



OVERVIEW OF THE REPUBLIC OF KOREA'S GREEN GROWTH NATIONAL VISION

(An Interim Report)

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CONTENTS

1. Foreword.....	4
2. From “quantitative growth” to “qualitative growth”: An attempt towards a major shift in economic policy towards “green growth” in the Republic of Korea ...	6
2.1 Energy crisis and non-fossil fuel era	6
2.2 Heavier environmental load caused by the rapid industrialization and urbanization.....	7
2.3 Global climate change	7
2.4 Necessity for new growth engines	7
3. Republic of Korea’s plan to achieve a green growth strategy	7
3.1 Republic of Korea’s Green Stimulus Package	7
3.2 Republic of Korea’s Five-Year Green Growth Plan	8
3.3 Policy directions.....	10
3.4 Addressing change.....	10
3.5 Enhancing energy efficiency and development of new and renewable energy	13
3.6 Developing green technologies as future growth engines.....	14
3.7 Policy architecture for green growth	16
3.8 Green city and green transport.....	16
3.9 Education, awareness and lifestyle change.....	16
3.10 Promoting leadership on green growth.....	17
4. Overview of key projects in Republic of Korea’s green growth strategy:	
The four river restoration project	17
4.1 The Four River Restoration Project.....	18
4.1.1 Securing abundant water resources against water scarcity and climate change.....	18
4.1.2 Implementing comprehensive flood control measures	18
4.1.3 Improving the water quality and restoring the ecosystem.....	19
4.1.4 Creation of multipurpose spaces for local residents.....	19
4.1.5 Regional development centered on rivers	20
4.2 Investment Plan for the Four-River Project.....	20
4.3 Policy and Institutional Process.....	21
4.4 Economic Gains and Employment Generation.....	22
5. An Overall Assessment of the Korean Green Growth Strategy	22
5.1 Policy and Fiscal Measures	22
5.2 Economic Gains, Employment and Social Benefits	24
5.2.1 Production inducement.....	24
5.2.2 Employment generation and social considerations	24
5.3 Low-Carbon Growth and Environmental Improvement	25
5.3.1 Energy and fuel efficiency	26
5.3.2 Renewable energies	26
5.3.3 Ecosystems and well-being.....	26
5.4 Institutional Process, Transparency and Participation.....	28
6. Conclusions	29
Acronyms	31

This Interim Report was prepared by the United Nations Environment Programme (UNEP) as part of its Green Economy Initiative. The purpose of this Interim Report is to present an overview of the Republic of Korea's Green Growth National Vision announced in August 2008. It also examines Korea's Green New Deal launched in January 2009 along with the Five-Year Green Growth Plan released in July 2009.

The objectives of the review are:

- 1) to explain a major change in strategic thinking and economic policy in the Republic of Korea, towards a "green growth strategy",
- 2) to outline the plans that the Republic of Korea has put in place to achieve this strategy; and finally
- 3) to discuss the general approach and elements of The Republic of Korea's green growth strategy relative to the issues outlined in UNEP's publication "Global Green New Deal: A Policy Brief", published in March 2009.

This Interim Report was prepared in consultation with several ministries and agencies involved in the formulation and implementation of Korea's green growth strategy, as well as representatives of civil society and the private sector in Korea. The report benefited from consultations and communications with the Republic of Korea's Prime Minister's Office; the Republic of Korea's Presidential Committee on Green Growth; the Ministry of Environment; the Office of National River Restoration - Ministry of Land, Transport and Maritime Affairs; the Republic of Korea Chamber of Commerce and Industry; the Republic of Korea's Green Growth Forum; Korea's Environment Institute; the Republic of Korea Federation of Environmental Movements; The Eco-Horizon Institute; The Global Institute for Water, The Environment and Health, and The Secretariat of the RAMSAR Convention on Wetlands. We thank Professor Edward Barbier of Wyoming University, for his review of this report, and Peter Poschen, of the International Labour Organisation, and Benjamin Simmons, of UNEP, who provided comments and suggestions.

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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.

Overview of the Republic of Korea's Green Growth National Vision

Foreword

A year ago, 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 G-20 governments) was allocated to environmental themes such as freshwater, waste, energy efficient buildings, renewable energies, low-carbon vehicles, and the rail network.

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

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

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 signaled that it believes that green growth is a strategy well beyond current economic recovery efforts, and that it wants to create a green economic future for the Republic of Korea. The Republic of Korea has committed itself to moving away from the traditional "brown economy" growth-at-any-cost model to a "green economy" model where long-term prosperity and sustainability are the key objectives. This commitment by the Republic of Korea has the potential of creating a domino effect on the other major Asian economies.

The Republic of Korea is more vulnerable than average to the effects of climate change, and more exposed than most to fossil fuel dependence. During 1912-2008, average surface temperatures in Korea rose 1.74°C. 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 range of 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 a secular rise in oil prices due to the observed

peaking of oil. In their strategy now, the share of new and renewable energy in total energy use 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 applauds this initiative and encourages an even more aggressive target to improve the Republic of Korea's future energy security and to further support their Green Growth strategy and plans.

Freshwater scarcity has long been, and still is, a critical challenge facing Korea. With global warming likely to continue, the levels of flooding and drought are expected to worsen. The large investment (US\$ 13 billion equivalent, or one-third of the fiscal stimulus) in the "four 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. It is encouraging to observe that each of these objectives not only addresses a vital ecological scarcity, but that actions planned will also serve as useful forms of adaptation to the onset of climate change.

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

Pavan Sukhdev
Project Leader – UNEP Green Economy Initiative

2. From “quantitative growth” to “qualitative growth”: An attempt towards a major shift in economic policy towards “green growth” in the Republic of Korea

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

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

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

The green growth strategy has three key objectives:

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

2.1 Energy crisis and non-fossil fuel era

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 relatively low energy self-sufficiency, 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 Korea to explore other sources of energy supply.

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

2.2 Heavier environmental load caused by rapid industrialization and urbanization

The rapid industrialization and urbanization of Korea has led to a significant challenge for ensuring the sustainability of its environmental resources. There is a need to alleviate current pressures on the environment by redefining growth strategies in ways that better integrate economic and environmental objectives.

2.3 Global climate change

Korea, like many countries, is vulnerable to the effects of climate change. Throughout 1912-2008, the average surface temperature in Korea rose by 1.74°C which is above the world average. Moreover, for the last 40 years, the sea level around Korea rose by 22cm, notably three times the global average sea level rise. Consequently, Korea is obliged to actively respond to climate change. It needs to inject supplementary investments to lessen the damage caused by climate change. Additionally, the country's carbon emissions have increased significantly during the past fifteen years, making Korea one of the world's fastest growing sources of carbon emissions.

2.4 Necessity for new growth engines

In order to achieve the transition from quantitative to qualitative growth, Korea has targeted its efforts on the development of environmental industries and technologies. Focus on these industries and technologies are expected to stimulate the economy through additional investment, innovation and employment generation, while having minimal adverse effects on the environment. The green growth strategy seeks to provide the foundation with the aim of long-term economic prosperity guaranteeing environmental conservation.

3. Republic of Korea's plans to achieve a green growth strategy

Since the announcement of the Green Growth National Vision last August 2008, the Korean Government worked on the formulation of a master plan that will serve as a blueprint for the implementation of the strategy. This process involved all segments of Korean Government, collectively with a Presidential Committee on Green Growth, established under the authority of the President of Korea.

