

The Green Growth and Korean Movement

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I. Introduction

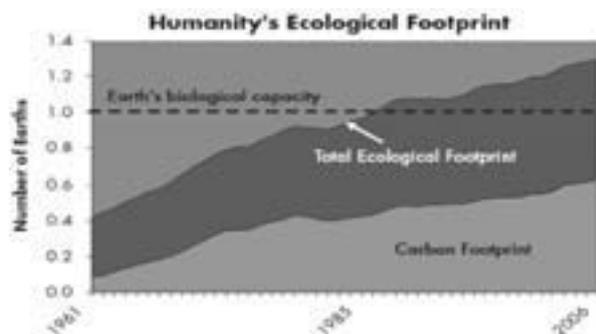
Greenhouse gas emissions need to be cut by 80 percent until 2050 according to the IPCC (Intergovernmental Panel for Climate change) and finite natural resources from fossil fuels to metals need to be used more efficiently and must be re-used since natural resources are depleting so quickly.

According to the UNEP, from 1981 to 2005, the global Gross Domestic Product (GDP) has been increased more than double. However, 60 percent of the world's ecosystems have been degraded in an unsustainable manner since global annual spending on the environment estimated at best US 10 billion dollars per year. On the other hand, global energy subsidies ranges from US \$240 billion to US \$310 billion dollars per year, which is around 0.7 per cent of global GDP. UNEP and OECD(2010) argued that reduction of fossil fuel subsidies can cut greenhouse gas emissions by six per cent by boosting energy efficiency in the world.

Besides, many international research institutions such as UN and WRI (World Resource Institute) also warned the seriousness of environmental degradation and the problem of poverty as a result of economic growth over the past decades. Especially, they warned that Asia and the Pacific countries are facing severe economic and environmental problems even if average gross domestic product's growth rate in Asia and the Pacific countries are outstripping the world's average growth rate after the year 2000.

The United Nation has argued that Asia and the Pacific countries are living beyond the edge of sustainable growth. i.e. managing beyond the environmental carrying capacity.

<Figure 1> Humanity's Ecological Footprint



Source: www.Global Footprint Network.org, 2009

<Table 1> Comparison of Ecological Footprint among AP and the world

	bio-capacity	ecological footprint	ecological deficit
AP	1.0	1.5	- 0.5
World	1.8	2.2	- 0.4

Source: UNESCAP, "The Ecological Footprint and National Wealth," 2006.
www.globalfootprint.network, "Global Footprint Network," 2006.

It is believed that one-fifth of Asia and the Pacific countries are still living with less than one dollar per day, and two hundred million peoples are living under two dollar per day in the world.

<Table 1> shows that Asia and the Pacific region's ecological footprint are already surpassing bio-capacity. Ecological footprint of Asia and the Pacific region is much larger than its own biological capacity. Therefore, ecological deficit in the world is negative 0.4 according to the table. Usually, the ecological footprint measures humanity's demand on nature. The footprint is the total area required to produce food, timber, and gives space for its infrastructure. Bio-capacity is a measure of nature's ability to produce resource from its biologically productive area

Most countries have desire to maintain rapid economic growth, and one of the most important element for policy makers to agonize is how to harmonize economic growth with environmental sustainability. Most countries' current economic growth model is relying on the cost efficiency paradigm which indicates that market is dictating us to minimize the market costs while maximizing the profits. However, cost efficiency does not ensure ecological quality of economic growth, what they call, eco-efficiency. Since market price does not fully reflect environmental costs, cost efficiency will always have a gap between eco-efficiency. Climate change is a classical example of the gap between market based cost efficiency and eco-efficiency as market price of energy does not fully internalize environmental costs of climate change in their products.

Therefore, the paradigm of economic growth in the past should be changed from manufacturing based economic growth ('black growth' if I put it) to the 'green growth' for all countries in the future. The measurement of economic growth should also be changed. Here, the 'green growth' is an economic policy focusing on combination of economic growth with environmental sustainability, not destroying the environment, according to the UNESCAP.

President of South Korea, Lee Myung-Bak announced the green growth as Korea's new economic growth vision in his speech at August 15th Independence Day ceremony in 2008. Korea aims to shift its manufacturing based economic growth paradigm to an environmental friendly growth by creating green jobs through green industry such as green car, green home and green energy in the future. Of course, it is difficult to exactly define what the green job is. Also it can be difficult to decide which jobs are truly green. UNESCAP defines a green job as an employment that contributes to preserving or restoring environmental quality and avoiding future damage to Earth's ecosystems.

The announcement of vision for green growth in Korea was very timely and crucial for Korean economy. As we might know, the world is experiencing economic crisis because of financial problems in the U.S after 2007. In order to overcome such an economic crisis, the world

does desperately need any kind of breakthrough in the near future. As a path way, the world declared the 'Green New Deal' as the U.S and the world had made good economic success during the 1920's economic depression with 'New Deal' economic policy. At that time, the world and the U.S had successfully overcome economic crisis through dam construction and created many manufacturing jobs.

At this time, once again the world is eager to escape from the economic crisis through green policy strategy. Center for American Progress, an environmental think-tank research institution for the Democratic Party in the U.S.A, call this as a 'Green Recovery'. Developed countries such as Japan, Germany, UK, and the Netherland are moving toward to the green industry and have started to green racing around ten years ago.

