed of a total of 91 experts from the private sector, experts from the Korea Environment Institute, and government officials and is currently installed and operated by district environmental agencies. The future Post-management Investigation Commission expected to be installed in January 2009 will be entrusted with monthly investigation, monitoring and inspection of the implementation of measures to mitigate identified environmental effects.

5.2 Review

Many of the projects envisaged in the green growth national plan will have profound environmental and socio-economic implications. In particular, as a major infrastructural project, the Four Major River Restoration Project has given rise to several concerns regarding its potential effects on the environment and ecosystems surrounding the rivers. Concerns have been raised about potential risks to biodiversity and wetlands that may result from the large-scale dredging and building of the dams. It is also feared that the construction of dams may affect water quality as water flow may be slowed and that construction work may create suspended particles in the water.

Korean authorities have initiated a process of assessment of the potential environmental impacts of the Four Major River Restoration Project, and announced a number of measures to mitigate negative effects that have been identified. It is estimated that at least three Wetland Protection Areas in Korea may be directly affected by the project: the Dalseong Wetland, Nakdong Estuary and Damyang Wetland which are protected as protected area.

The process allows for public comments and requires relevant authorities to respond. Concerns have been expressed with reference to the short amount of time given to undertaking the environmental impact assessments, which limited the participation of some stakeholders in Korea. Certain groups have noted, for example, that the Four Major River Restoration Project was made public for the first time on 15 December 2008 and the Five-Year Plan was announced in July 2009. The implementation was expected to start in October 2009, subject to clearance of the environmental impact assessment, and should be completed by 2012. Such a schedule appears to some as too short for a proper planning, impact assessment and careful implementation of this project worth more than US\$ 17 billion.

Reports have stressed that dams with floodgates, which will be among the prominent features of the project, have never been built in the Republic of Korea before. Despite the undertaking of an environmental impact assessment, there are fears that the nature and full scale of the impacts of the project will only be understood once construction would have started. This has prompted calls, among certain law-makers and stakeholders in the Republic of Korea for a progressive

approach to the implementation of the project that would start with some of the rivers as a first step, rather than going ahead with dredging on all the four main rivers at the same time.

Setting aside the technical justification of one approach or the other, critical to the success of the Four Major River Restoration Project will be the realization of a certain consensus on the importance of the policy goals that the project seeks to achieve, a justification of the large amount of financial resources that it requires in a period of economic crisis, and an agreement on the overall economic, social and environmental costs and benefits to Korean society. To that effect, furthering dialogue and consensus building among the various actors and stakeholders appears to be offering the best possible outcome for a positive way ahead.

5.3 Recommendations

- While pursuing green growth objectives, it will be essential to ensure environmental integrity of the various projects being considered, in particular those that may present risks to sensitive ecosystems and biodiversity. In that respect, it is essential that prior and full environmental impact assessments continue to be undertaken, and that all relevant experts and stakeholders are provided with an opportunity to participate effectively in processes of environmental impact assessment.
- The whole range of possible impacts of the Four Major River Restoration Project remains uncertain and may only be fully understood once the implementation of the project has started. Therefore the Republic of Korea should ensure that a mechanism of continuous monitoring of the project's effects on biodiversity, wetlands, water quality and other sensitive ecosystems is put in place and remains so throughout the period of the project.
- The Republic of Korea should ensure that the institutional processes for monitoring the environmental effects of the project allow for effective participation by relevant stakeholders, so that consensus can be created on the understanding of the nature of such impacts and ways to mitigate negative consequences.

Annex 1: Investment in the Five-Year Plan (2009 – 2013) in billion US\$

Category of action plan and policy direction	Amount of investment			
	Total	2009	2010-11	2012-13
	83.6	13.6	37.6	32.4
[1] Measures for climate change and securing energy independence	44.3	6.7	22.7	14.9
1. Reduce carbon emissions	4.4	0.8	1.7	1.9
2. Decrease energy dependence on oil and enhance energy self-sufficiency	11.6	2.2	4.4	5.1
3. Support adaptation to climate change impacts	28.3	3.7	16.7	7.9
[2] Creation of new growth engines	22.3	3.7	8.3	10.2
4. Develop green technologies as future growth engine	8.8	1.6	3.3	3.9
5. Greening of industry	3.6	0.6	1.4	1.6
6. Develop cutting-edge industries	8.5	1.2	3.0	4.2
7. Set up policy infrastructure for green growth	1.4	0.2	0.5	0.6
[3] Improving quality of life and strengthening the status of the country	21.7	4.0	8.2	9.5
8. Green city and green transport	19.7	3.7	7.4	8.6
9. Green revolution in lifestyle	1.5	0.3	0.6	0.6
10. Enhance national status as a global leader in green growth	0.5	0.1	0.2	0.2
Note: Currency rate (= Korean Won / U.S. Dollar) = 1284.7 (June 30, 2009)				

Annex 2: Investment plan for the Four Major River Restoration Project “Main project” (US\$ billion)

Lead ministry	Investment				
	Total	2009	2010	2011	2012*
Ministry of Land, Transport and Maritime Affairs	10.6	0.6	4.8	4.7	0.4
Ministry of Food, Agriculture, Forestry and Fisheries	2.2	0.1	0.4	0.8	0.9
Ministry of Environment	0.4	-	0.2	0.2	
Total	13.1	0.7	5.4	5.7	1.3
(Note) Most of the main projects are planned to be completed by 2011. * Building dams and reservoirs for irrigation will be completed by 2012.					