3.1 Republic of Korea's green stimulus package

The eruption of the financial and economic crisis in late 2008 resulted in a fall in the Republic of Korea's growth rate below 4 per cent in the fourth quarter of 2008. This is a significant reduction when compared to an average rate of growth of between 7 to 8 per cent in the last ten years. The reduced growth rate has dramatically affected the Korean labour market, triggering an increase in the number of unemployed to 757,000.

The Republic of Korea responded to the financial and economic crisis with a stimulus package, a "Green New Deal", released on 6 January 2009. The stimulus package comprised of a mix of financial, fiscal and taxation policies aimed at creating jobs and reviving economic activity. Korea's stimulus amounted to a total of US\$38.1 billion, the equivalent of 4 per cent of Korea's Gross Domestic Product (GDP), to be implemented over the period from 2009 to 2012. The Republic of Korea allocated US\$30.7 billion of its stimulus package to environmental themes, including US\$1.80 billion to renewable energies, US\$6.19 billion to energy efficient buildings, US\$1.80 billion to low carbon vehicles, US\$7.01 billion to rails, and US\$ 13.89 billion to water and waste management. The Republic of Korea's Green New Deal represented over 80 per cent of its

total stimulus package². In a recent report, HSBC noted that the Republic of Korea has been most 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 countries³.

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. 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)⁴. In part, as a result of these measures, Korea was the only Organization for Economic Co-operation and Development (OECD) member country that registered a positive growth in the first quarter of 2009 compared to the previous quarter.

The Korea Green New Deal represents a policy for creating jobs and revitalizing the economy. In the short-term, it aims to respond to the recent economic downturn, and in the mid- and long-term, to boost green growth⁵. The Korea Green New Deal will run through 2012, while the long-term strategy will continue to be pursued through five-year green growth plans; the first of which runs from 2009 to 2013.

3.2 Republic of Korea's Five-Year Green Growth Plan

The Korean Government announced a five-year green growth plan (5YGGP) on 6 July 2009, to serve as a medium-term plan for implementing the green growth strategy. The 5YGGP is designed to turn the green growth strategy into concrete and operational policy initiatives for achieving green growth from 2009 to 2013.

The 5YGGP encompasses a number of projects that were previously announced as part of the Republic of Korea's Green New Deal. For instance, the 5YGGP integrates the four-river restoration project previously designated as the main project in the Green New Deal, as well as the "Strategy for New Growth Engines", announced by the Korean Government in 13 January 2009. As such, the 5YGGP is an amalgam of several existing and newly designed projects on green growth, articulated as part of a mid- to long-term strategy. The total funding for the 5YGGP of 107.4 trillion won (US\$83.6 billion) includes funding for the Green New Deal (US\$38.1) and financial support for other related projects.

In some cases, the 5YGGP 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 in promoting green technologies.

The 5YGGP outlines a set of three strategies, ten policy directions and fifty core projects. The three strategies are as follows:

- i) Measures for climate change and securing energy independence;
- ii) Creation of a new growth engine; and
- iii) Improving the quality of life and strengthening the status of the country.

²Robins, N., R. Clover, and C. Singh (2009). Building a Green Recovery. May 2009. HSBC Global Research, New York

³Robins, N., R. Clover, and C. Singh (2009). A Global Green Recovery ? Yes, but in 2010. August 2009. HSBC Global Research, London.

⁴The Republic of Korea Ministry of Strategy and Finance. Briefing on the Green New Deal.

⁵ Id.

Box 1: Three strategies and 10 policy directions in Korea's 5-year green growth plan	
Strategies	Policy directions
Measures for climate change and securing energy independence	Reduce carbon emissions
	Decrease energy dependence on oil and enhance energy 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 national status as a global leader in green growth

The five-year national plan is based on the "Basic Law for Green Growth", a bill currently in the legislative process, which will provide the legal basis for Korea's green growth strategy.

It represents a guide for the national policy directions for the green growth vision. The plan specifies 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.

To promote green growth, the Korean government will invest in the economy a total of 107.4 trillion won (US\$83.6 billion) between 2009 and 2013. This amount represents 2 per cent of GDP and is expected to induce production worth 182 to 206 trillion won (US\$141.7 billion to US\$160.3 billion) as well as create green jobs for 1.56 to 1.81 million people in the next five years.

Box 2: Investment plan for green growth in Korea (2009 – 2013) in Billion US\$					
Category of action plan and policy direction		Amount of investment			
		Total	2009	2010-2011	2012-13
		83.6	13.6	37.6	3 2.4
[1] Measures for climate change and securing energy independence		44.3	6.7	22.7	1 4.9
	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	.9 ⁷
[2]	Creation of new growth engines	22.3	3.7	8.3	0.2 ¹
	4. Develop green technologies as future growth Engine	8.8	1.6	3.3	.9 ³
	5. Greening of industry	3.6	0.6	1.4	.6 ¹
	6. Develop cutting-edge industries	8.5	1.2	3.0	.2 ⁴
	7. Set up policy infrastructure for green growth	1.4	0.2	0.5	.6 ⁰
[3]	Improving quality of life and strengthening the status of the country	21.7	4.0	8.2	.5 ⁹
	8. Green city and green transport	19.7	3.7	7.4	.6 ⁸
	9. Green revolution in lifestyle	1.5	0.3	0.6	.6 ⁰
	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)					

3.3 Policy directions

The 5YGGP contains the following ten policy directions:

- 1) Set up guidelines to drastically cut carbon emissions;
- 2) Develop new and clean energy technologies to decrease energy dependence on oil;
- 3) Enhance disaster control systems;
- 4) Secure new growth engines by developing green technology and renewable energy sources;
- 5) Switch industries into green ones;
- 6) Develop and promote cutting-edge industries;
- 7) Create policy and institutional infrastructure for green economy (including new tax schemes to attract private funds into green industries);
- 8) Green city and green transport;
- 9) Green revolution in lifestyle; and
- 10) Increase global cooperation on green growth. These policy directions are discussed below in a manner integrating related objectives.

3.4 Addressing climate change

Korea ranks as the sixth largest greenhouse gas (GHG) emitter among OECD member countries. In the green growth strategy, the reduction of carbon emissions is pursued through the establishment of a legal and regulatory framework, carbon trading, the creation of a national GHG inventory report system, in addition to public awareness. These will be implemented within a

voluntary target for reducing Korea's carbon emissions, which the Government is expected to announce in 2009.

Legal and regulatory frameworks will be developed to set up a carbon emission trading system, new auto emission standards, a waste-to-energy programme to reduce greenhouse gas emissions from waste materials, a shift to low-carbon transportation, the introduction of a light-emitting diode (LEDs), and stricter heat insulation standards for buildings.

A law on Green Growth, which is currently being reviewed, will provide the basic legislation for Korea's national GHG inventory report system. Korea also plans to launch a carbon emissions trading system. The carbon market is projected to be a major policy tool for greenhouse gas reductions in Korea. It is further expected that the growing carbon market will create an innovative business environment for domestic and international industries.

Other key measures to be taken for emissions reduction comprise a stepping up of efforts on Carbon Capture and Storage (CCS) in a safe and cost-effective method, the establishment by 2010 of a "national greenhouse gas information and management system" and the promotion of recycling. Forests encompass more than two-thirds of Korea's land surface. The potential for reducing emissions from the forest sector is expected to be enhanced by CCS from 1,452 million CO₂ ton to 1,613 million CO₂ ton in 2013. The 5YGGP also incorporates provisions for aid for forest projects in North Korea.