The potential for green jobs is immense and pursuit of "green jobs" will be the key for the economic driver in the 21st century. But much of green jobs will not be activated without strong and sustained investments from the public and private sectors. Government need to establish a firm framework for greening all aspects of the society, with concrete achievement targets and mandates implementation, business economic incentives, and reform environmental tax and subsidy policies.¹

EU is already active on this issue. UNEP's Green Economy Initiative supporting from the European Commission with \$4 million-worth of funding has three aspects - valuing and mainstreaming nature's services into national and international accounts; employing generation through green jobs and laying out the policies; instruments and market signals able to accelerate a transition to a Green Economy (UNEP, 2008).

The Green Economy Initiatives is trying to focus on five sectors; clean energy and clean technologies including recycling, rural energy including renewable and sustainable biomass, sustainable agriculture including organic agriculture, and ecosystem infrastructure, Reduced Emissions from Deforestation and Forest Degradation(REDD), sustainable cities including urban planning, green transportation, and green building. Investments in renewable energy and energy efficiency are central strategy to this green economic policy proposal, and would be funded through a combination of public funds, tax credits, and loan guarantees to spur private-sector investment.

Through green investments, U.S may expecting to create about total number of 2 million jobs over the next years. Direct jobs will create about 1 million workers and 600,000 workers will be hired indirectly.

Global unemployment stands at roughly 6 percent, affecting some 190 million people. In addition, more than 3 billion people's job aged 15 or older are confronted with vulnerable employment situations. About 487 million workers do not earn enough money to survive which is above \$1-a-day level of extreme poverty, and an estimated 1.3 billion workers earn less than \$2 a day.²

The number of green jobs from various sectors is

<Table 2 > Green Investments and Jobs in the U.S.A

Strategies for Green Economic Investment	Representative Jobs
Building Retrofitting	Electricians, Heating/Air Conditioning Installers, Carpenters, Construction Equipment Operators, Roofers, Insulation Workers, Carpenter Helpers, Industrial Truck Drivers, Construction Managers, Building Inspectors
Mass Transit/Freight Rail	Civil Engineers, Rail Track Layers, Electricians, Welders, Metal Fabricators, Engine Assemblers, Bus Drivers, Dispatchers, Locomotive Engineers, Railroad Conductors
Smart Grid	Computer Software Engineers, Electrical Engineers, Electrical Equipment Assemblers, Electrical Equipment Technicians, Machinists, Team Assemblers, Construction Laborers, Operating Engineers, Electrical Power Line Installers and Repairers
Wind Power	Environmental Engineers, Iron and Steel Workers, Millwrights, Sheet Metal Workers, Machinists, Electrical Equipment Assemblers, Construction Equipment Operators, Industrial Truck Drivers, Industrial Production Managers, First-Line Production Supervisors
Solar Power	Electrical Engineers, Electricians, Industrial Machinery Mechanics, Welders, Metal Fabricators, Electrical Equipment Assemblers, Construction Equipment Operators, Installation Helpers, Laborers, Construction Managers
Advanced Biofuels	Chemical Engineers, Chemists, Chemical Equipment Operators, Chemical Technicians, Mixing and Blending Machine Operators, Agricultural Workers, Industrial Truck Drivers, Farm Product Purchasers, Agricultural and Forestry Supervisors, Agricultural Inspectors

Source: Robert Pollin, Heidi Garrett-Peltier, James Heintz, and Helen Scharber, 'Green Recovery', 2008.09

already on the rise. For instance, current employment in renewable energy and supplier industries estimated at a conservative 2.3 million jobs worldwide.(UNEP, 2008) The wind power industry employs around 300,000 people, the solar photovoltaic's (PV) sector employs an estimated

¹ 'Green Jobs, 2008 Working for People and the Environment' Michael Renner, Sean Sweeney and Jill Kubi, 2008

² Michael Renner, Sean Sweeney and Jill Kubi "Green Jobs, 2008 Working for People and the Environment', 2008

<Table 3> Total Job Creation through \$ 100 Billion Green Stimulus Program

Direct jobs	935,200
Indirect jobs	586,000
Induced jobs	496,000
Total job creation	1,999,200

Source: Center for American Progress , "U.S Bureau of Economic Analysis" 2007

<Table 4> Estimated Jobs in Renewable Energy, Selected Countries and World, 2006³

Renewable Energy Source	World	Selected Countries	
Biomass	1,174,000	Brazil	500,000
		United States	312,300
		China	266,000
		Germany/ Spain	95,400/10,349
Solar Thermal	624,000-plus	China	600,000
		Germany	13,300
		Spain/United States	9,142/1,900
Wind	300,000	Germany	82,100
		United States	36,800
		Spain	35,000
		China	22,200
		Denmark	21,000
		India	10,000
Solar PV	170,000	China	55,000
		Germany	35,000
		Spain	26,449
		United States	15,700
Hydropower	39,000-plus	Europe	20,000
		United States	19,000
Geothermal	25,000	United States	21,000
		Germany	4,200

Source: "Green Jobs: Toward Decent Work in a Sustainable, Low Carbon World," 2008