Annex 3: Investment plan for the Sumjin river and the tributaries to the four major rivers (US\$ billion)

Lead ministry	Investment				
	Total	2009	2010	2011	2012
Ministry of Land, Transport and Maritime Affairs	1.3	-	0.4	0.5	0.4
Ministry of Food, Agriculture, Forestry and Fisheries	0.2	-	-	0.1	0.1
Ministry of Environment	2.6	0.8	0.9	0.5	0.5
Total	4.1	0.8	1.2	1.2	0.9

Note: These projects are planned to be completed by 2012.

Annex 4: Issues to address in the assessment of the usefulness and feasibility of wetland restoration projects

Assessments for the selection of appropriate wetland restoration projects should include the following questions (adapted from the Annex to Resolution VII.17):

- Will there be environmental benefits (for example, improved water quantity and quality, reduced eutrophication, preservation of freshwater resources, biodiversity conservation, improved management of "wet resources", flood control)?
- What is the cost-effectiveness of the proposed project? Investments and changes should in the longer term be sustainable, not yielding only temporary results. Aim for appropriate costs in the construction phase and appropriate running costs for future maintenance.
- What options, advantages or disadvantages will the restored area provide for local people and the region? These may include health conditions, essential food and water resources, increased possibilities for recreation and ecotourism, improved scenic values, educational opportunities, conservation of cultural heritage (historic or religious sites), etc.
- What is the ecological potential of the project? What is the present status of the area in terms of habitats and biological values, and in particular will any current features of wetland conservation or biodiversity importance be lost or damaged? How is the area expected to develop with respect to hydrology, geomorphology, water quality, plant and animal communities, etc?
- What is the status of the area in terms of present land use? The situation will differ widely between developed countries, countries with economies in transition, and developing countries, and within such countries depending on local circumstances, with respect to the objectives of restoration and rehabilitation. In particular, marginal lands yielding few benefits in the present situation can often be improved.
- What are the main socio-economic constraints? Is there a positive regional and local interest in realising the project?
- What are the main technical constraints?

Source: Principles and guidelines for wetland restoration (Resolution VIII.16). "Wetlands: water, life, and culture" 8th Meeting of the Conference of the Contracting Parties to the Convention on Wetlands (Ramsar, Iran, 1971) Valencia, Spain, 18-26 November 2002. Box 2. Issues to address in the assessment of the usefulness and feasibility of wetland restoration projects

ACRONYMS

ANP	Advanced Nano Products
CCS	Carbon Capture and Storage
CO ₂	Carbon dioxide
GDP	Gross Domestic Product
EPI	Environmental Performance Index
ERP	The Eco-river Restoration Programme
GFEI	The Global Fuel Economy Initiative
GHG	Greenhouse Gas
GND	Green New Deal
IEA	International Energy Agency
IPCC	The Intergovernmental Panel on Climate Change
LED	Light Emitting Diode
LNG	Liquefied Natural Gas
MLTM	Ministry of Land, Transport and Maritime Affairs
MOCT	Ministry of Culture, Sports and Tourism
MOFAFF	Ministry of Food, Agriculture, Forestry and Fisheries
ODA	Official Development Assistance
OECD	Organization for Economic Co-operation Development's
RFS	Renewable Fuel Standard
RPS	Renewable Portfolio Standard
R&D	Research and Development
SMEs	Small and Medium Enterprises
TMS	Tele-Monitoring System
TOE	Ton of oil equivalent
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNFCCC	United Nations Framework Convention on Climate Change

Endnotes

¹ The concept of “Green Growth” was first adopted at the “Ministerial Conference on Environment and Development” jointly hosted by the Ministry of Environment of the Republic of Korea and the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) in 2005. It was initiated by Republic of Korea, the host country, and included in the outcome of the Conference, “Seoul Initiative Network on Green Growth”. Source: Korea Ministry of Environment.

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¹⁹ OECD (2006) Environment Performance Review of Korea. Paris: OECD.

²⁰ South Korea Ministry of Land, Transport and Maritime Affairs and the Ministry of Environment, 2009

²¹ Principles and guidelines for wetland restoration ([Resolution VIII.16](#)). "Wetlands: water, life, and culture" 8th Meeting of the Conference of the Contracting Parties to the Convention on Wetlands (Ramsar, Iran, 1971) Valencia, Spain, 18-26 November 2002.

²² Annex to Ramsar Resolution VII.17 on restoration as an element of national planning for wetland conservation and wise use

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²⁷ Communication from a meeting with representatives of the Presidential Committee on Green Growth on 29 July 2009.

²⁸ Communication from a meeting with representatives of the Korea Chamber of Commerce and Industry, Business Institute for Sustainable Development on 30 July 2009.

²⁹ UNEP and United Nations Foundation (2004). Energy Subsidies: Lessons Learned in Assessing their Impact and Designing Policy Responses.

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³⁰ OECD (2009). Agricultural Policies in OECD Countries: Monitoring and Evaluation. Highlights. <http://www.oecd.org/dataoecd/37/16/43239979.pdf>

³¹ OECD (2009), *Review of Fisheries in OECD Countries Policies and Summary Statistics 2008*. Paris: OECD.

³² In a bid to familiarize central and local government officials with the concept of green growth, the Korean Prime Minister has led a series of 19 lectures on green growth to government officials. Five such lectures were directed at central government officials and 14 to local government officials. Altogether, over 5,000 central and local government officials attended those sessions. Communication from a meeting the authors of this report had with the Prime Minister's Office, Republic of Korea, on 29 July 2009.



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