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

Box 3: Korea's 2020 midterm greenhouse gas (GHG) mitigation target

The Korean government announced on 4 August 2009 that it would launch a national consensus-building process, as the next step in formulating Korea's 2020 mid-term greenhouse gas (GHG) mitigation target. The consensus building process will be based on a mitigation potential study conducted by key research institutions, which set out three mitigation scenario options for 2020.

Scenario 1: 21% reduction from BAU (= 8% increase from 2005 level)

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

Scenario 2: 27% reduction from BAU (= Return to 2005 level^{*})

- Implementation of additional measures from scenario 1, which have a mitigation cost of less than 50,000 KRW per ton of CO₂.

Scenario 3: 30% reduction from BAU (= 4% reduction from 2005 level)

- Implementation of aggressive measures with high mitigation cost.

Considering that Korea's GHG emission has more than doubled in the last fifteen years (1990-2005), drastically reducing this trend and preventing further increases from the current level of emissions within fifteen years is an ambitious and robust target.

The Korean Government has proposed three mitigation scenarios to emphasize the importance of building wide stakeholder consensus. It plans to conduct a public survey as well as consultations and public hearings with various stakeholders. The final mid-term mitigation target will be announced within 2009, by taking into consideration the progress of the national consensus-building process.

* 2005 GHG emission of Korea = 594MtCO₂e

* BAU = Business As Usual

The 5YGGP includes measures to undertake climate change risk assessment and develop action plans to prepare for the likely impacts of climate change on infrastructure, health, water management, agriculture, biodiversity and housing, and options for dealing with them. Efforts will be put on improving the validity of climate change forecasting.

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

3.5 Enhancing energy efficiency and development of new and renewable energy

The 5YGGP seeks to reduce reliance on oil and enhance energy self-sufficiency. This includes measures targeted in particular at high-emission industries. It is planned that the government and heavy energy consuming companies will enter a “Negotiated Agreement” to reduce energy consumption. In the transport sector, Korea will increase the fuel efficiency standard for automobiles and institute a reporting system on transport companies with high-energy consumption. By 2013, Korea will introduce a ban on incandescent lights. The electricity pricing system will be changed into a cost-based electricity pricing system.

Improvements in energy use is expected to enhance energy efficiency from 0.317 (ton of oil equivalent (TOE)/thousand dollars) in 2009 to 0.290 (TOE/thousand dollars) in 2013 and to 0.233 (TOE/thousand dollars) in 2020. To make this possible, the 5YGGP sets 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.

By 2030, a smart grid system will be established comprising a network of electric power suppliers that incorporates digital technology to efficiently manage power production and distribution. The information technology-based network would lead to sound and reasonable energy consumption. Furthermore, it would allow renewable energy sources with inconsistent production rates like solar or wind energy to be connected to the power network and deliver power to consumers in a stable manner. This system is expected to drastically reduce CO₂ emissions and contribute to enhancing energy security.

The development of renewable energy forms an important part of the 5YGGP. The plan is to increase the share of new and renewable energy in total energy use from 2.7 percent (2009) to 3.78 per cent (2013), and 6.08 per cent (2020). A renewable energy portfolio standard (RPS) will be introduced in 2012, which will make it mandatory for utility companies to produce 3 per cent of their electricity from renewable sources in the next three years, and increasing to 10 per cent in 2020. Along with the RPS, there is a plan to establish a renewable energy certification (REC) system to enable the issuance and trade of certificates between the RPS obligators.

Renewable fuels form another part of the renewable energy effort. Korea plans to adopt a renewable fuel standard (RFS), which will make it mandatory for transportation fuel suppliers to provide bio-diesel, bio-ethanol, and bio-gas for automobiles. Fuels suppliers will have to supply 3 per cent of their transportation fuel from bio-diesel sources by 2012, and 7 per cent in 2020.

The development of renewable energy will also be promoted through economic incentives to increase the use of solar energy in homes and small buildings. Korea's strategy is to build and refurbish two million energy saving green homes using new and renewable energy. Starting in 2010 a million green homes and a million existing houses will be built and refurbished into green homes. Approaching 2020, fourteen “Environment Energy Towns” in eight areas nationwide, will support efficient use of waste resources, green power, and biomass. In small regional communities, a total of 800 low-carbon green villages are expected to be built.

The promotion of waste-to-energy is also part of the 5YGGP. It is estimated that the amount of waste generated per unit area in Korea is nine times greater than that in the U.S. and 3.5 times than that of France. In 2006 the amount of waste generated daily in Korea was some 320 thousand tons and has been gradually increasing since 2000. Energy generated from waste accounts for 76 per cent of the renewable energy in Korea. The government plans to expand this potential through a “waste and biomass energy development project”, which relies on waste-to-energy, agriculture- and ocean- oriented biomass, low-carbon green village construction, and forest biomass. A total of 48 environmental facilities will be installed to generate energy out of some 3.86 million tons of waste by 2013. In addition, 17 facilities will be set up to absorb the residual heat from

incinerating sites. Technologies existing in the chemical industry will be used to foster the development of renewable energy.

The mastering of core nuclear power technology and increasing the role of nuclear power in energy supply is part of the 5YGGP. By 2012, the government envisages to completely localize nuclear technology and commence to export nuclear power plants from 2013. The country will gradually increase the proportion of nuclear power facilities in power generation from 24 per cent in 2009, to 27 per cent in 2013, and to 32 per cent in 2020.

3.6 Developing green technologies as future growth engines

Technology is a crucial factor in promoting green growth. In the Korean green growth strategy, the development of green technologies is conceived as the pillar of the country's economic transformation in the medium- to long-term, after a first phase of investment in large infrastructure projects as part of the Green New Deal. As discussed above, the Green New Deal is meant to generate employment in the short-term and revive the economy mainly through large projects such as the four-river restoration project (examined below). Such projects would create employment in environment-related construction and manufacturing sectors, estimated at 920,000 jobs, 68.8 per cent of which would be for manual workers⁶.

The promotion of green technologies, on the other hand, is intended to create employment for technical and professional workers. The technology component of the 5YGGP 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 5YGGP, focusing on the 27 core technologies, which the Korean Government considers as having a potential to provide new engines for growth to the Korean economy (see Box 4). The 27 core technologies were selected through a process of consultation by experts from various Korean Government ministries, the private sector, academic circles and civil society.

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

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

The development of green technologies is expected to create 481,000 jobs by 2012 and 1.18 million jobs by 2020. It is projected to cut 130 million tons of carbon dioxide emissions by 2020.

Box 4: List of 27 core technologies in Korea green growth national plan		
Sector	27 Core Technologies	
Climate change	1. Monitoring and modelling for climate change	(4)
	2. Climate change assessment and adaptation	(4)
Energy source technology	3. Silicon-based solar cells	(1)
	4. Non-silicon based solar cells	(4)

⁶ South Korean Ministry of Strategy and Finance. Briefing on Green Economy.

