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# **OVERVIEW OF THE REPUBLIC OF KOREA'S NATIONAL STRATEGY FOR GREEN GROWTH**

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## Overview of the Republic of Korea's National Strategy for Green Growth

### 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 an overview of the Republic of Korea's strategies and policy goals set under 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 objectives of the review are:

- 1) to analyze the 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.

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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 more efficient use of resources 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 use 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 energy efficient construction, renewable energies, low carbon 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 observed that the Republic of Korea’s Green New Deal stimulus package provided a model for 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. Indeed, 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.

This report shows that 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 new strategy, the share

of 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 (22.2 trillion Korean won (US\$ 17.3 billion)) in the Four Major Rivers 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 encourages the stepping up of investment in ecological restoration, to address this key ecological scarcity as well as to prepare effective and cheap adaptation strategies for the onset of climate change reducing recurrent costs associated with periodic flooding.

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 employment, reduces poverty and inequality, and does so without exhausting natural capital or creating ecological scarcities and climate risks.

**Pavan Sukhdev**  
**Special Advisor and Head UNEP Green Economy Initiative**

## Executive Summary

Transforming the global economy away from dependence on fossil fuels and unsustainable use of the Earth's limited resources and achieving a transition towards a Green Economy<sup>1</sup> 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 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 a remarkable effort to reorient and refocus investment in the environment.

The Republic of Korea responded to the economic crisis with a stimulus package that included a significant portion of green spending. In fact, it 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 Ministerial Council Meeting of member countries of the Organisation for Economic Cooperation and Development (OECD) on 25 June 2009. It is also playing a key role in promoting an East Asia Climate Partnership.

The bullet points below summarise the key action areas contained in the Korean Green Growth Strategy, the outcome of the review done by UNEP, and the main recommendations.

### Climate Change

- Korean carbon emissions have been growing fast and are expected to grow much faster than the average for the OECD countries. 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 IEA's 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.
- This makes it critical and urgent for the country to address the challenges posed by the level and pace of growth of carbon emissions and their consequences. Moreover, achieving a low-carbon green growth will require an effort to reduce the carbon intensity of the Korean economy.

- 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, in a voluntary and independent manner, 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. This is the highest reduction level that the IPCC has recommended for developing nations.
- The creation of a carbon emission trading scheme in Korea can be 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. It is also important to design new systems to work in harmonious ways with the existing ones.
- The Republic of Korea could enhance its capacity to respond and adapt to climate change 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 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 roles in climate change adaptation, as natural defences against increasing hazards associated with climate change, such as storms, cyclones, flooding and sea-level rise, thereby alleviating future expenditures associated with disaster recovery.

## 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 27.9 per cent of GDP. This is well above the 17.4 per cent OECD average.
- The 2006 OECD *Environment Performance Review of Korea* noted that "Korea is one of the few OECD countries which have 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 (IEA) found Korea's energy efficiency targets as not 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 comparative terms, however, energy intensity remains slightly above that of most IEA member countries.
- The Republic of Korea could improve its position by seeking 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 could improve compliance and results by monitoring voluntary agreements with industry, to ensure they achieve the expected targets, and consider alternative policies in case voluntary targets are not met.

## **Renewables and Nuclear 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 would double the share of renewables in energy supply. When renewable energy that will be generated from the 1 Million Green Homes Project is taken into consideration, the share of renewable energies in total energy supply would be 11 per cent in 2030. This will not only reduce the country's carbon footprint but also dependence on volatile fuel imports.
- In comparison with renewable energy targets adopted in many comparable countries, these Korean renewable energy targets appear to be relatively modest. However, the pace of change envisaged is remarkable considering that the country had increased its renewable energy supply only by 0.37 per cent in the past, from 2.06 per cent in 2005 to 2.43 per cent in 2008. UNEP encourages an even more aggressive target to improve future energy security and to further efforts toward green growth.
- Government will have to expand assistance for the national strategic technology development in such areas as solar and bio-energy technologies and pursue the target through various policy measures such as RPS, waste energy, and the 1 Million Green Homes Project.
- UNEP recommends that the Republic of Korea 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 energy generation in other countries pursuing nuclear energy options.

## **Transport, Cities and Fuel Efficiency**

- The transport sector accounts for 21 per cent of Korean energy consumption, with an annual average increase rate of 6.3 per cent. 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.
- 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 could formulate specific policies and measures to provide the physical and policy

infrastructure in support of the development of a smart grid system by 2013 in order 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 announced a GHG reduction target of 31 per cent by 2020 for the building sector, which is the highest level compared to any other country. The target includes strengthening energy standards by 30 percent by 2012, achieving passive level by 2017, and zero-energy housing by 2025.

## **Water and Ecological Infrastructure**

- The Republic of Korea faces many water related challenges due to rapid economic growth and high population density. Reports indicate that current aqua-ecosystem protection mechanisms are insufficient. Climate change could exacerbate risks of water scarcity and increase the frequency and intensity of floods.
- In response to these challenges, the Four Major Rivers Restoration as a part of the “Green New Deal” policy attempts to secure abundant water resources; create systems for flood control; improve water quality; restore ecosystems; and to create opportunities for rural development. These are important policy goals that could bring numerous positive effects to the national economy and people’s lives.
- The attempt of ecological restoration of four rivers (Han, Nakdong, Geum and Yeongsan) and their tributaries is commendable, but its implementation needs to follow approaches that will result in effective “ecological restoration”, by making efforts to enhance the ecological integrity of river ecosystems, in order to achieve the important policy objectives pursued under this project.
- UNEP recommends paying particular attention to compliance with the results of environmental impact assessments, and to ensuring the maintenance of key ecosystem functions, since the four major rivers are ecologically sensitive.

## **Green Technologies**

- As seen, 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, is therefore a core component of a green growth strategy.
- The Korean Green Growth Plan seeks to promote the development of 27 core green technologies that would provide future engines of growth to the Korean economy. UNEP encourages that the development of new green technologies goes hand-in-hand with the greening of the existing manufacturing sector by adopting specific policy goals and targets to reduce carbon intensity and energy intensity.

- In addition, taking a more comprehensive reform of existing incentives and other support mechanisms in carbon and energy-intensive industries would complement and support efforts to spur green innovation.

## **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.
- The Republic of Korea is taking important policy and fiscal measures which include a reform of energy pricing, the creation of a national carbon market, the adoption of tax reforms that lower the tax burden on consumption of low-carbon goods, and fiscal incentives to encourage investment in green sectors.
- 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 seeks better coordination of policy-making among ministries of finance, transport, energy, environment, land, and tourism, among others, so that investment decisions are guided by multi-sectoral processes.
- The effort to clearly link the Korean Green Growth strategy with the design of the country's mid-term target for reducing greenhouse gas emissions offers a strategically important opportunity to connect growth and development policy with measures to address 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 making 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.

## Learning for other Countries

- Governments should carefully weigh up the economic, social, and environmental costs and benefits of different strategies and policy options, including “green investments” as a means of achieving a more green economy. This is particularly important in times of economic crisis, when jobs are under threat and industries are re-tooling.
- 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 ecological 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, 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.

Despite significant economic progress, 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. In this context, President Lee Myung-Bak announced a "low-carbon, green growth<sup>2</sup>" strategy as a new vision to guide the nation's long-term development on 15 August 2008, during a national address on the 60<sup>th</sup> 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 implemented through Five-Year Plans for Green Growth.