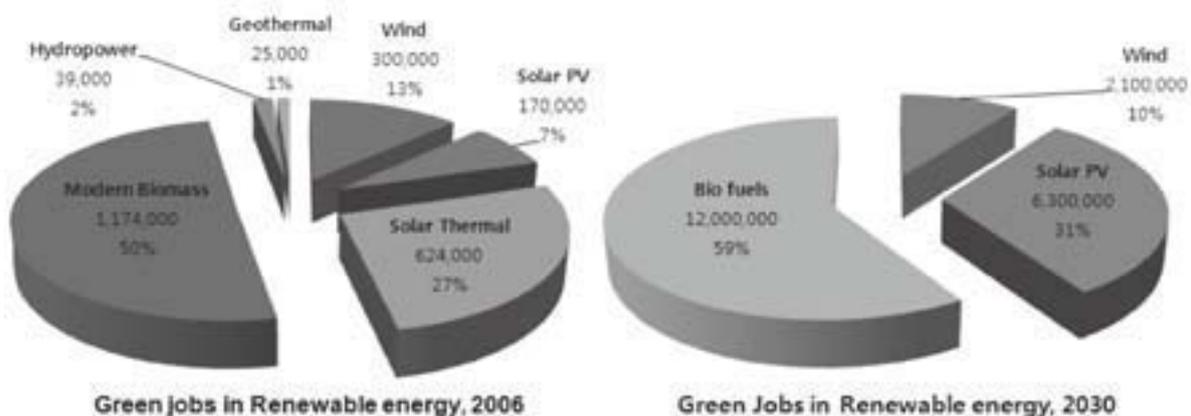
170,000 people, and the solar thermal industry employs more than 600,000 jobs in the world. More than 1 million jobs are found in the bio- fuel industry. Growing and processing a variety of feed stocks into bio ethanol and biodiesel is also under rising.

The potential of biomass market is quite promising. If we consider only few leading countries like U.S.A, Brazil, China, Germany and Spain, about 1.2 million workers may be employed in biomass industry until year 2030, which is half of total green jobs, and Solar Thermal will also be taken around 600,000 employs in these countries. Spain which takes the advantage of geographical location in southern Europe is the leading country in this field.

Several countries have reasonably good estimates for renewable energy employments. Globally about 300,000 peoples are employed in wind power and maybe 170,000 in solar power sector. Over 600,000 are employed in solar thermal, mostly in China. Nearly 1.2 million are employed in biomass energy in four countries - Brazil, USA, Germany and China. Germany boasted 259,000 direct and indirect jobs in the renewable energy sector in 2006.

Investment in clean development and in green jobs has been growing rapidly in recent years; such investment creates employment (breaks flow of the sentence). According to the UNEP and ILO's report in 2008, global investment in clean technology expanded by 60 per cent from \$ 92.6 billion in 2006 to \$ 148.4 billion in 2007. Currently, many major companies worldwide are considering about investing in climate solutions.⁴

Spain's renewable industry employs 89,000 workers directly and an estimated 99,000 indirectly, for a total of 188,000. In the United States, a 2007 study for the American Solar Energy Society found that the renewable sector earned \$39 billion in revenues in 2006 and employed close to 200,000 people directly and 246, 000 indirectly. In China, an estimated 1 million people are employed in the wind, solar PV, solar thermal, and biomass industries. According to the consulting firm Roland Berger, the

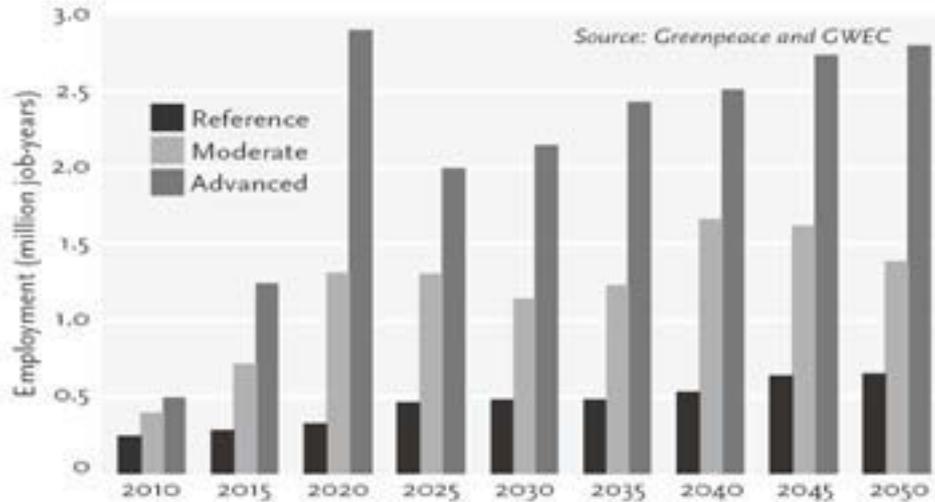
<Figure 2> Green Jobs in Renewable Energy 2006 and 2030

Source: Green jobs-Towards Decent Work in a Sustainable, Low-carbon World, UNEP/ILO/ITUE, 2007

³ 'Green Jobs, 2008 Working for People and the Environment' Michael Renner, Sean Sweeney and Jill Kubi, 2008