	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 car	(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)
End-of-pipe technology	20. Secondary batteries	(2)
	21. CO2 capture, storage and processing	(3)
	22. Non-CO2 processing	(2)
	23. Assessment of water quality and management	(2)
	24. Alternative water resources	(2)
	25. Waste recycling	(2)
R&D in Virtual Reality	26. R&D in Monitoring and processing for hazardous substances	(3)
	27. Virtual reality	(2)
(1) Technologies for short-term intensive investment; (2) Technologies for mid-term intensive investment; (3) Technologies for long-term intensive investment; and (4) Technologies for long-term gradual investment.		

Projects in the area of information technology (IT) will contribute to enhancing the use of IT through 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 technological shift envisaged. This involves a transformation of production processes of the steel, fiber and textile, petro-chemistry, and the shipbuilding industries to increase resource and energy efficiency. The Korean Government is focusing its efforts in this regard on investment in research and development and facility upgrades.

By 2013, Korea foresees building “Green Industry Complexes”, which will mainly use waste resources, green power, biomass, and other new and renewable energy. Finally, the Korean Government will encourage green partnerships between large and small 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.

The 5YGGP embraces measures aimed at developing a set of cutting-edge technologies, which have a potential to promote growth in service industries and minimizing impact on the environment and natural resources. These include robotics, Advanced Nano Products (ANP), IT-convergence high-tech products, biomedicines, and the telecommunications, information technologies and broadcasting services.

Over the next five years, a total of 10.9 trillion won (US\$84.8 billion) will be invested to cultivate development of these industries. In the area of telecommunication and broadcasting service, the Korean Government expects to increase the amount of exports more than two-fold to US\$123.7 billion from current \$52 billion.

3.7 Policy architecture for green growth

Part of the 5YGGP is a set of legal, regulatory, fiscal, financial and economic measures that will form the policy architecture of the green growth strategy. The creation of a local carbon market in 2010 is part of that policy architecture, although details of the carbon market, including the pricing of carbon and industries to be covered under the scheme are yet to be defined.

A range of incentives are offered for private sector investments. These include tax benefits to corporate and individual investors, the issuance of long-term and low-interest green bonds and savings, and the creation of a green fund aimed at offering a “stable credit line” to small and medium-sized enterprises. Individual investors will also be given tax exemptions on their interest income from “green bonds” and other financial products to be issued by banks. Credit guarantees for green projects will increase from 2.5 trillion won (US\$1.9 billion) in 2009 to 7 trillion won (US\$5.4 billion) in 2013. In addition, the government plans to launch a “green” private equity fund.

The strategy attempts to increase energy welfare for low-income households with the 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.

3.8 Green city and green transport

In the transport sector the strategy is to increase the role of public transportation to 55 per cent of total transport use by 2013. In that regard the use of trains would increase from 19 per cent in 2009 to 30 per cent in 2013. Bicycle use will be promoted with the construction of 3,114 km of additional bicycle lanes nationwide from 2009 to 2018. About 1,700 km of bicycle lanes will be constructed along the water front 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 in 2013.

3.9 Education, awareness and lifestyle change

A set of policy measures is also targeted at behavioural change through education and information. Programmes educating about “green lifestyle” are focused on contributing to a shift in attitudes needed to support green growth, such as changing daily consumption patterns and the use of transportation by individuals. 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 5: Carbon labelling system in Korea

Ever 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.

Korea has adopted a green procurement law (the Green Consumption Enhancement Act) to increase the consumption of environmentally friendly products by central and local government agencies.

Private consumption of eco-friendly products is promoted through a “Carbon Point System”, which grants “carbon points” to consumers purchasing low-carbon products. Carbon points can then be exchanged for concessions at public facilities.

3.10 Promoting leadership on green growth

The Korean Government aims to endorse leadership and international cooperation on green growth. In doing so, the country intends to actively participate in global efforts to tackle climate change, to raise its rank in the Environmental Performance Index (EPI) and to increase the share of environment-related aid in Official Development Assistance (ODA).

4. Overview of key projects in the Republic of Korea’s green growth strategy: The four river restoration project

The restoration of Korea’s four major rivers – the Han, Geum, Nakdong and Yeongsan – was first announced as part of the “Green New Deal” policy launched in January 2009. It was later included in the 5YGGP released in July 2009, and its funding, a total of 22.2 trillion won (US\$17.3 billion) is reflected in the 5YGGP total investment.

This project includes water security measures such as disaster prevention and floodwater storage; wetland restoration; and development initiatives such as bike lanes, public waterways, ecological parks and water sports.

Amid rapid economic growth and high population densities, Korea continues to face challenging sustainable development issues. For instance, much work must still be undertaken to reach its water quality objectives for rivers and reservoirs. In 2004, approximately one-third of the 194 river sections achieved their planned quality targets. Biochemical oxygen demand remains the primary focus of these management efforts, while heavy metals and persistent contaminants have so far received little attention. Moreover, the protection of aquatic species and biodiversity has been largely ignored. “Red tides” of decomposing algae in coastal waters are a sign of serious nutrient pollution; three-quarters of sewage sludge is still dumped at sea.

Water infrastructure in rural areas lags behind densely populated urban areas. The impact of intensive agriculture on water quality and quantity has not been sufficiently brought under control. The control of diffuse pollution sources is only beginning to be addressed. In order to face the long-standing and intense pressure on its water resources, the Republic of Korea may consider adopting integrated urban water management systems, such as rainwater harvesting, reuse of grey water and retention of storm water. Korea may also consider strengthening the management of pollutants to improve water quality.

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, the 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 Korean peninsula experiences extreme variability in rainfall, from heavy monsoons in the summer to long severe droughts in the spring. Fast moving water does not only cause an immediate flood hazard, but groundwater

reserves are low because the water flows quickly into the sea rather than being absorbed to replenish groundwater resources.

Significant funds has been exhausted in recovering water-related damages that could have been saved through investment in disaster prevention measures. The annual flood damage was estimated at 170 billion won (US\$132.3 million) in the 1970's. Flood damages reached 2.7 trillion won (US\$2.1 billion) in 2009. Korea currently spends an average of 5.3 trillion won as annual investment in flood prevention and recovery expenses.⁷ In order to weather expected climate irregularities, substantial revisions in current water control policies will likely be necessary.

4.1 The four river restoration project

The four river projects has five key objectives: 1) securing abundant water resources against water scarcity; 2) implementing comprehensive flood control measures; 3) improving water quality and restoring the ecosystem; 4) creation of multipurpose spaces for local residents; and 5) regional development centered on rivers.

4.1.1 Securing abundant water resources against water scarcity and climate change

The project aims to secure adequate water supply (1.3 billion cubic meters) to counter future water scarcity and severe drought due to climate change. The four river restoration project includes the construction of sixteen new movable dams and reservoirs, two small and medium sized multi-purpose dams, the large-scale dredging of the floodway, strengthening of levees, three retention ponds, flood gate installation and replacement, water tunnel connection between two existing dams, and lastly raising irrigation dams in order to mitigate risks of water crests. The 16 reservoirs can house an additional 800 million cubic meters of water in addition to the crest raising of 87 dams, which will provide 250 million cubic meters of water for irrigation. In addition, two multi-purpose dams will supply at least 200 million cubic meters of water. A total of 1.3 billion cubic meters of water will be held in reserve to accommodate for severe droughts.