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 drivers is expected to generate substantially intensive, qualitative growth unlike the extensive quantitative growth of the past. This approach facilitates a mutually beneficial relationship

between economic growth and the environment. The green growth strategy has three key objectives:

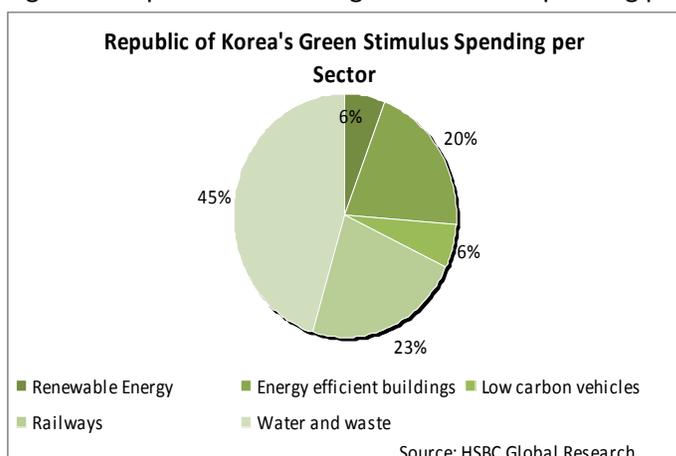
- 1) Creating new engines of a higher and sustainable growth path by developing low-carbon, environmentally-friendly industries;
- 2) Ensuring climatic and environmental sustainability; and
- 3) Contributing to the international negotiations to fight climate change.

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.

Figure 1: Republic of Korea's green stimulus spending per sector



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)<sup>3</sup>.

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 countries<sup>4</sup>.

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)<sup>5</sup>.

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)<sup>6</sup>.

The Korean 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 growth<sup>7</sup>. The 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 is implemented 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 Green New Deal. For instance, the Five-Year Plan integrates the Four Major Rivers 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”, which will provide the legal basis for Korea’s green growth strategy. On December 29, 2009, the Korean National Assembly adopted the Basic Law, which President Lee Myung-Bak signed into law on January 13, 2010.

<b>Strategies</b>	<b>Policy directions</b>
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\$ 141.1 billion to US\$ 160.4 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 tables<sup>8</sup> 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 1.18 to 1.47 million people during the five years. In the design of the 50 projects included in the Five-Year Plan, there appears to be a strategy focusing first on large infrastructural projects such as the Four Major Rivers Restoration Project. 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.

<b>Indicator/period</b>	<b>Economic gains</b>					
	<b>Production inducement (US\$ Billion)</b>		<b>Value-Added inducement (US\$ Billion)</b>		<b>Job creation (thousand people)</b>	
	Case 1	Case 2	Case 1	Case 2	Case 1	Case 2
2009-2013	141.1	160.4	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 <sup>st</sup> quarter 2009 (908,000)						

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

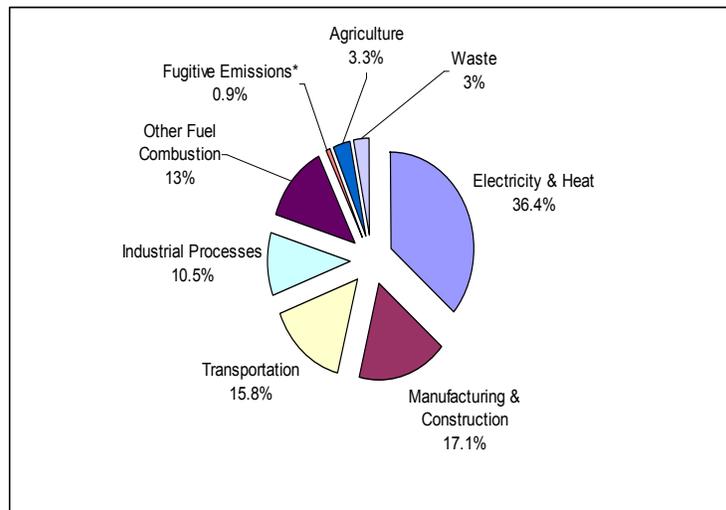
### 2.1. Climate Change

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 (Jeju Island) rose by 22 cm, which is three times higher than the global average sea level rise<sup>9</sup>.

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 (see Annex 5). This has given rise to concerns about the climate change impacts of the country's rapid pace of growth and industrialisation.

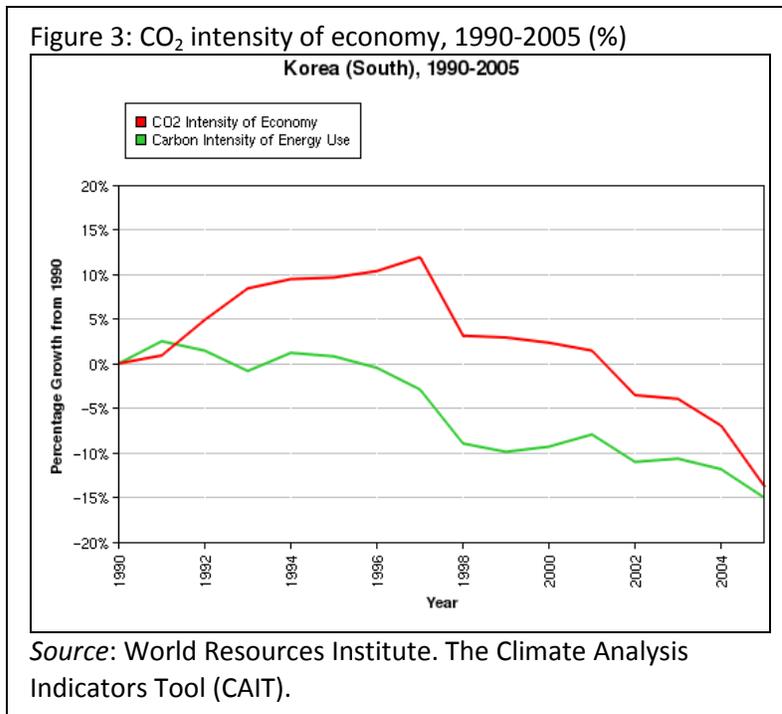
On a sectoral basis, the Republic of Korea's greenhouse gas emissions are concentrated in electricity and heat, manufacturing, transportation, and industrial processes. Energy-related emissions from all sectors cumulating to 456.6 Mt CO<sub>2</sub>e in 2005, account for the bulk of GHG emissions (see Figure 2).

Figure 2: GHG Emissions by Sector in 2005 (CO<sub>2</sub>, CH<sub>4</sub>, PFCs, HFCs, SF<sub>6</sub>, excludes land use change).



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

The Korean 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.



The carbon-intensity of the Korean economy has declined noticeably since 1997 (Figure 3), but remains relatively high in comparison with other OECD member countries.

In fact, compared to the IEA average, in 2004 Korea’s energy-related CO<sub>2</sub> emissions per unit of GDP (a measure of CO<sub>2</sub> intensity) was over 40 per cent higher than Japan, nearly 23 per cent higher than the IEA Pacific average (Australia, Japan, Korea and New Zealand), and 15 per cent above the total IEA average<sup>10</sup>.

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 (CO<sub>2</sub>) emissions as well as its use of energy, pesticides, and fertilizers are among the highest in the OECD relative to GDP or area<sup>11</sup>. 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. Korean 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. Under these scenarios, the country’s emissions would be reduced by 21, 27, and 30 per cent, compared to projected growth in 2020<sup>12</sup>.

**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 CO<sub>2</sub>.

**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<sub>2e</sub>*

*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 raising public awareness. Other measures announced include the adoption of new auto emission standards, a waste-to-energy programme to reduce GHG 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 was adopted by the Korean National Assembly in December 2009, provides 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 GHG reductions in Korean Plan. It is further expected that the growing carbon market will create an innovative business environment for domestic and international industries. Although details of the carbon market, including the auctioning and/or pricing of carbon emission permits, and industries to be covered under the scheme, are yet to be defined, Korea is positioned to capitalize on this market.

Forests cover more than two-thirds of the Korean land surface. The potential for reducing emissions from the forest sector is expected to be enhanced from 1.452 billion CO<sub>2</sub> ton to 1.613 billion CO<sub>2</sub> ton in 2013. The Five-Year Plan also incorporates provisions for aid for forest projects in the Democratic People's Republic of Korea.

Additionally, 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 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.