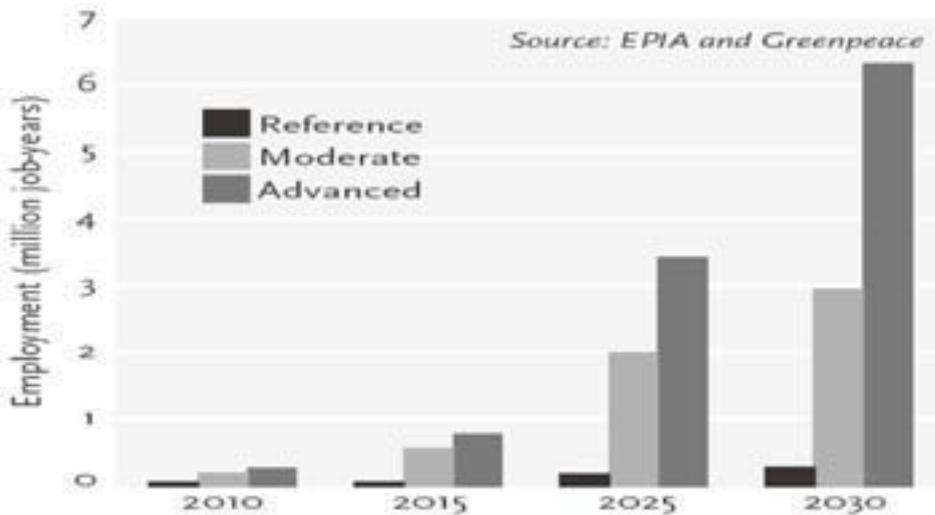
⁴ Green Jobs: Towards decent work in a sustainable, low-carbon world

<Figure 3> Global Wind Power Employment, Projections, 2010-2050



Source: Greenpeace and GWEC, 2010

<Figure 4> Global Solar PV Employment Projections, 2010-2030



Source: EPIA and Greenpeace, 2010

number of employment in green job may grow to 400,000-500,000 by 2020, and to 710,000 by 2030.

Renewable energy investments rose from \$100 billion in 2006 to \$160 billion in 2007. Many countries change their fossil fuel based-energy to various renewable based energies. Norway intends to double its national research fund for renewable energy to \$3.4 billion. UK announced a \$100 billion investment to build 4,000 onshore and 3,000 offshore wind turbines by 2020, while creating some more 160,000 jobs in this area. The German renewable sector, for example, already generates \$240 billion in annual revenue, employs 250,000 people, and is expected to provide more jobs than the country's auto industry by 2020.

Green building or green home offers tremendous opportunity for green jobs. The building and construction sector currently employs more than 111 million people

worldwide. In the United States alone, the Apollo Alliance projects that investing in high-performance buildings such as retrofitting as well as new construction could result in the creation of 827,260 jobs. This would require \$89.9 billion in investments, tax incentives, R&D expenditures, and promotion of new green building codes and standards. According to the world Green Building committee, 11 countries have green certification code and will increase the numbers in the future; LEED (U.S.A., Canada, India), BREAM(U.K), Green Star(Australia, New Zealand), Pasivhaus (Australia, Germany, UK).

A worldwide transition to energy-efficient and green buildings will create millions of jobs. UNEP is expecting to have an additional 2-3.5 million green jobs in Europe and the United States from that sector alone.⁵ According to the IPCC, the largest energy saving potential within the

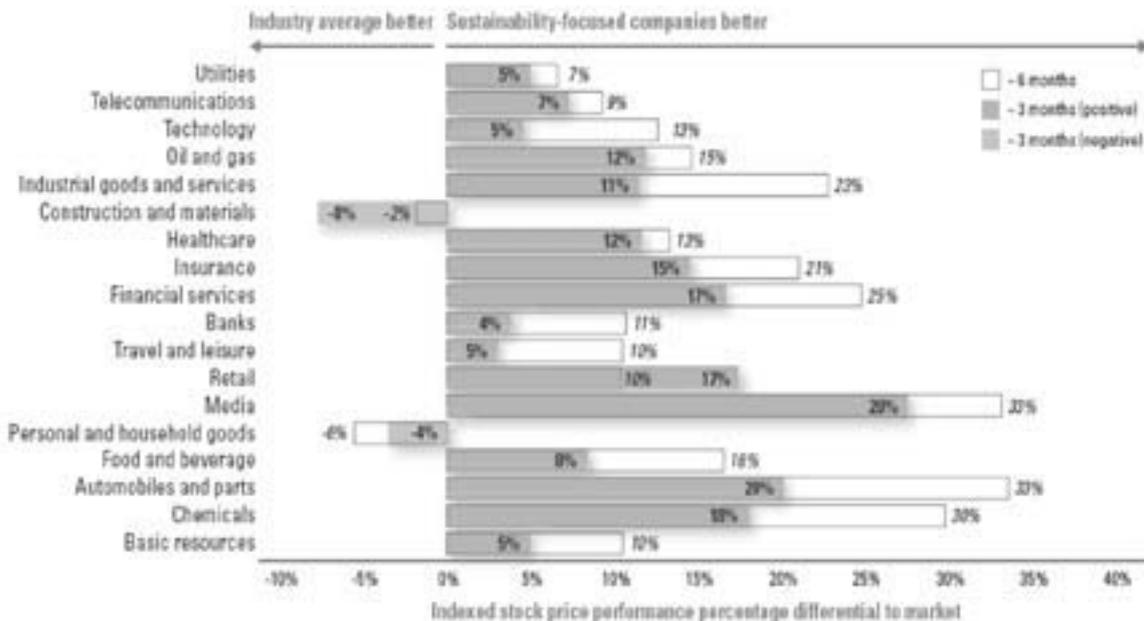
⁵ UNEP, "Global Green New Deal" - Environmentally-Focused Investment Historic Opportunity for 21st Century Prosperity and Job Generation, 2008.10.22