4.1.2 Implementing comprehensive flood control measures

The project calls for pre-emptive measures against the risk of repetitive floods due to climate change. Large-scale dredging of the floodway, strengthening of levees for 200-year design floods, flood gate installation and replacement, construction of two multi-purpose dams, and the development of three retention ponds will provide 920 million cubic meters of flood control volume. Moreover, the water tunnel connection between two existing dams makes for better water regulation on the river basin. These campaigns will enhance security against climate risks, which until now had not been adequately addressed under existing water plans or emergency plans.

4.1.3 Improving the water quality and restoring the ecosystem

The project call for, by 2012, a 90 per cent increase in water quality (BOD less than 3ppm) by expanding sewage treatment facilities and establishing green algae reduction facilities. Moreover, the project will restore ecological rivers, create wetlands, and readjust farmlands along the river to rehabilitate the ecosystem. In terms of adaptation strategies to climate change and sea level rise, federal and local government are to maintain adequate salinity concentration to protect drinking water supply and other water usage.

⁷ South Korea Ministry of Land, Transport and Maritime Affairs and the Ministry of Environment, 2009

The Eco-river Restoration Program (ERP) initiated in 2008 is centered among several national programmes. The total budget from federal and local governments was approximately US\$104 million in the first year and increased to US\$219.5 million in 2009. The increase in budget is due to the monitoring measurements of water flow, water quality, and aquatic species that must be undertaken by local governments prior to project support from the Republic of Korean central government. One of the ultimate goals of the programme is to restore indigenous and endangered aquatic species and maintain the quality of water and ecosystems. In the urban river restoration projects, public participation is being promoted in order to facilitate voluntary management programmes and develop an eco-river network using different approaches such as eco-tourism and cultural and recreational resources.

The other national programme to restore freshwater ecosystems is to develop an aquatic ecosystem-monitoring network. Since 2007, preliminary field surveys were conducted at more than 540 locations. This represents a significant river management planning project if one considers the total area (100,032 km²) of the Republic of Korea. In addition, a "stream continuum" concept is employed in the monitoring programme from headwaters to wadeable, non-wadeable and coastal waters.

More than 929 km of national streams will be restored as part of the four-river restoration project. A follow-up project will be planned by 2010 to restore more than 10,000 km of local streams. More than 35 riparian wetlands will also be reconstructed; riparian areas will also be afforested or reforested, which will be used for biomass production as well.

The Republic of Korea plans to extend the Tele-Monitoring System (TMS) on water quality, which is expected to significantly improve the water quality of the major rivers in Korea. Starting from July 2009, the Ministry of Environment is expanding the TMS to 105 large wastewater treatment plants and about 150 medium-sized plants. In addition, the ministry will link its policy and technical experience in operating the TMS with the green growth strategy of the Korean government in order to foster a TMS measuring equipment industry. For example, it plans to conduct technical assessments on existing TMS equipment to encourage companies to produce improved equipment and provide better services.

4.1.4 Creation of multipurpose spaces for local residents

The project also calls for rivers to be turned into multipurpose areas for lifestyle, leisure, tourism, and cultural activities, in support of the Republic of Korea's new paradigm of qualitative and green growth. There are plans for the waterfront areas next to rivers to have cycling lanes and esplanades extending over 1,206 kilometres. In the midst of another 522 kilometres of paths along the tributaries, hands-on tour programmes will be promoted, and walkways and sports facilities will be expanded.

4.1.5 Regional development centered on rivers

The four-river project is expected to contribute to regional development through various plans for developing cultural and tourism resources near rivers. The Korean government course of action is to modify villages located near rivers into recreational spots for visitors where they can experience farm life. By attracting tourists, those recreational spots with enhanced aquatic ecosystem near rivers are expected to develop the rural economy.

The four-river restoration scheme will involve the installation of photovoltaic and small hydropower power plants. Photovoltaic power generation facilities will be built on riversides that are not submerged and will include the construction of small hydropower plants when expanding existing reservoirs and agricultural reservoirs.

Through these activities, the four major rivers restoration project is expected to contribute to significant job creation and local economic revitalization.

4.2 Investment plan for the four-river project

The Korean government plans to restore the country's four major rivers – Han, Nakdong, Geum and Yeongsan – with a massive injection of public funds. The '4-River Project' is divided into three parts:

- 1) Main projects – the Han, Nakdong, Geum and Yeongsan rivers development projects;
- 2) Projects related directly to the Main Projects (projects for Seomjin river and the tributaries to the 4 major rivers) – projects for Seomjin river and the 14 tributaries of the 4 major rivers; and
- 3) Refurbishment for other smaller-sized waterways.

According to the Master plan, a total of 22.2 trillion won (US\$17.3 billion) is planned to be injected into refurbishing the four major rivers and their tributaries. The implementation of the project follows three phases:

In phase 1, approximately 16.9 trillion won (US\$13.2 billion) will be spent on the "main project" dredging operations, and building dams and reservoirs on the 4-major rivers. Most of the main projects are planned to be completed by 2011. However, projects for dams and reservoirs for irrigation will be completed by 2012.

In phase 2, another 5.3 trillion won (US\$4.1 billion) will be invested on improving water flow and sewage systems of tributaries of the 4 major rivers. Projects for the development of Sumjin River and other tributaries to the 4 major rivers are planned to be completed by 2012.

Phase 3 will include refurbishment plans for smaller-sized waterways and development of cultural and tourism resources near rivers. The Ministry of Culture, Sports and Tourism (MOCT) will be involved in these projects. The work will be undertaken in stages when budgets are secured by each Ministry.

Several ministries, such as the Ministry of Land, Transport and Maritime Affairs (MLTM) and the Ministry of Food, Agriculture, Forestry and Fisheries (MOFAFF), will take part in the different phases of the project. The Ministry of Culture, Sports and Tourism (MOCT) will be involved in the third phase.

Box 6: Investment plan for the four rivers “Main Project” (\$ 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	13.2	0.7	5.4	5.7	1.3

(Note) Most of the main projects are planned to be completed by 2011.
Building dams and reservoirs for irrigation will be completed by 2012.

Box 7: Investment plan for the for Sumjin river and the tributaries to the 4-major rivers (\$ 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.

4.3 Policy and institutional process

The process of policy-formulation and implementation on the four-river project is based on a multi-stakeholder consultative process that Korean officials refer to as the “trialogue” concept. This approach is meant to develop links between government (responsible for policy formulation and implementation), society (which is at the centre of the economy and ecology), and science (balancing and integrating natural and social sciences) as a means of achieving better water governance.

The Office of National River Restoration under the Ministry of Land, Transport and Maritime Affairs is the lead agency for the project. During implementation of the project, the office will operate in cooperation with other government agencies with specific responsibilities:

1) The Ministry of Culture, Sports and Tourism will initiate a project to restore cultural and historic heritages around the 4 major rivers and develop cultural tourism resources.

2) The Ministry of Agriculture, Fisheries and Food will give a face-lift to rural areas near the rivers to create the so-called "For La Ville", a village with forest and lake.

2) The Ministry of Land, Transport and Maritime Affairs will transform the existing cities into more liveable and attractive cities.

The Ministry of Land, Transport and Maritime Affairs publicized a graphic representation for smooth implementation of the project together with progress of the master plan. The Ministry will establish and operate compensation centers along the four rivers to pay compensation for the riverside farmlands and implement a compulsory joint contract system. By doing so, more local companies will be encouraged to participate in the project and be consigned some of projects.