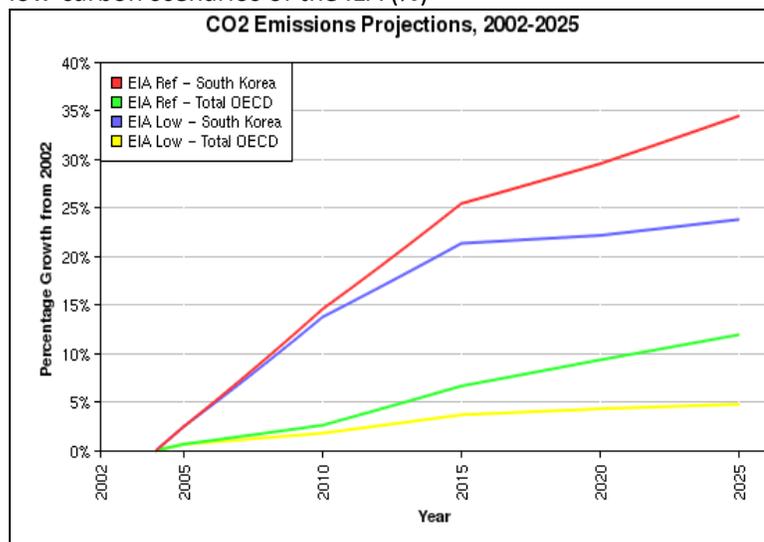
The Five-Year Plan includes measures to undertake climate change risk assessment and to develop action plans to prepare for the likely impacts of climate change on infrastructure, health, water management, agriculture, biodiversity and housing, and options for dealing with them. Efforts will focus on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

Securing water resources is a critical dimension of climate change adaptation objectives. In that respect, around 1.3 billion cubic meters will be secured by 2012, as part of the Four Major Rivers 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 by enhancing 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 was 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.”<sup>13</sup>

Figure 4: Projected growth in CO<sub>2</sub> 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 4). 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 principle 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 29 December 2009, the National Assembly passed the Framework Act on Low-carbon Green Growth. On 6 April 2010, the government adopted the Enforcement Decree of the Framework Act on Low Carbon during the 15<sup>th</sup> Cabinet meeting. Both the law and its enforcement decree are due to come into effect on 14 April 2010. The Law 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 CO<sub>2</sub> 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 a 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 Rivers 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 km<sup>2</sup> 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 IPCC reports suggest 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 Rivers 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, if properly conserved and made more resilient, could play important infrastructural functions, and provide natural defences against increasing hazards associated with climate change, such as storms, cyclones, flooding and sea-level rise. However, 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)<sup>14</sup>.

## **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. Korean 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. The “negotiated agreement” will be applied to companies with an annual energy consumption over 500 thousand TOE in 2010, over 50 thousand TOE in 2011, and over 20 thousand TOE in 2012. In the transport sector, there will be new standards to increase the fuel efficiency 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 light emitting diode bulbs (LEDs) with 3 to 5 times higher energy-efficiency.

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**

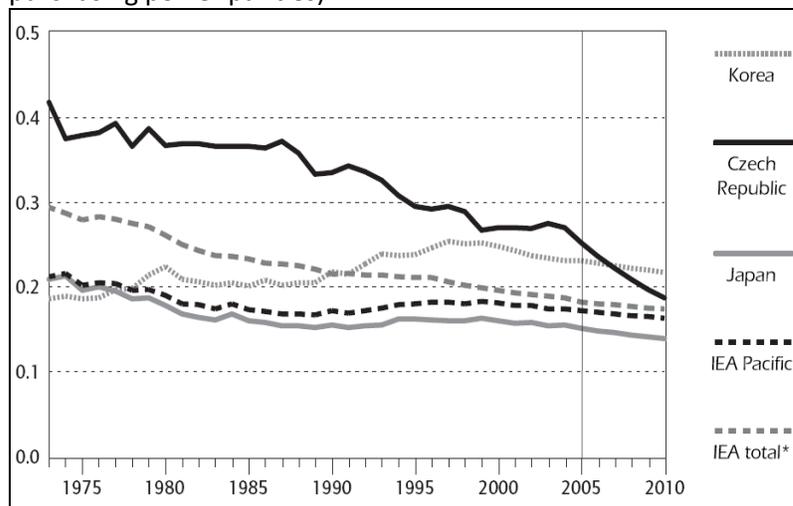
Enhancing energy efficiency is particularly important given that manufacturing and energy-intensive industries remain predominant in the Korean economy. With the world’s largest shipbuilding industry and the fifth largest steel production, industry in Korea accounts for 27.9 per cent of GDP which is well above the 17.4 per cent OECD average.

In 2004, the Korean Government adopted a General Energy Conservation and Efficiency Improvement Plan, which set the objective of enhancing energy efficiency so that Korea’s energy intensity is reduced 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 were not high at that time and could be improved. 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 (see Figure 5).

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.

Figure 5: Energy Intensity in Korea and 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).

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. Therefore, it is critical that voluntary agreements with industry are monitored to ensure that they achieve the expected targets, and that alternative policies are considered in case voluntary targets are not met. The Korean Government's newly announced "negotiated agreements" with measuring, reporting, and monitoring (MRV) processes will help in this regard.

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.

## **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)<sup>15</sup>. Given its high energy import dependence, Korea is seeking to expand its renewable energy generation through target setting and regulator measures.

### **2.3.1. Korean 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. Renewable energy generation from the "1 Million Green Homes" project would increase this share to 11 per cent in 2030.

In 2006 the amount of waste generated daily in Korea was approximately 320 thousand tons. Currently, energy generated from waste accounts for 76 per cent of the renewable energy in Korea. To develop such a potential, the Korean Government plans to implement measures for waste resources and biomass energy by utilizing waste energy, agricultural and marine biomass, forest biomass, and building low carbon and green villages. To generate energy from 3.86 million tons per year of combustible and organic waste resources, 48 environmental energy facilities will be installed by 2013. In addition, in order to recollect and reuse the heat from incinerators, 17 remaining heat collecting facilities are planned to be built, and to recollect and reuse the landfill gas from landfill sites all over the country, 25 landfill gas recollecting facilities are planned to be built. A comprehensive system for treatment of waste resources from the industrial sector will be prepared by 2011. Technologies that are currently employed in the chemical industry will also be deployed to promote the development of renewable energy. To efficiently produce and utilize waste energy, integration and broad-banding of energy plants will be pursued by 2020.

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. The country will gradually increase the proportion of nuclear energy in power generation from 24 per cent in 2009, to 27 per cent in 2013, and to 32 per cent in 2020.

The development of tidal power is a notable change in the country's energy matrix. Starting virtually from nil in 2008, tidal power generation will expand to 0.9 per cent of total renewable energy generation in 2010 and 5.2 per cent in 2020, representing a 50 per cent annual increase.

Hydropower generation is also expected to increase, with the construction of new dams and 42 hydroelectric plants that would generate 278,471 MWh per year. Nonetheless, the share of hydropower in the total renewable energy supply will decrease, as a result of larger increases in the other renewable resources such as bioenergy, wind, tidal power, and solar PV and solar thermal.

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 600 low-carbon green villages are expected to be built. The government plans to build one million energy-saving green homes by 2020 and to refurbish one million existing houses using new and renewable energy.

Table 3: New and renewable energy (NRE) deployment in Korea: Status and projections (Unit: Thou. TOE, %)

	2008	2010	2015	2020	2030	Annual increase (%)
Solar thermal	33 (0.5)	40 (0.5)	63 (0.5)	342 (2.0)	1,882 (5.7)	20.2
PV	59 (0.9)	138 (1.8)	313 (2.7)	552 (3.2)	1,364 (4.1)	15.3
Wind	106 (1.7)	220 (2.9)	1,084 (9.2)	2,035 (11.6)	4,155 (12.6)	18.1
Bioenergy	518 (8.1)	987 (13.0)	2,210 (18.8)	4,211 (24.0)	10,357 (31.4)	14.6
Hydro	946 (14.9)	972 (12.8)	1,071 (9.1)	1,165 (6.6)	1,447 (4.4)	1.9
Geothermal	9 (0.1)	43 (0.6)	280 (2.4)	544 (3.1)	1,261 (3.8)	25.5
Marine	0 (0.0)	70 (0.9)	393 (3.3)	907 (5.2)	1,540 (4.7)	49.6
Waste	4,688 (73.7)	5,097 (67.4)	6,316 (53.8)	7,764 (44.3)	11,021 (33.4)	4.0
<b>Total</b>	<b>6,360</b>	<b>7,566</b>	<b>11,731</b>	<b>17,520</b>	<b>33,027</b>	<b>7.8</b>
<b>Primary Energy (M TOE)</b>	<b>247</b>	<b>253</b>	<b>270</b>	<b>287</b>	<b>300</b>	<b>0.9</b>
<b>Share (%)</b>	<b>2.58%</b>	<b>2.98%</b>	<b>4.33%</b>	<b>6.08%</b>	<b>11.0%</b>	

Source: Korea Energy Management Corporation, April 2010.