<Table 5> Green Jobs Estimates in Vehicle Manufacturing

	European Union	Japan	South Korea	United States
Passenger-car manufacturing workforce	2,000,000	952,000	247,000	1,095,000
Share of vehicles emitting ≤120 grams of CO ₂ per kilometer (percent)	7.5	6.3	4.3	n.a.
Share of vehicles achieving 40 miles per gallon or more (percent)	n.a.	n.a.	n.a.	1.2
Jobs in manufacturing "green" vehicles	150,000	62,000	10,000	13,000

Source: Renner, Sweeny and Kubit, "Green Jobs: Working for People and the Environment," World Watch Report 177, 2008

<Figure 5> Sustainability-focused Companies Outperform Peers



Note: Indexed stock prices at ~ 3 months = September 8, 2008 and ~ 6 months = May 19, 2008 to current date, November 24, 2008. Percentage performance differential calculated by taking the percentage point difference of averaged sustainability companies' indexed performance to the market indexed performance over the market indexed performance.

building sector for reducing greenhouse gases by 2030 is in retrofitting and replacing equipment. Retrofitting provides many works for energy and building auditors, engineers, estimators, and project managers as well as jobs in the construction trades (pipe fitters, sheet metal workers, HVAC technicians, engineers, electricians, etc.).

The Clinton Climate Initiative's Energy Efficiency Building Retrofit Program, active in 16 of the world's largest cities, is providing \$5 billion for retrofitting municipal buildings and also offers incentives for private owners to retrofit existing buildings. The related C 40 Large Cities Climate Leadership Group provides support for energy-efficiency programs in 40 megacities worldwide (Global Green New Deal, 2008).

The European Trade Union Confederation reports that it will cost \$4,300 billion (3,145 billion) to retrofit the EU's residential building sector so as to reduce carbon dioxide emissions by 75 percent. Implementing such policies would lead to 1.4 million full time employment jobs by 2050, and 2.6 million by 2030 if the government carried out over a more compressed time frame.

Transportation and automobile industry is another

promising area. Hybrid vehicles are one of the paths to achieve higher fuel efficiency. In 2007, some 541,000 hybrids cars were produced worldwide, representing 0.7 percent of passenger vehicle production. Diesel engines, one of the most popular engines in many European countries, typically consume 30 percent less fuel than gasoline engines and emit 25 percent less CO₂. The consulting firm J.D. Power and Associates projects that global demand for diesel light vehicles will nearly double from 15 million in 2005 to 29 million in 2015.

The prospects of green jobs from various areas mentioned above so far are showing good market signs. A.T Kearney's 2009 analysis on eco-friendly companies' stock prices in 18 industries committed to corporate sustainability practices, so called 'Green Winners', are achieving above-average performance in the financial markets during this economic slowdown. Over three months, the performance differential across the 99 companies in the analysis worked out of 10 percent; over six months, the differential was 15 percent. This performance differential translates to an average \$650 million in market capitalization per company.⁶ The stakeholders reward the eco-friendly companies' stock

⁶ ATKEARNEY, "Green Winners", 2009

prices.

According to German consultants Roland Berger, the global market for environmental products and services currently runs at around \$1,370 billion or \$1,000 billion Euro. However, the market in 2020 could double to \$2,740 billion or Euro 2,200 billion. The World Bank projected that the size of carbon market will be US \$ 150 million, which is half the size of electric and electronics, and aviation market around 2015. The Silicon Valley in California in the U.S.A. is turning into the "Watt Valley". Kleiner Perkins, the venture capital firm that supported the establishment of Google, Netscape and Amazon.com, recently invested \$100 million to new companies working on lowering CO₂ emissions.

II. Korean Movement and Business Sector's Response

Green growth is a win-win strategy for the economy and the environment. The environment cannot be sustained without the economic stability, while the economy must take environmental concerns into account to sustain its competitiveness. Harmonious working of the environment and the economy will create a synergy effect.

1. Greening Key Industry and Promoting Green Industry

Green Growth is advancing Korea in every way and the extensive support will be provided for expansion of green industrial complex, including circulation of waste resources, high efficiency facilities, equipment and IT-based management system will be promoted with an aim to secure a larger global market share. As a result, green