4.4 Economic gains and employment generation

As per the Master Plan, the "4-river restoration project" and related water projects are expected to create 340,000 jobs by stimulating the growth of relevant industries such as the construction, service, and manufacturing sectors. In total, an estimated 40 trillion won (\$31.1 billion) of positive economic effects are expected from these efforts.

5. An overall assessment of the Korean green growth strategy

This segment examines the objectives and expected achievements of Korea's green growth strategy. The objectives set under the strategy are considered in terms of their targets and, where possible and relevant, comparing them with existing international and national standards in other countries, in order to assess the level of ambition.

The expected successes are considered under three aspects: 1) the potential for the green growth strategy to yield economic recovery, respectable job creation and long-term growth and sustainability; 2) the potential to generate environmental gains able to foster a low-carbon path of growth, improve resource efficiency and well being; and 3) the capacity of proposed fiscal, policy, regulatory and institutional reforms to position the foundations of a sustainable green economy.

The assessment assumed in this section draws upon key elements of a green economy as outlined in the "Global Green New Deal" report published by UNEP in March 2009 as well as the latest OECD Environment Performance Review of Korea published in 2006.

5.1 Policy and fiscal measures

In March 2009, UNEP released a report on the "Global Green New Deal"⁸, which benefited from contributions from several intergovernmental and civil society organizations. 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. While not prescriptive, the GGND report recommended domestic policy reforms to substantially reduce perverse subsidies (e.g. fossil fuels) and instead to create positive fiscal and other incentives and appropriate taxes to encourage a greener economy. Domestic reforms were also

⁸ Barbier, E.B. (2009). Rethinking the Economic Recovery: 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>

discussed in order to deal with some common issues in land use and urban policy, public transport, and the pricing of carbon.

The Republic of Korea's green growth strategy represents encouraging steps in terms of the policy, regulatory and fiscal reforms needed to achieve a green economy. Starting with policy signals on effective control of carbon emissions, the green growth strategy entails measures to enhance energy and resource efficiency and reverse past ecosystem degradation. These measures can be expected to yield a range of environmental benefits that would contribute to addressing national and global environmental challenges, while enhancing the quality of life and well-being for the Korean people. 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.

UNEP's Global Green New Deal report encouraged governments and other decision makers to seize the historic opportunity presented by the financial and economic crisis by refocusing public spending and private investment in green economic sectors, such as green construction, renewable energies, sustainable transport, and water management. The report argued that an investment of 1 per cent of global GDP (i.e. approximately USD 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.

In promoting its green growth strategy, 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.

In the OECD's 2006 Environment Performance Review of Korea⁹, it was noted that environmental expenditure in Korea has reached over 2 per cent of GDP, "a relatively high level by OECD standards". It is too early to assess whether the 2 per cent of GDP announced for the green growth plan is an expansion in the sectoral coverage of environmental spending, or an incremental change above the level of environmental expenditure in 2006.

The investment arrangement for green growth projects was developed in close collaboration with relevant government agencies, in particular the Korean Ministry of Finance. The Ministry of Finance has given assurance that funding for green growth projects will be given priority over other funding, in order the secure swift implementation¹⁰.

Carefully tailored, time bound and targeted fiscal and financial incentives are recognized as essential in facilitating the transition towards a green economy. Fiscal and financial incentives, including tax benefits, the creation of a green fund to support investment by SMEs, and an increase in credit guarantees for green projects from 2.5 trillion won (US\$1.9 billion) in 2009 to 7 trillion won (US\$5.4 billion) in 2013, are among measures intended to level the field and provide the needed support to green industries. In addition, the government's road map seeks to mobilize investment from pension schemes and support the development of green equity funds.

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. KCCI is

⁹ OECD (2006) Environment Performance Review of Korea. Paris: OECD.

¹⁰ Communication from a meeting the authors of this report had with representatives of the Presidential Committee on Green Growth on 29 July 2009.

currently preparing a report to provide views and perspectives on the government's five-year green growth plan¹¹.

5.2 Economic gains, employment and social benefits

The two major policy objectives of Korea's green growth strategy are to stimulate economic recovery and long-term growth by investing in environmental sectors and generating employment.

5.2.1 Production inducement

By means of this investment, the Republic of Korea expects to induce production worth 182 to 206 trillion won (US\$141.7 billion to US\$160.3 billion) during 2009-2013 with a yearly average production inducement of 36.3 to 41.2 trillion won. This production inducement corresponds to 3.5 to 4.0 per cent of estimated 2009 GDP. The value-added inducement is calculated at 75.0 to 94.9 trillion won (US\$58.4 billion to US\$73.9 billion) over the 5 years, with a yearly average of 15.0 to 19.0 trillion won (US\$11.7 billion to \$14.8 billion). These estimates are based on two scenarios developed by the Presidential Committee on Green Growth, using input-output tables¹² to calculate the expected macro-economic gains from the country's five-year green growth plan.

5.2.2 Employment generation and social considerations

The plan is expected to create jobs in green industries for 1.56 to 1.81 million people during the 5 years, with a yearly average of job creation of 31,200 to 36,000 jobs. In the design of the 50 projects included in the 5-year plan, the Korean government has devised a strategy focusing first on large infrastructural projects such as the 4 major rivers restoration projects, which are expected to provide employment opportunities for the category of workers in sectors that were hit hardest by the global economic downturn. It is planned that investment will then move into the high-technology sectors (the 27 core technologies), which should provide the future engines of growth for the country, making use of its highly educated work force.

In recognition of the uneven energy burden on Korean families, the green growth plan set the objective of reducing the number of households whose energy expenditure is worth 10 per cent of their total revenue, from the present 7.3 per cent of total households to 5.0 per cent in 2013.

¹¹ Communication from a meeting the authors of this report had with representatives of the Korea Chamber of Commerce and Industry, Business Institute for Sustainable Development on 30 July 2009.

¹² 2005 input-output tables, the most up-to-date input-output tables as of 2009, were used in the calculation.

Box 8: Estimated economic effects of Korea's 5-year green growth plan						
Indicator/period	Economic gains					
	Production inducement (\$ Billion)		Value-Added inducement (\$ Billion)		Job creation (thousand people)	
	Case 1	Case 2	Case 1	Case 2	Case 1	Case 2
2009-2013	141.4	160.3	58.4	73.9	1,561	1,805
Yearly average	28.3	32.1	11.7	14.8	31.2	36.1
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 (= \$801.0 Billion)
** Number of unemployed in 1st quarter 2009 (908,000)

5.3 Low-carbon growth and environmental improvement

Korea's carbon emissions doubled in the past 15 years from 1990 to 2005, making it the fastest growing source of emissions in the OECD. Under a business-as-usual scenario, the Republic of Korea's carbon emissions are estimated to increase by 30 per cent by 2020. The OECD 2006 Environment Performance Review of Korea stressed that Korea's carbon dioxide (CO₂) emissions as well as its use of energy, pesticides and fertilizers are among the highest in the OECD relative to GDP or area¹³. The Review recommended that 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".

At the G-8 extended summit held in Toyako, 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 their level of 2005, using a target from three options being considered. Depending on the option adopted, Korea's GHG would increase by 8 per cent, remain unchanged or decrease by 4 per cent when compared to 2005 levels. The Presidential Committee on Green Growth indicated that under these scenarios, Korea's emissions level would be reduced by 21, 27 and 30 per cent, compared to projected growth in 2020¹⁴.