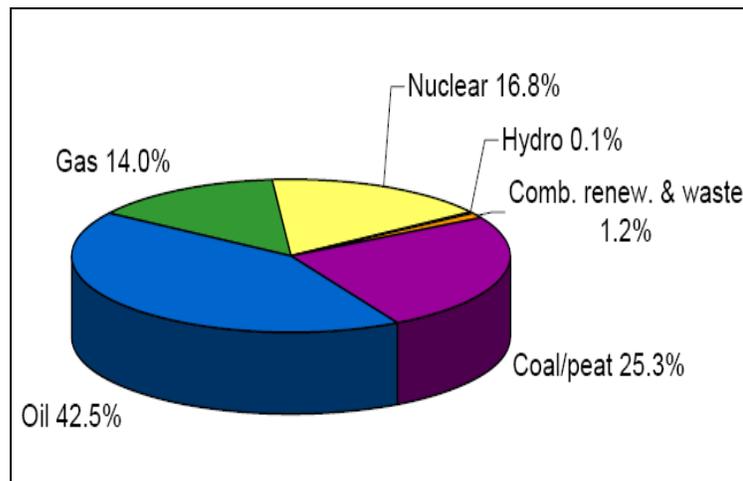
Apart from these technological options and targets, measures are being considered to create economic incentives and regulatory standards that will create a market for demand and supply of renewables. These include economic incentives to increase the use of solar energy in homes and small buildings. To increase the distribution of new and renewable energy, measures such as Renewable Portfolio Standard (RPS) and Renewable Fuel Standard (RFS) will be adopted from 2012. The RPS will require large-scale energy plants to supply new and renewable energy, and the required supply share will be increased annually up to 10 per cent by 2022.

By 2030, a smart grid system will be established comprising a network of electric power suppliers that incorporates advanced control and communication 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 CO<sub>2</sub> emissions and contribute to enhancing energy security.

### 2.3.2. Review

The Korean energy matrix is largely dominated by fossil fuels, accounting for over 80 per cent of total primary energy supply, the remaining consisting of nuclear energy mainly, and a little fraction of renewables (see Figure 6). As such, 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.

Figure 6: Share of total primary energy supply in the Republic of Korea in 2007 (excl. electricity trade)



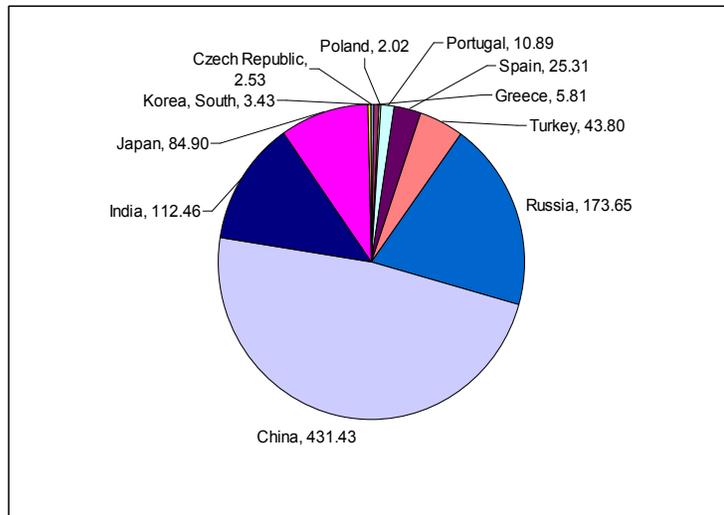
Source: IEA Energy Statistics, 2009.

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 sources of energy 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.

However, despite the importance of hydroelectricity in the Republic of Korea's renewable energy supply, the volume of hydro-electricity 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.

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



Source: Energy Information Administration, International Energy Annual 2006.

There appears to be efforts in that direction. As part of the Four Major Rivers Restoration project, there are plans to construct 42 hydroelectricity generating plans. These 42 hydroelectric plants with a total cost of around US\$ 163 millions are expected to generate 278,471 MWh per year. In addition to expanding the share of hydropower in total energy use, this will contribute to reducing about 150 thousand tons of CO<sub>2</sub> and replace 470 thousand barrels of oil for power generation per year.

To respond to the increasing energy demand, Korean authorities plan to expand nuclear energy supply and also improve infrastructure and continuous development of capacities in accordance with the results of regular safety assessments. The Republic of Korea is the world's sixth largest generator of nuclear electricity, accounting for 4.8 per cent of global generation<sup>16</sup>.

In its 2006 Energy Policy Review of the Republic of Korea, the International Energy Agency concluded that Korea's nuclear energy industry is a model for other countries. The report noted that the nuclear energy regulatory framework implemented by Korea is comprehensive and in line with best international practices<sup>17</sup>.

Overall, there appears to be an increased interest in nuclear power generation in OECD countries, in large part as a result of policies to address climate change. The IEA projects in its 450 ppm scenario that nuclear power along with renewable energies will have increased shares in the total global energy mix by 2030<sup>18</sup>.

Typically, a number of environmental and social concerns arise with respect to the development of nuclear energy. They range from safe storage and long-term disposal of nuclear waste to risk of proliferation of nuclear weapons. The specific procedures for further developing nuclear energy should carefully consider these issues and devise ways to address them in a manner compatible with agreed international norms. Cautious and diverse measures to strengthen public trust on nuclear energy should also be considered. In addition, it is important to 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 nuclear power options.

The rapid expansion in tidal power will add to the country's renewable energy supply. In addition to tidal power plants that are operating in Shiwa Lake, new plants are being proposed at Incheon/Ganghwa Bay and Garorim Bay. These proposed sites have large tidal ranges, up to 9 meters, with extensive areas of intertidal mudflats that are of high ecological value, especially for waterbirds, in addition to their importance as fishery grounds. The tidal-flats around Incheon/Ganghwa include nationally designated protected areas such as the Republic of Korea's Natural Monument No. 419 under the title of "Ganghwa tidal flat and Black-faced Spoonbill Breeding Sites." The Republic of Korea has recognized the importance of natural resources such as tidal flats and bays in its 4th National Report under the Convention on Biological Diversity<sup>19</sup>. In pursuing efforts of conservation of such valuable ecosystems, the construction of the tidal power plants demand a careful assessment of its possible negative effects and ways to mitigate them.

In 2002, the Republic of Korea adopted a fixed minimum price for renewable energy, which contributed to increase renewable energy use. New measures to regulate energy pricing and offer incentives for clean energy generation are important steps in creating an environment conducive to behaviour change and investment in clean energy. The launching of a RPS with attracting private investment and market based mechanism is an innovative trial. The experience in other countries could provide useful insights for the Republic of Korea's efforts in this direction.

Overall, the target of achieving 3.78 per cent share of renewable energies in 2013; 6.08 per cent in 2020, and 11 per cent in 2030 appear to be modest in comparison with targets that exist in many comparable developed countries. However, the pace of change that is envisaged is remarkable considering that the country had increased its renewable energy supply only by 0.37 per cent in the past, from 2.06 per cent in 2005 to 2.43 per cent in 2008.