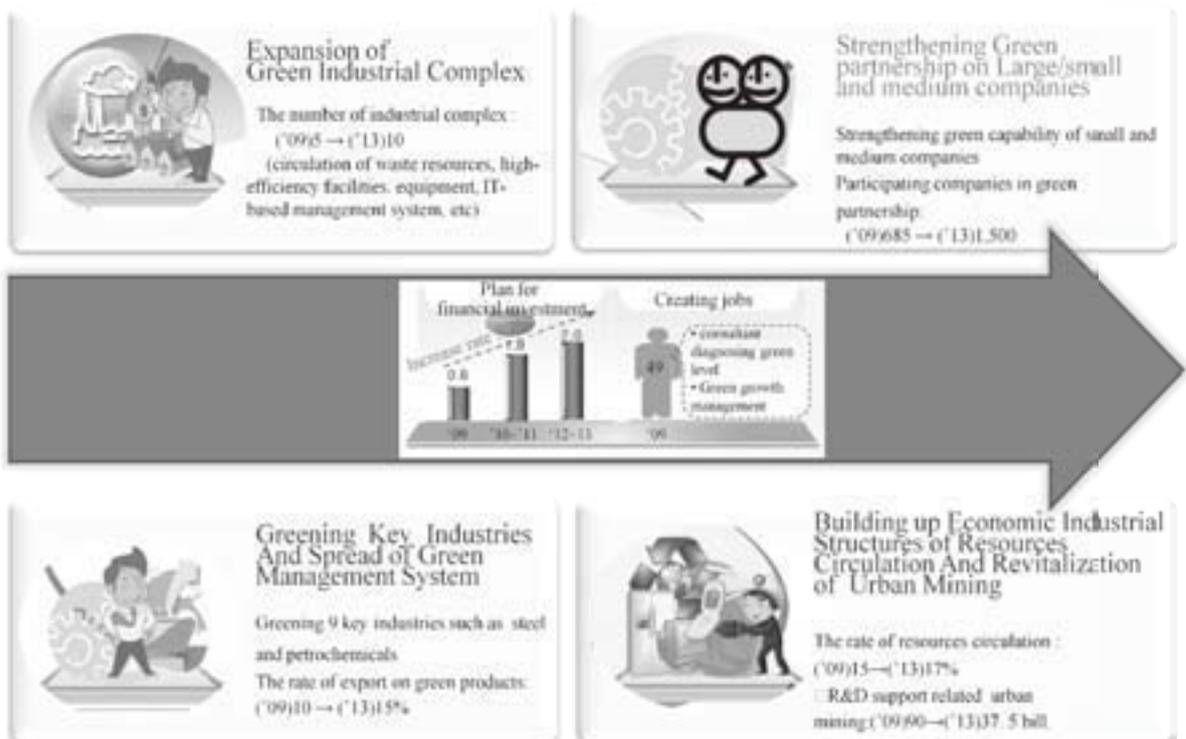
industries will be fostered and a new method of economic growth will be realized.

For enhanced corporate competitiveness and new exporter of green industries, knowledge-based industries will replace factor intensive industries as new growth engines in a past-manufacturing world. For example, 'urban mining' projects will be conducted by aiming at dramatically increasing recovery of resources from electronic waster and auto parts. Recycling of resources will be further promoted by green buildings.

<Table 6> Four keys to achieve green growth>

4 key principle	Actions
1. Greening Key Industry and Promoting Green Industry	<ul style="list-style-type: none"> · industrial restricting to cut energy use · energy conservation & efficiency enhancement · eco-efficiency improvement
2. Developing Green Technologies and Growth Engines	<ul style="list-style-type: none"> · developing & promoting clean and renewable energy sources · R&D investments in green technologies
3. Green plan, green transport	<ul style="list-style-type: none"> · low-carbon, eco-friendly infrastructure · implementing mechanisms for CO₂ mitigation
4. Green life innovation	<ul style="list-style-type: none"> · promoting purchase of green products among technologies · supporting overseas market access(e.g. ecology-tourism, culture campaign)

<Figure 6> . Greening Key Industry and Promoting Green Industry



Source: Committee of Green Growth, Implementation Plan for the Reduction of GHGs.2010.03.23

Also, Greening key industries and spread of green management system will be improved through process innovation in energy-intensive sectors (e.g. steel, petrochemical, petrochemical). Korea will seek to strategically develop and globalize a host of eco-friendly industries including environmental service, contaminated land recovery and water management. Also, Korea will play the role of green hub for the developing countries and East Asia countries. Support for strengthening green capability of small and medium companies will be provided through green partnership projects.

The national image and the Korea's brand power will be strengthened through the promotion of 'green Korea'. Transition to low-carbon economy will result in an advanced green Korea with a cleaner environment for the people.

2. Developing Green Technologies and Growth Engines

Green technology initiative for energy efficiency will be improved through process innovation in energy-intensive sectors, while high-efficiency energy industries such as LED, secondary batteries, hybrid cars, fuel cell, and improved model-light water reactor will be nurtured. Green technologies will be fostered to reduce greenhouse gas emissions and create new growth engines. This technology refers to a wide range of technologies aimed at reducing energy uses and minimizing contaminants including development as climate response, responses to climate change energy and resources use and the environment which are essential for sustainable growth. Also, Green technologies through convergence among IT, BT and NT will be fostered and exported. Korea's green technologies will be selected based on the 'green TCS system' to secure technologies best suited for its circumstances.

Korea's R&D investments in green tech will increase more than double by 2013 from the current level. These financial incentives will be provided for green companies while policy-based financial support for R&D investment

in green industries will be expanded and become a global leader in green technology.