A successful execution of the green growth strategy such that it delivers low-carbon growth entails a decoupling of growth from carbon emissions. This, in turn, requires significant reductions in the carbon-intensity of growth; that is, reducing the unit of carbon emissions per unit of economic growth. The green growth strategy contains a number of specific measures and targets for emissions reduction in several areas discussed below.

¹³ OECD (2006) Environment Performance Review of Korea. Paris: OECD.

¹⁴ Korea.net, Seoul maps out plans to cut greenhouse gas emissions. 5 August 2009. <http://www.korea.net/>.

5.3.1 Energy and fuel efficiency

The Intergovernmental Panel on Climate Change (IPCC) has indicated that the global fleet's vehicle fuel economy needs to improve by 50 per cent by 2050 to stabilize emissions from road transport¹⁵. The Global Fuel Economy Initiative (GFEI) launched by UNEP, together with the International Energy Agency, FIA Foundation and the International Transport Forum, seeks to double the fuel economy of the global vehicle fleet – in line with IPCC and G8 recommendations. The 2006 OECD Review noted that “Korea's energy and transport policies need to better integrate environmental concerns... Korea is one of the few OECD countries, which has not improved its energy intensity (energy use per unit of GDP) relative to 1990”.

As the world's 5th 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. The 5YGGP sets regulatory standards on fuel efficiency and GHG emissions from the transport sector that will require a re-design of cars to either drive 17 kilometres per litre or cut greenhouse gas emissions below 140 grams per kilometre between 2012 and 2015. The average fuel efficiency of 11km per litre and emissions of 210 grams per kilometre will be raised to 15.1 km per litre by 2016. These new fuel efficiency and emission rules will be applied to 30 per cent of automobiles sold by automakers in 2012, rising to 100 per cent by 2015. The effort by the Korean government to orient its car industry into technology, rather than cost-driven, competition is considered to be important in that regard.

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

The development of green technologies is also projected to cut 130 million tons of carbon dioxide emissions by 2020. By 2013, carbon capture and storage in the forestry sector would reduce CO₂ in the atmosphere by 1,613 Million tons.

In terms of energy efficiency, Korea plans to enhance energy efficiency from 0.317(TOE/thousand dollars) in 2009 to 0.290 (TOE/thousand dollars) in 2013 and to 0.233 (TOE/thousand dollars) in 2020. These measures represent important steps in the direction of improving energy and fuel efficiency.

5.3.2 Renewable energies

Overall, 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. Korea's share in the global market of new and renewable energy would increase from 2.8 per cent in 2009 to 5.4 per cent in 2013. Under the green growth plan, the country's self-sufficiency in oil and gas would increase to 20 per cent in 2013, from its 2009 level of 7.4 per cent.

Nuclear energy will play a greater role in Korea's energy mix, growing from 24 per cent of power generation in 2009, to 27 per cent in 2013, and to 32 per cent in 2020. A number of environmental and social concerns arise with regard to the development of nuclear energy. They range from safe disposal and storing of nuclear waste to general social safety concerns. The specific procedures for further developing nuclear energy should carefully consider these issues and devise ways to address them in an effective manner.

¹⁵ FIA Foundation. *50 By 50 – Global Fuel Economy Initiative*. Available at: http://www.fiafoundation.org/Documents/Environment/50by50_Leaflet_Ir.pdf

The Republic of Korea government is also heavily investing in the area of waste-to-energy. Korea plans to install a total of 48 environment facilities to create energy from 3.86 million tons of waste by 2013. Another 17 facilities will be set up to absorb the residual heat from incinerating sites. The government also plans to develop a comprehensive system to process waste resources from industry by 2011. These are important measures that will improve energy and material efficiency while contributing to increasing generation of energy from waste.

The introduction of a renewable portfolio standard (RPS) starting at 3 per cent in 2013 and reaching 10 per cent in 2020 will make it mandatory for energy suppliers to provide a set amount of renewable energy in their portfolio. While a large number of countries, including almost all developed countries and countries in transition (in existence in Korea since 2003) have adopted feed-in tariffs, fewer countries have adopted RPS at a nation-wide level (although RPS exists at the state-level in many countries, such as the United States). This new renewable portfolio standard is expected to heighten, through mandatory requirements, renewable energy supplies in the Republic of Korea.

The current plan on renewable energy does not appear to be particularly ambitious. The 2006 OECD Review remarked that Korea's second national energy plan stipulated a growth of 3.1 per cent a year from 2002-2011 and envisaged only limited changes in the energy mix (with only 5 per cent for renewable energies by 2011). The target of achieving 3.78 per cent share of renewable energies in 2013 and 6.08 per cent in 2020 seems to be lower than the target of 5 per cent set in the second national energy plan. In comparison, both the European Union and China have set objectives of achieving a 20 per cent share of renewable energy sources in their total energy supply by 2020.

5.3.3 Ecosystems and well-being

Ecosystem restoration and human well-being are central aspects of the Korean green growth strategy, underlying the change in paradigm from quantitative to qualitative growth. In that respect, the 4-river restoration project would secure 1.3 billion cubic meters of adequate water supplies to respond to future water scarcity and severe droughts due to climate change. A large-scale dredging of the floodway, the construction of multi-purpose dams and retention ponds, among other installations, will provide a flood control capacity of 920 million cubic meters. In addition, the project is expected to restore more than 929 km of national streams. More than 35 riparian wetlands will be reconstructed, afforested or reforested, which will be utilized for biomass production.

As consumers are made more aware of the environmental implications of their consumption patterns, including through carbon-labelling schemes, Korea expects to double the share of its eco-friendly agricultural products from 4.5 per cent in 2009 to 10 per cent in 2013. The use of pesticides and fertilizers was found to be among the highest in the OECD relative to GDP or area, in the 2006 OECD Review. The 5-year plan on green growth does not seem to include a specific target of reducing use of pesticides and fertilizers, along with the promotion of eco-friendly agricultural products. As the Republic of Korea looks for ways to improve the sustainability of its agricultural sector, which relates not only to sustainable forms of production, but also connects to the agenda on water quality, it is recommended that they consider reducing the use of non-organic pesticides and fertilizers.

While all these measures will undoubtedly be important in reducing the level and rate of growth of GHG emissions for Korea, there needs to be an overall assessment of the cumulative effect on GHG emissions of the entire 5YGGP. Such an exercise is not considered in the context of this report, but would certainly be warranted.

5.4 Institutional process, transparency and participation

The planning and formulation of Korea's green growth strategy and its five-year plan has brought about an inter-agency process that has included the participation of all government ministries. The Presidential Committee on Green Growth, established in 2008, is a fundamental pillar of the institutional course of action. With representatives from all government ministries, the private sector, academia and civil society, the Committee met four times since its creation and before the release of the 5-year plan on green growth. At each ministry, a Chief Green Officer, generally at Director-General level, served as 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 circle participated in the formulation of Korea's green growth strategy.

This policy and institutional process is believed to have contributed to streamlining government action. Green growth related projects that were planned under the different ministries were integrated in ways that will enable focused policy direction and provision of financial and fiscal support in a more effective manner. For example, the Korean Ministry of Strategy and Finance reported that in 2008, 267 green growth related projects were submitted by 20 ministries and offices, with a total budget of 148 trillion won. The assumed planning process resulted in packaging these projects into 9 core projects and 27 related industries.