In order to achieve the target of 11 per cent of renewable energy supply by 2030, the implementation of policies and measures set in the Five-Year Plan will be essential. In addition, to expand renewables in mid- and long-terms, new renewable technology development and fostering the industry are very critical. In this sense, national strategic technology development assistants in solar, wind, fuel cell, bio energy sectors should be increased further.

## **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 transport<sup>20</sup>. The Global Fuel Economy Initiative (GFEI) launched by UNEP, together with the International Energy Agency, FIA Foundation (Fédération Internationale de l'Automobile), 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. Korean 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. 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 between 2009 and 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 annual increase rate of 6.3 per cent. The number of vehicles is at 17 million, and increases by 13 per cent a year<sup>21</sup>. 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 emissions<sup>22</sup>. The Five-Year Plan seeks 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 a leading car manufacturer, expanding investment in the development of low-carbon vehicles such as hybrid cars and electric vehicles deserve to 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. In order to realize 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.

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. Experience suggests that to be effective, 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. The creation of a long segment of bicycle lanes along the waterfront pavements of the four major rivers can promote sustainable forms of transportation in recreational activities. However, 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.

In the building sector, 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. There are also important 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<sup>23</sup>. 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).

Currently available advanced building technologies can reduce residential energy use by 80 per cent compared to traditional designs<sup>24</sup>, while simple adoption of common technologies such as insulation can reduce energy 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 announced a GHG reduction target of 31 per cent by 2020 for the building sector. There are encouraging targets of strengthening energy standards by 30 percent till 2012, achieving passive level by 2017, and reaching zero-energy housing by 2025.

## **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 OECD<sup>25</sup> concluded that much work must still be undertaken to reach the country’s water quality objectives for rivers and reservoirs. Biochemical oxygen demand remains the primary focus of these management efforts, while heavy metals and persistent contaminants have not so far received much attention. Moreover, the protection of aquatic species and biodiversity requires proactive management.

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.

The recurrence of flooding has significant costs to the Korean economy, some of which could have been saved by investing in disaster prevention measures. 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) since the 2000s. The Republic of Korea currently spends an average of 5.3 trillion won (US\$ 4.3 billion) as annual investment in flood prevention and recovery expenses.<sup>26</sup> In order to weather expected climate irregularities, additional water control policies will likely be necessary.

### 2.5.1. Korean 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 Rivers 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. Its funding, a total of 22.2 trillion won (US\$ 17.3 billion), is reflected in the Five-Year Plan total investment<sup>27</sup>.

The Four Major Rivers Restoration Project concerns not only the four main rivers – Han, Nakdong, Geum and Yeongsan – but also a number of related projects on tributaries. The overall project consists of three sets of projects: 1) the main project – the Han, Nakdong, Geum and Yeongsan rivers restoration projects; 2) projects on the 14 tributaries of the four major rivers; and 3) maintenance of local rivers and other small rivers that directly inflow into the four major rivers. These projects have five key objectives: 1) securing abundant water resources against water scarcity; 2) preparing well-coordinated measures for flood control; 3) improving water quality and restoring ecosystems; 4) creating multipurpose spaces for local residents; and 5) promoting regional development centred on rivers.

The Four Major Rivers Restoration Project will aim at securing sufficient water volume by building 16 weirs. These 16 weirs are expected to secure 800 million cubic meters of water. The project will increase peak water levels of 96 agricultural reservoirs so as to secure 250 million cubic meters of water. Additionally, the construction of 3 small and medium size multipurpose dams is expected to yield another 250 million cubic meters of water.

Flood control measures involve an expansion of the water gates of tributaries, which would allow a quick water level decline and fast draining of flood. In addition, 2 flood-control areas and 3 underflow areas of river sides will together expand the flood control capacity up to 920 million cubic meters of water.

Additionally, the project seeks to ensure that, by 2012, 86 per cent of river reaches should maintain 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 bound to maintain an adequate level of salinity concentration to protect drinking water supply and other water usages. In order to monitor water quality, Korea's Ministry of Environment has expanded the existing Tele-Monitoring System (TMS) to 586 sewerage and waste water treatment facilities by the end of 2009. This includes 323 sewerage facilities, 58 waste water treatment facilities, and 205 operating sites.

On ecosystem restoration, an Eco-river Restoration Programme (ERP) initiated in 2008 is being implemented in the context of the Four Major Rivers 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 Rivers Restoration Project. A follow-up project will be planned by 2010 to restore about 120 local streams. More than 84 riparian wetlands will also be

reconstructed. Riparian areas will be afforested or reforested, and will also be used for biomass production.

Finally, the project seeks to support regional economic development. This is pursued 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. 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.

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 weirs, small dams and embanking reservoirs on the four major rivers. Most of the main projects are planned to be completed by 2011; projects for small dams and reservoirs for storing water 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. Projects for the development of Seomjin River and other tributaries to the four rivers would be completed by 2012. Phase 3, includes restoring local and small rivers, and developing cultural and tourism attractions around the four major rivers. The Ministry of Culture, Sports and Tourism is involved in this phase.

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 for Food, Agriculture, Forestry and Fisheries, the Ministry of Environment and the Ministry of Land, Transport and Maritime Affairs.

The Korean government conducted an environmental impact assessment (EIA) of the Four Major Rivers Restoration Project in order to assess the potential effects of the project and to devise response measures. The results of the EIA were announced on November 6, 2009<sup>28</sup>.

On ecosystems, the assessment identified around 68 legally designated protected species and natural treasures that may be affected by the Four Major Rivers Restoration Project. The assessment concluded that direct impacts would be minimal if mitigation measures are implemented. Measures planned include an adjustment and reduction of the intensity of the construction work during the winter time when migratory birds arrive. Small size habitats such as small rivers corridors and food places will be created to provide sanctuaries and places for laying eggs. In addition, green belts will be constructed to provide additional habitats for animals to live in a natural environment.

With regard to the natural environment, the assessment 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 12.5 per cent of the total area which will be affected by the project. Considering ecological functions of the wetlands, the Korean Ministry of Environment decided to conserve wetlands that have high ecosystem value. Parts of the wetland areas that are likely to be affected are compensated for through the construction of man-made wetlands. As a result, after the four major rivers projects, in total 84 alternative or new wetlands are expected to be created and ecological and environmental functions of the rivers are expected to be improved. In addition,

lower river ways will be created with mild slopes of 1.5 ratio so as to lead to a natural creation of wetland areas after the completion of the projects.

Regarding 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. As 570 million of cubic meters of dredged materials will result from the dredging of the rivers, there is plan to create a sedimentation basin and a diversion waterway will be installed at the storage yards of the dredged material in order to prevent secondary water pollution. The Korean government is considering options for a differentiated use of the dredged material according to the grain size and the level of contamination.

The Korean Ministry of Environment has the responsibility to ensure follow-up and implementation of the conclusions of the IEA. 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 future Post-management Investigation Commission will be entrusted with monthly investigation, monitoring and inspection of the implementation of measures to mitigate identified environmental effects.

## **2.5.2. Review**

Challenges facing Korea in relation to climate change and its impact on rainfall, flooding and water are indeed serious. The Four Major Rivers Restoration Project seeks to respond to these challenges. It is expected to bring numerous positive effects by providing significant ecological infrastructures for the national economy and people's lives. However, a prudent ecological approach is necessary given the significant scale of the project, and the fact that the four major rivers are sensitive ecosystems.

In line with the significance of the challenges that it seeks to address, the Four Major Rivers Restoration Project is a large project involving among others the building of 16 new weirs on the main streams of the four rivers and 2 new dams on their tributaries; the renovation of two estuarine barrages; the embankment of 87 existing irrigation dams; the strengthening of 377 km of river bank; and the dredging of 570 million cubic meters of sand and gravel from a total 691 km of the rivers. These imply major infrastructural work in the implementation of the project.

Therefore, the attempt of ecological restoration of the four main rivers and their tributaries is commendable, but its implementation needs to follow approaches that will result in effective "ecological restoration" by making efforts to enhance the ecological integrity of river in order to achieve the important policy objectives pursued under this project. The study on The Economics of Ecosystems and Biodiversity's (TEEB) review of a large number of restoration projects suggests that 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). An ecosystem-based adaptation could yield many of these benefits in the context of the Korean river restoration.