3. Green Plan, Green Transport

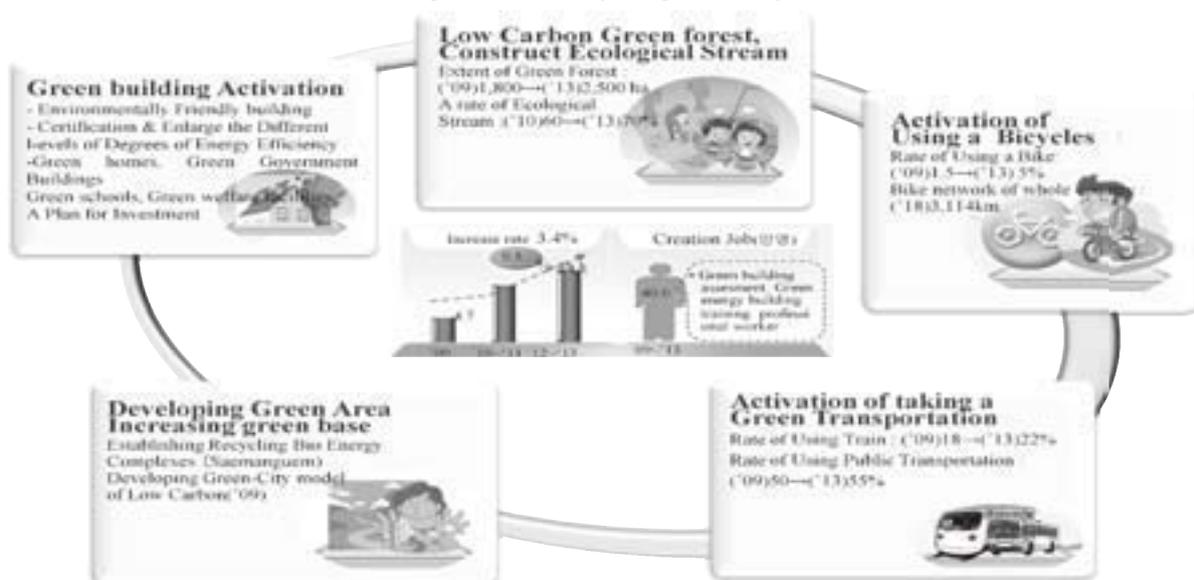
Improvement in social systems will lead to higher quality of life and environment. Competitiveness of cities will be enhanced by implementing through eco-friendly urban and land planning schemes incorporating energy, environment, transport and land use issues, improving air quality and expanding ecological spaces. For example, transport systems will be restructured to promote use of bicycles and transit system instead of passenger vehicles, by imposing traffic congestion fees and boosting investment in public transportation improvement. Green homes and buildings will be promoted through efforts such as issuing environmentally friendly building, certification and enlarging the different levels of degree of energy efficiency, green government buildings, green schools and green welfare facilities.

4. Green Life Innovation

From vitalizing green consumption patterns to overall life styles, green daily revolution will be set in place. For everyday practice of low-carbon, a public campaign for enhancing green values in the society (e.g. green life movement) will be launched. Low-carbon life styles will be introduced by green stores, green purchase and carbon-labeling-certificated system, which seeks to manage the demand side and disclose information of environmental footprint.

Green culture campaigns will be widely promoted by using the mass media and education. Korea will bring up green citizens, reflecting the concept of green growth in primary and launching various practical campaigns such as green start and green energy family. Ecological culture education and experience programs will be developed to help them understand and learn the concept. Also, the idea of greenness will be the centerpiece of ecology-tourism.

<Figure 7> . Green plan, green transport



Source: Ibid

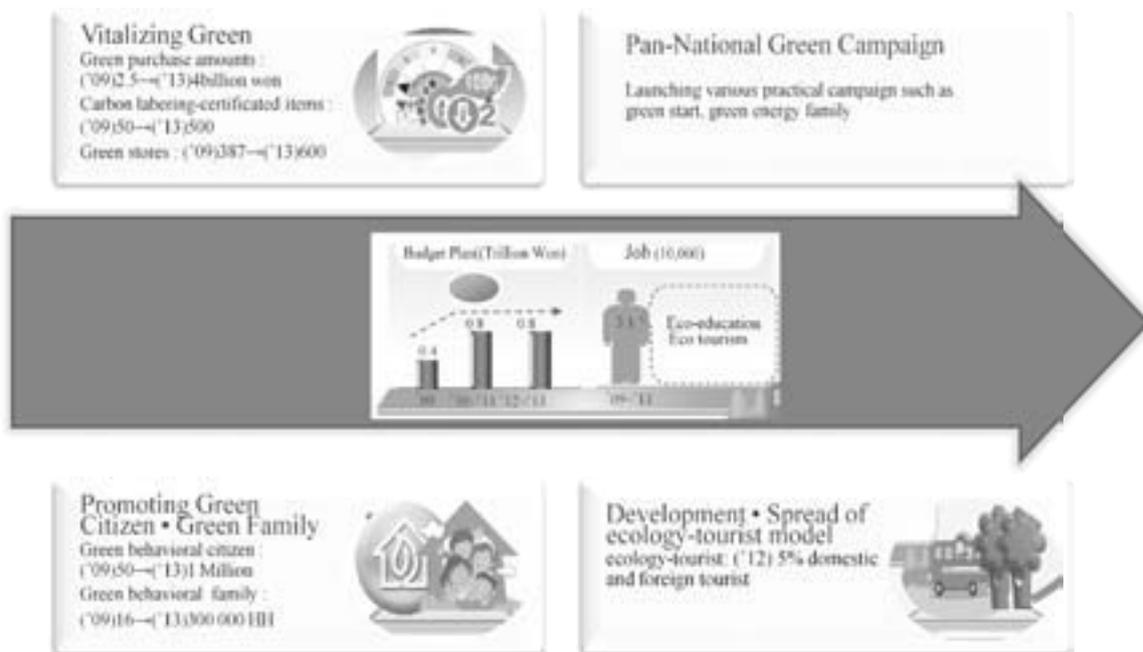
Green tour will bring high added values. Renewable energy clusters will be promoted as attractive tourist destinations.