In addition, a series of presentations and public hearings were undertaken to introduce the green growth strategy to the Korean public. Nonetheless, concerns have been raised by certain groups with about the need to increase the level of interaction with experts and stakeholders in civil society to benefit from their views and perspectives on green growth projects.

In addition to involvement of central government agencies, 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. Their local five-year plans are due to be formulated in 2009. It is expected that through such plans, local authorities will be able to tailor green growth projects to the needs and priorities of their constituencies¹⁶.

Many of the projects envisaged in the green growth national plan will have profound environmental and socio-economic implications. For those that have particularly significant impacts on the environment, as mandated by Korean laws and regulations, a prior environmental review and an environmental impact assessment is required for each project prior to its implementation. Central and local governments have the responsibility to commission such impacts assessments, which must be reviewed and approved by the Korean Ministry of Environment. The process allows for public comments and requires relevant authorities to respond. Concerns have been expressed with reference to the short amount of time given to undertaking the environmental impact assessments, which limited the participation of some stakeholders in Korea. Certain groups have noted, for example, that the four major rivers restoration project was made public for the first time on 15 December 2008 and its master plan was announced in July 2009. The implementation is expected to start in October 2009, subject to clearance of the EIA, and should be completed by 2012.

While some see this timeline as too short to allow for effective consultations with all stakeholders, Korean authorities view the plan as a race against time to respond to urgent challenges of water quality, flood control and ecosystem restoration, while contributing to the country's new qualitative

¹⁶ In a bid to familiarize central and local government officials with the concept of green growth, Korean Prime Minister has led a series of 19 lectures on green growth to government officials. 5 such lectures were directed at central government officials and 14 to local government officials. Altogether, over 5000 central and local government officials attended those sessions. Communication from a meeting the authors of this report had with the Prime Minister's Office, Republic of Korea, on 29 July 2009.

growth paradigm. Korean authorities appear to be adequately considering the need to balance swift and effective implementation with concerns for transparency and public information and participation in the policy-formulation process. In that respect, the start of the four-river project initially set for September 2009 was moved to October, in order to provide more time for public input into the EIA. The legislative process on the Basic Law on Green Growth is considered to be another platform for elected representatives to consider various aspects of the green growth strategy. The Presidential Committee on Green Growth has recently announced another round of dialogue with civil society that would be launched in October 2009.

6. Conclusions

Transforming the global economy away from dependence on fossil fuels and unsustainable use of the Earth's limited resources is not an option; it is a fundamental requirement for the survival of our economic and social systems in the 21st century. Beyond the attempts to jump-start a "green recovery", there is today a chance to restructure resource allocation and enshrine national economies on a long-term path of sustainable growth and development.

The Republic of Korea's green growth vision and strategy is a major attempt to fundamentally transform the country's growth paradigm from its focus on "quantitative growth", since the first five-year economic plan was launched by President Park Chung-hee in 1962, to focus on low-carbon, "qualitative growth". Such an attempt is an indication that governments are gaining awareness of the need to undertake significant changes in the economies of today. It also demonstrates that governments are able to formulate and implement policies that can respond to the urgency of action and the magnitude of the challenge.

The objectives of Korea's green growth vision and strategy are comprehensive as they relate to tackling climate change and enhancing energy security, creating new and sustainable engines of growth, and restoring ecosystems for a better quality of life. Whether these will deliver a green economy that will contribute to achieving sustainable development in its economic, social and environmental dimensions is a question that cannot be fully and firmly answered in this overview report.

Nonetheless, by committing 2 per cent of GDP over the next five years to invest in green technologies, resource and material efficiency, renewable energies, sustainable transport, green buildings and ecosystem restoration, the Republic of Korea is responding positively to UNEP's call upon governments, the private sector and citizens to reorient and refocus investment in the environment and economic sectors that can deliver sustainable growth, decent jobs and human well-being for present and future generations.

The 2006 OECD Environmental Performance Review of Korea already noted that Korea's spending of 2 per cent of GDP on environment was a high figure even by OECD standards. As the green growth vision and strategy seeks to turn environmental investment into a pillar of economic growth, there are reasons to believe that such a strategy can at least serve as a useful test to current thinking on opportunities and challenges to the transition towards a green economy.

Regulatory and fiscal reforms envisaged in Korea's green growth strategy are important steps in fostering behavioural change in industry and society. As fiscal and financial incentives are being created to sow the transition towards green economy, governments also need to reform harmful policies across their economies, including harmful subsidies, from energy to transport and agriculture to fisheries. Such policy reform will not only contribute to advancing the transition to a green economy in their own countries, it will also enable other countries to pursue the path of reform, and facilitate efforts by the international community to carry out the needed changes in the international policy architecture. UNEP encourages the Korean Government to further expand the process of policy reform, building on its already remarkable progress.

The inter-agency process that has led to the formulation of the five-year green growth national plan reflects the kind of transformative change in governance that a green economy would demand. When finance and economic ministries are working side by side with transport, energy, environment, land, and tourism ministries to design green investment plans, we stand a better chance of ensuring that adequate resources are secured to support the greening of economies and that investment decisions are guided by multi-sectoral processes.

The effort to clearly link the Republic of Korea's green growth strategy with the design of the country's mid-term target for reducing greenhouse gas emissions offers a strategically important opportunity for connecting growth and development policy with the necessity of tackling climate change. If successful, this would prove that changes in economic systems can equally deliver prosperity and respond adequately to the challenge of climate change.

Engaging the private sector and civil society as stakeholders and partners is fundamental to the success of the green economy. Similarly, civil society organizations in the Republic of Korea have been active participants in the debate on green growth either through the voicing of their concerns and by contributing in analytical thinking with a view to make the best choices for their country. Dialogue and consultations ensures that stakeholders in the private sector and civil society are able to participate effectively in the formulation and execution of the green growth strategy and this deserves to be pursued and strengthened.

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. Under the chairmanship of Prime Minister Han Seung-soo, the OECD Ministerial Meeting adopted on 25 June 2009 a Declaration on Green Growth. The OECD Ministers declaration comments that "a number of well targeted policy instruments can be used to encourage green investment in order to simultaneously contribute to economic recovery in the short-term, thus helping build the environmentally friendly infrastructure required for a green economy in the long-term".

The Korean green growth vision and strategy is based on a similar notion that green investment that transforms factors underlying growth can contribute to sustainable economic recovery while placing the Korean economy on a low-carbon and sustainable path of development.

ACRONYMS

UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
LNG	Liquefied Natural Gas
GDP	Gross Domestic Product
GND	Green New Deal
OECD	Organization for Economic Co-operation Development's
5YGGP	Five-Year Green Growth Plan
GHG	Greenhouse Gas
LED	Light Emitting Diode
CCS	Carbon Capture and Storage
IPCC	Inter-governmental Panel on Climate Change
RFS	Renewable Fuel Standard
R&D	Research and Development
SMEs	Small and Medium Enterprises
ANP	Advanced Nano Products
EPI	Environmental Performance Index
ODA	Official Development Assistance
TMS	Tele-Monitoring System
MLTM	Ministry of Land, Transport and Maritime Affairs
MOFAFF	Ministry of Food, Agriculture, Forestry and Fisheries
MOCT	Ministry of Culture, Sports and Tourism
UNFCCC	United Nations Framework Convention on Climate Change
IPCC	The Intergovernmental Panel of Climate Change
GFEI	The Global Fuel Economy Initiative
ERP	The Eco-river Restoration Programme



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