The Republic of Korea showed commitment to international efforts to protect and conserve wetlands by hosting the 10th Meeting of the Conference of the Contracting Parties to the Ramsar Convention on Wetlands in 2008. Many of the resolutions and other outcomes of that conference, including Resolution X.19 “Wetlands and river basin management: consolidated scientific and technical guidance”<sup>29</sup> and Resolution X.24 on “Climate change and wetlands,” are relevant instruments to consider<sup>30</sup>.

The follow-up and implementation of the conclusions and recommendations of the EIA done by the Ministry of Environment are also critical to ensure environmental integrity of the project. In addition, it is important that communication with relevant stakeholders continue to be strengthened in order to achieve an effective implementation of measures identified through the EIA and to develop appropriate measures for unexpected environmental impacts.

## **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 and long-term, after a first phase of investment in large infrastructure projects as part of the Green New Deal.

### **2.6.1. Korean 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. These 27 technologies are considered to have a potential to provide new engines for growth to the Korean economy. They are divided into four categories: (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 (see Table 4).

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 up to 2013.

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.

<b>Table 4: List of 27 core technologies in Korea green growth national plan</b>		
<b>Sector</b>	<b>27 Core Technologies</b>	
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 <sub>2</sub> capture, storage and processing	(3)
	22. Non- CO <sub>2</sub> 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 of 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.		

By 2013, the government plans to build “Green Industry Complexes,” which will mainly use waste resources, green power, biomass, and other new and renewable energy sources. Finally, the 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 is an effort 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 by 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. Questions have been raised about the effectiveness of government support to specific industries and technologies, as opposed to promoting innovation based on competition among various possible technologies depending 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 policies<sup>31</sup>, the International Energy Agency remarked that support provided for the development of solar photovoltaic through a feed-in-tariff was more than six times that of wind. In this sense, the government is keen on gradually reducing such feed-in-tariffs in certain sectors and is planning to introduce RPS (Renewable energy Portfolio Standard) by 2012. The RPS is expected to generate better competition among the various renewable energy technologies without "picking winners".

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, have therefore be considered in the context of a broader policy objective of promoting desirable qualitative growth and further diversification of the Korean economy into a knowledge and service economy.

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).

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<sub>2e</sub> in 2005.

### **3. Policy and Fiscal Reforms**

In March 2009, UNEP released a report on the "Global Green New Deal"<sup>32</sup>, 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 carbon-inducing or regressive 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 capitalize on 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. Korean 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 the 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 Strategy and Finance has given assurance that funding for green growth projects will be given priority over other funding, in order to enable a swift implementation<sup>33</sup>.

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 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 2.8 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 and a significant re-orientation of resource allocation.

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 map<sup>34</sup>.

The fiscal measures and incentives designed in the Korean 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 Korean Presidential Committee on Green Growth estimates that spending US\$ 83.6 billion on the Green Growth plan would stimulate production worth between US\$ 141.1 billion and US\$ 160.4 billion during 2009-2013 and create between 1.18 and 1.47 million jobs.

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 (e.g. resource extraction and polluting activities). The Republic of Korea’s indicators of carbon and energy intensity remain among the highest in the OECD. While important efforts are being made and more action is announced to enhance energy efficiency, these need to be complemented with further reforms of energy pricing, subsidies, and taxation.

The Green Growth plan envisions a reform of energy 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 that examined Korea’s energy pricing and taxation policy concluded that reforming energy subsidies and the system of energy taxation could yield environmental gains with minimal potential adverse social and economic effects<sup>35</sup>.

Following a trend common in most OECD countries, the share of 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, the Republic of Korea 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)<sup>36</sup>. Korea's CO<sub>2</sub> emissions and use of energy relative to its GDP and land area are among the highest, while its use of pesticides and chemical fertilizers are the highest among OECD countries. Agricultural subsidies not carefully targeted may continue to support 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 markets<sup>37</sup>. 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 fishery access arrangements, presents a risk that excess capacity is transferred to other fishing grounds that often lack effective management regimes. The net effect is growing pressure on global fishing stocks that inhibit efforts to achieve a sustainable level of fishing at the global level.

## **4. Institutional Process and Participation**

The Republic of Korea 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. Korean 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 2009, 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.

Korean policy makers have sought to foster understanding and awareness of the objectives of the Green Growth strategy among the general public and to induce public action to support those objectives. Educational programmes have been developed, that focus on providing information

and raising awareness to encourage behavioural change 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.

Changes in consumption patterns are also being promoted within government and the private sector. 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 Cash-back System”, which grants “carbon points” to consumers purchasing low-carbon products. Carbon points can then be exchanged for concessions at public facilities.

Additionally, a Carbon Point System is promoted to encourage households to save energy, water, and gas. About 400,000 households were participating in this program as of October 2009. There is an effort to stimulate the production of environmentally-friendly goods so as to supply products that respond to changing consumers choices. In that regard the Korean government plans 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 established as an institutional mechanism for the Green Growth Strategy 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 would 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.

There appears to be an effort to link the Green Growth strategy with the formulation of a long-term strategy to address 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.

Beyond central government agencies, there appears to be 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 constituencies<sup>38</sup>.

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 and should be actively engaged in the implementation of the green growth strategy. Further promoting a process of broad-based dialogue and consultation with a cross-section of all stakeholders could prove to be essential for the success of such transformational public policies.

## **5. Conclusion**

Despite remarkable economic progress, the Republic of Korea is still faced with numerous sustainable development challenges that require reforms and innovative approaches in various areas of the economy. The country's energy challenges are enormous, as it imports 97 per cent of its total energy requirements. The rapid industrialization and urbanization have resulted in a significant pressure on the environment and natural resources such as forests and water resources, biodiversity and the urban environment. Freshwater scarcity remains a critical challenge facing Korea.

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. Climate change presents risks of higher levels of flooding and drought, which are already costing the country billions of dollars in damage. Urgent measures are needed to address climate change both with respect to mitigation and adaptation.

In responding to these challenges, the Republic of Korea has embarked onto a major attempt to fundamentally transform the country's growth paradigm from "quantitative growth" to low-carbon, "qualitative growth"; from an economy that is based on extensive growth in labour and capital to an economy driven by investment in natural capital assets, transformational innovations and state-of-the-art technology.

The Republic of Korea responded to the financial and economic crisis in January 2009 with an economic stimulus package equivalent to US\$ 38.1 billion of which 80 per cent was allocated to more efficient use of resources such as freshwater, waste, energy-efficient buildings, renewable energies, low-carbon vehicles, and development of the rail network. Beyond this immediate response to the crisis, the Korean Government has initiated a new plan to achieve transformative

change through a Five-Year Plan for Green Growth. The Korean National Strategy for Green Growth has set ambitious goals for addressing climate change, enhancing energy and material efficiency, developing renewable sources of energy, promoting sustainable forms of transportation, investing in water and ecological infrastructure, and promoting a new set of green technologies as future engines of growth. It is significant in size, mobilising over US\$ 83 billions or 2 per cent of GDP over five years.

The Republic of Korea is equally taking important steps in the area of policy and pricing reforms by creating a new carbon market, reviewing energy pricing, and expanding incentives for environmentally-friendly businesses and consumer behaviour. The country's unilateral decision to set a national GHG emissions reduction target is an indication of the seriousness of its resolve to respond to the challenge of climate change and to contribute to the global effort to address this challenge.

This report shows that these measures are encouraging steps in creating a policy architecture that could stimulate green investment and contribute to making such investment economically viable. UNEP encourages the stepping up of investment in addressing the key ecological scarcities facing the Korean society and economy, and to fuel a new dynamism that reorients the economy towards a green path of growth and development. To that effect, as outlined in the previous sections of this report, UNEP encourages further policy, regulatory and fiscal reform in order to remove existing policy and market distortions in areas such as energy, agriculture, and fisheries.

UNEP also encourages a careful assessment of the economic, social, and environmental costs and benefits of different strategies, policy options, or choice of projects so as to minimise potentially negative effects and maximise sustainable development gains. In that regard, effective use of environmental and sustainability assessment is warranted, given the scale and nature of certain green growth projects relating to highly sensitive ecosystems.

Achieving the fundamental changes pursued in the Korean green growth strategy requires a strong government commitment, but equally necessitates positive engagement of the private sector and civil society as stakeholders and partners. UNEP encourages 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.

## 6. Annexes

### 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 Rivers 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 small dams and embanking reservoirs for increasing water storage capacity will be completed by 2012.					

**Annex 3: Investment plan for the Seomjin 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

## **Annex 5: Other Ramsar Resolutions on the conservation of tidal flats and wetlands**

### **Res VII.21 "Enhancing the conservation and wise use of intertidal wetlands"**

[http://www.ramsar.org/pdf/res/key\\_res\\_vii.21e.pdf](http://www.ramsar.org/pdf/res/key_res_vii.21e.pdf)

Para. 11: CALLS upon Contracting Parties to document the extent of loss of intertidal wetlands that has occurred in the past and to inventory those intertidal wetlands which remain, and their conservation status;

Para. 14: FURTHER URGES Contracting Parties to identify and designate as Wetlands of International Importance a greater number and area of intertidal wetlands, especially tidal flats, giving priority to those sites which are important to indigenous people and local communities, and those holding globally threatened wetland species, as encouraged by Resolution VII.11; and

### **Res X.22 "Promoting international cooperation for the conservation of waterbird flyways"**

[http://www.ramsar.org/pdf/res/key\\_res\\_x\\_22\\_e.pdf](http://www.ramsar.org/pdf/res/key_res_x_22_e.pdf)

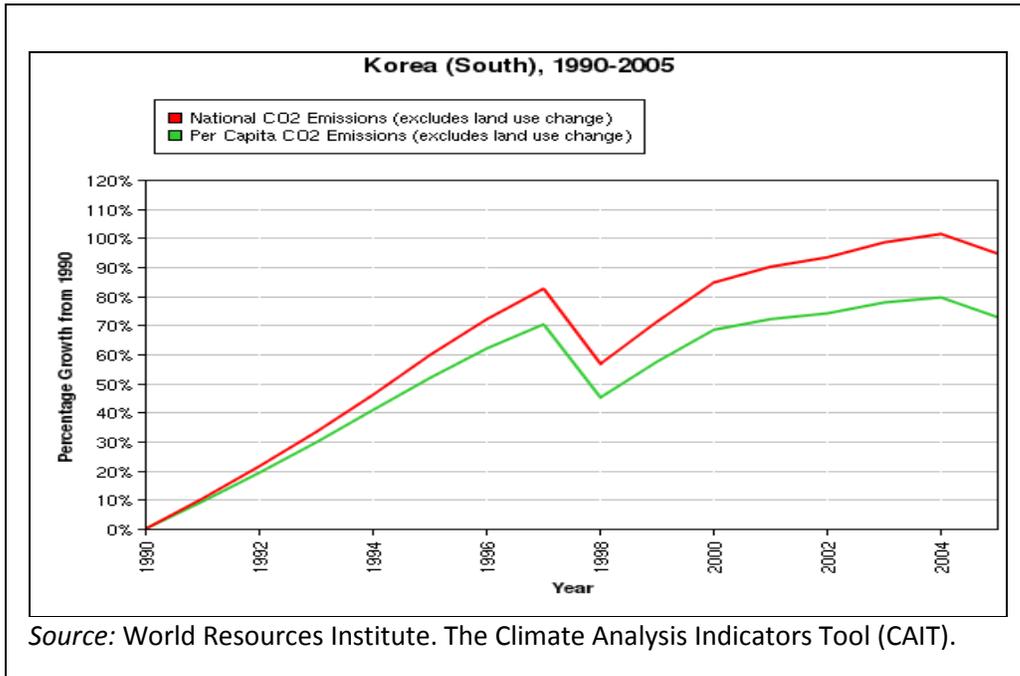
Para. 22: WELCOMES the statement by the Republic of Korea to the 35th meeting of Ramsar's Standing Committee that intertidal mudflats should be preserved and that no large-scale reclamation projects are now being approved in the Republic of Korea, and ENCOURAGES all Contracting Parties in their efforts to protect such habitats in future and to monitor them and mitigate any past development impacts on or losses to them.

### **Res VIII.4 "Principles and guidelines for incorporating wetland issues into Integrated Coastal Zone Management (ICZM)"**

[http://www.ramsar.org/pdf/res/key\\_res\\_viii\\_04\\_e.pdf](http://www.ramsar.org/pdf/res/key_res_viii_04_e.pdf)

Para. 14: Urges Contracting Parties to ensure that coastal wetlands and their values and functions for human well-being, including their role in mitigating the impacts of climate change and sea-level rise and their importance for the conservation of biological diversity are fully recognized in planning and decision-making in the coastal zone, including through ICZM initiatives.

**Annex 6: National and per capita CO<sub>2</sub> emissions, 1990-2005 (excluding land use change)**



## ACRONYMS

ANP	Advanced Nano Products
BOD	Biological Oxygen Demand
CAIT	Climate Analysis Indicators Tool
CCS	Carbon Capture and Storage
CH <sub>4</sub>	Methane
CO <sub>2</sub>	Carbon dioxide
GDP	Gross Domestic Product
EPI	Environmental Performance Index
ERP	The Eco-river Restoration Programme
FIA	Fédération Internationale de l'Automobile
GFEI	The Global Fuel Economy Initiative
GHG	Greenhouse Gas
GND	Green New Deal
H <sub>2</sub>	Hydrogen
HFCs	HFCs
IEA	International Energy Agency
ILO	International Labour Organization
IOE	International Organisation of Employers
IPCC	The Intergovernmental Panel on Climate Change
ITUC	International Trade Union Confederation
Kwh	kilowatt hour
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
PFCs	Perfluorocarbons
PPM	parts per million
RFS	Renewable Fuel Standard

RPS	Renewable Portfolio Standard
R&D	Research and Development
SF6	Sulfur Hexafluoride
SMEs	Small and Medium Enterprises
TMS	Tele-Monitoring System
TEEB	The Economics of Ecosystems and Biodiversity
TOE	Ton of oil equivalent
UNEP	United Nations Environment Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNFCCC	United Nations Framework Convention on Climate Change

## Endnotes

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<sup>1</sup> Green Economy: For UNEP, a “green economy” can be defined as a system of economic activities related to the production, distribution, and consumption of goods and services that result in improved human well-being over the long term, while not exposing future generations to significant environmental risks and ecological scarcities. A green economy is characterized by substantially increased investments in green sectors, supported by enabling policy reforms. These investments, both public and private, provide the mechanism for the reconfiguration of businesses, infrastructure and institutions, and the adoption of sustainable consumption and production processes. Such reconfiguration will lead to a higher share of green sectors in the economy, more green and decent jobs, reduced energy and material intensities in production processes, less waste and pollution, and significantly reduced greenhouse gas emissions. While it will be necessary to measure progress towards a green economy, it is counter-productive to develop generic green economy indicators applicable to all countries given differences in natural, human, and economic resources. Rather, focusing on the process of transitioning to a green economy acknowledges that countries will take many different paths in achieving this objective, and recognizes that a green economy in one country may look quite different than a green economy in another country.

Green Jobs: Green jobs reduce the environmental impact of enterprises and economic sectors, ultimately to levels that are sustainable. Green jobs can include work in agriculture, industry, services and administration that contributes to preserving or restoring the quality of the environment. Green jobs are found in many sectors of the economy from energy supply to recycling and from agriculture and construction to transportation. They help to cut the consumption of energy, raw materials and water through high-efficiency strategies, to de-carbonize the economy and reduce greenhouse-gas emissions, to minimize or avoid altogether all forms of waste and pollution, to protect and restore ecosystems and biodiversity. Green jobs play a crucial role in reducing the environmental footprint of economic activity. This reduction is gradual and the different jobs contribute to different degrees. Workers manufacturing fuel-efficient or hybrid cars, for example, contribute less to reducing emissions from transport than those working in public transport systems. Moreover, what is considered fuel-efficient today will no longer qualify in ten years’ time. The notion of a green job is thus not absolute, but there are “shades” of green and the notion will evolve over time (see UNEP, ILO, IOE, and ITUC (2008). *Green Jobs: Towards decent work in a sustainable, low-carbon world*. September, United Nations Environment Programme, accessible at:

<http://www.unep.org/greeneconomy/GreenJobs/tabid/1377/language/en-US/Default.aspx>

<sup>2</sup> 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.

<sup>3</sup> Robins, N., Clover, R. and C. Singh (2009). *Building a Green Recovery*. May. HSBC Global Research, New York.

<sup>4</sup> Robins, N., Clover, R. and C. Singh (2009). *A Global Green Recovery ? Yes, but in 2010*. August. HSBC Global Research, London.

<sup>5</sup> The Republic of Korea Ministry of Strategy and Finance. Briefing on the Green New Deal.

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- <sup>6</sup> OECD.Stat.Extracts. Key Short-Term Economic Indicators: *Quarterly National Accounts (GDP Constant Prices)*. Data extracted on 9 September 2009 at [http://stats.oecd.org/Index.aspx?DatasetCode=SNA\\_TABLE1](http://stats.oecd.org/Index.aspx?DatasetCode=SNA_TABLE1)
- <sup>7</sup> The Republic of Korea Ministry of Strategy and Finance. Briefing on the Green New Deal.
- <sup>8</sup> 2005 input-output tables, the most up-to-date input-output tables as of 2009, were used in the calculation.
- <sup>9</sup> National Emergency Management Agency, Republic of Korea. Accessible at: <http://eng.greatkorea.go.kr/1/1-1.asp>
- <sup>10</sup> IEA (2006) *Energy Policies of IEA Countries: The Republic of Korea. 2006 Review*. Paris: International Energy Agency. <http://www.iea.org/textbase/nppdf/free/2006/korea2006.pdf>
- <sup>11</sup> OECD (2006) *Environment Performance Review of Korea*. Paris: OECD.
- <sup>12</sup> Korea.net, Seoul maps out plans to cut greenhouse gas emissions. 5 August 2009. <http://www.korea.net/>.
- <sup>13</sup> Presidential Committee on Green Growth, Republic of Korea, "Republic of Korea sets its mid-term greenhouse gas reduction goal for 2020". Press Release, 17 November 2009.
- <sup>14</sup> The Economics of Ecosystems and Biodiversity: <http://www.teebweb.org/>
- <sup>15</sup> IEA (2009). *Key World Energy Statistics 2009*. Paris; International Energy Agency.
- <sup>16</sup> International Atomic Energy Agency, April 2010.
- <sup>17</sup> IEA, 2006. Op. cit.
- <sup>18</sup> IEA (2009). *World Energy Outlook 2009*. Executive Summary. Paris: International Energy Agency. <http://www.iea.org/Textbase/npsum/weo2009sum.pdf>
- <sup>19</sup> Republic of Korea Fourth National Report to the Convention of Biological Diversity, May 2009, accessible at: <http://www.cbd.int/doc/world/kr/kr-nr-04-en.pdf>
- <sup>20</sup> FIA Foundation. *50 By 50 – Global Fuel Economy Initiative*. Available at: [http://www.fiafoundation.org/Documents/Environment/50by50\\_leaflet\\_lr.pdf](http://www.fiafoundation.org/Documents/Environment/50by50_leaflet_lr.pdf)
- <sup>21</sup> Korea Ministry of Land, Transport and Maritime Affairs, [http://www.uncrd.or.jp/env/4th-regional-est-forum/Presentations/07\\_BS2\\_Korea.pdf](http://www.uncrd.or.jp/env/4th-regional-est-forum/Presentations/07_BS2_Korea.pdf)
- <sup>22</sup> IEA, 2006. Op. cit.
- <sup>23</sup> UNEP (2009). *Global Green New Deal: A Policy Brief*. [http://www.unep.org/pdf/A\\_Global\\_Green\\_New\\_Deal\\_Policy\\_Brief.pdf](http://www.unep.org/pdf/A_Global_Green_New_Deal_Policy_Brief.pdf)
- <sup>24</sup> UNEP, ILO, IOE and ITUC, 2008. Op. Cit.
- <sup>25</sup> OECD (2006) *Environment Performance Review of Korea*. Paris: OECD.
- <sup>26</sup> South Korea Ministry of Land, Transport and Maritime Affairs and the Ministry of Environment, 2009
- <sup>27</sup> The initial budget of 16.9 trillion won (US\$ 13.1 billion) announced in January 2009 was increased to 22 trillion Won (US\$ 17.3 billion) when the Five Year Plan was released in July 2009. Korean officials have explained this increase in the total funding of the project by its expansion beyond the four main rivers and the inclusion of the estuaries to the four rivers.
- <sup>28</sup> The Environmental Impact Statement (EIS) was prepared by the Regional Construction Management Administration after collecting opinions from various stakeholders. The EIS includes the anticipated and assessed environmental impacts. The draft was shared with the local residents, environmental organizations, and relevant experts to gather diverse opinions for 20 days. The EIS was then submitted to the Regional Basic Environmental Offices, under the authority of the Ministry of Environment. To verify feasibilities of the EIS, Korea Environment Institute (KEI) and the Environmental Assessment Team comprised of independent experts were entrusted for review of the EIS. The final EIS agreement was set after the opinions of KEI were considered. The final EIS, agreed by the Regional Basic Environmental Offices and the Regional Construction

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Management Administration, covers four categories (ecosystem, natural environment, water quality, and others) in short.

<sup>29</sup> Res X.19 “Wetlands and river basin management: consolidated scientific and technical guidance”, includes under its Guidelines Box N the following:

N3. Carry out Environmental Impact Assessment (EIA) and Cost Benefit Analysis (CBA) studies for land use or water development projects which may have significant impacts on rivers and wetlands, using independent multidisciplinary teams and in consultation with all stakeholders, and consider alternative proposals including the no-development option; and

N4. Disseminate the findings of any EIA and CBA in a form that can be readily understood by all stakeholders.

<sup>30</sup> This Resolution recognizes the services that wetlands provide to climate change mitigation (Res X.24; para. 1), especially in acting as carbon stores (Res X.24; para. 8).

<sup>31</sup> IEA, 2006. Op. cit.

<sup>32</sup> Barbier, E.B. (2009). A Global Green New Deal. Report prepared for the Economics and Trade Branch, Division of Technology, Industry and Economics, United Nations Environment Programme. Geneva, April. Available at <http://www.unep.org/greeneconomy/docs/GGND-Report-April2009.pdf>, UNEP (2009). Global Green New Deal: A Policy Brief.

[http://www.unep.org/pdf/A\\_Global\\_Green\\_New\\_Deal\\_Policy\\_Brief.pdf](http://www.unep.org/pdf/A_Global_Green_New_Deal_Policy_Brief.pdf)

<sup>33</sup> Communication from a meeting with representatives of the Presidential Committee on Green Growth, 29 July 2009.

<sup>34</sup> Communication from a meeting with representatives of the Korean Chamber of Commerce and Industry, Business Institute for Sustainable Development on 30 July 2009.

<sup>35</sup> UNEP and United Nations Foundation (2004). Energy Subsidies: Lessons Learned in Assessing their Impact and Designing Policy Responses.

<http://www.unep.ch/etb/publications/energySubsidies/Energysubreport.pdf>

<sup>36</sup> OECD (2009). Agricultural Policies in OECD Countries: Monitoring and Evaluation. Highlights.

<http://www.oecd.org/dataoecd/37/16/43239979.pdf>

<sup>37</sup> OECD (2009), *Review of Fisheries in OECD Countries Policies and Summary Statistics 2008*. Paris: OECD.

<sup>38</sup> 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.



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