Now, it is Korea's turn to move toward the green growth. From February, the government launched special team under Prime Minister and Committee for the Green Growth. We should keep in mind that the road to the green growth is not easy and cannot be finished within a short

time. The government announced some green growth strategy, but, it is more focused on renewable energy sector.

Of course, enhancement of renewable energy is important, but green building and high fuel efficient car that we discussed can create more green jobs. We must think about the different green strategy since we started a little late comparing to other developed countries. Therefore,

<Figure 8> Green life innovation



Source: ibid.

<Table 7> Economic Effect from Green Growth and R&D until 2012⁷

	Private Investment (100 million Won)		Employment (1000)		Domestic Market (100 million Won)		Export (100 million Won)	
	2008	09-12	2012	2030	2012	2030	2012	2030
Solar	547	21,774	30	350	31,000	218,000	31,000	508,000
Wind	258	4,850	49	542	8,000	175,000	18,000	550,000
Fuel cell	1,474	14,100	3	84	4,700	67,500	15,000	607,500
Electricity - IT	6,415	6,288	11	468	3,000	83,000	5,500	216,000
Store energy	12,730	22,315	1.2	63	1,000	49,000	1,300	114,000
LED	7,198	18,723	6	61	2,845	37,728	31,000	650,000
IGCC	913	4,475	6	56	2,000	62,000	70	60,450
CCS	130	6,049	2.5	180	1,500	100,000	3,500	250,000
Clean Fuel	-	20,006	3	69	1,000	119,000	1,000	50,000
Heat pump	539	1,935	5	22	16,800	23,500	8,000	20,000
Small CHP	246	303	2.7	48.3	520	56,853	195	38,539
Nuclear Power	169,530	204,807	55	110	60,000	60,000	30,000	60,000
Passive Building	109	110	1.6	23	5,000	10,000	2,500	20,000
Green car	4,854	9,000	15	100	195,00	312,000	500	90,000
Super Conduction	578	896	3	10	6,000	50,000	10,000	70,000
Total	205,584	335,631	194	2,186.3	162,865	1,423,581	157,565	3,304,489

Source: Korea Energy Resources & Technical Institute, "Green Energy Strategy Roadmap," 2009. 02.12

⁷ ATKEARNEY, "Green Winners", 2009

for example, it is worthwhile to know that number one automobile maker in the world Toyota Co. in Japan is trying to sell two person passengers in the future. Since consumer's demand for the high fuel efficient car is up soaring, the structure of population in terms of age over 65 is drastically increasing in developed countries, and younger generation's behavior for the marriage has also changed. They want to enjoy their life as being single and even if they get married, they prefer to have few offspring.

If Korea really want to show successful green growth to the world, Korean government must have long term plan by setting up effective and efficient implementation plan, and having innovative green policy, and more than any thing else, have people's willingness and self commitment by changing their life style or having sustainable consumption. In the following section, we will introduce Korean business sector's responses.

III. Korean Business Movement

1. POSCO

During the POSCO Family Green Growth Committee held in December 2009, POSCO finalized its low-carbon, green growth initiative and announced the result in February 2010. Over the past three years (2007-09), 2.18 tons of carbon dioxide (t-CO₂) were emitted on average per ton of crude steel (t-s) produced. The plan now calls for this CO₂ intensity figure to be lowered by 9 percent to 1.98 tons by 2020. To this end, the company will invest W1.5 trillion in research to reduce the amount of coal used as fuel in steel production, improving energy efficiency, and develop innovative technologies related to carbon dioxide.

The whole POSCO family is actively involved in the renewable energy business, such as fuel cells for power generation, wind power, turning waste to fuel, and synthetic natural gas (SNG). POSCO plans to expand the scope to include small and medium nuclear reactors, smart grids, turning CO₂ into a resource, and the general materials sector. In November 2009, POSCO Power has completed a 2.4MW-a class fuel cell generator facility in the Incheon LNG that combined power plant, which is currently operating 11 fuel cell generating systems, accounting for a total of 23MW. POSCO is producing 50MW of electricity at the fuel cell power plant which completed in September 2008 at Yeongilman industrial complex in Pohang. Fuel cell has generation efficiency about 47% in turning energy into electricity compared to 17% of solar photovoltaic power and 30% of thermal power. Also, POSCO constructed a solar photovoltaic power generation facilities with a 1-megawatt capacity on the roofs of steel plants. The company said it is built on the facilities to make use of the empty spaces (e.g. warehouse) and to help reduce greenhouse gases by selling the generated electricity. It is the nation's first commercial installation with a massive capacity over 1MW.

POSCO is implementing activities for the protection of the global environment and efficient use of resources. In 2009 POSCO has reused 98% of gaseous by-products in the hot blast furnace, heat treating furnace and coke furnace. Water used at each mill undergoes preliminary treatment at the wastewater treatment facility, after which over 98%

is reused. The remainder undergoes secondary treatment at the sewage treatment facility, which after water is partly recycled for cleaning roads within the mills and spraying water to mitigate dust, and finally discharged to the nearby sea. Slag, dust and sludge generated during steelmaking are recycled to be used as road aggregates, fertilizer and cement material. In 2009 a total of 18.61 million tons of by-products have been generated, of which 99% or 18.37 million tons have been reused. By product gas recovered from the iron and steel making processes provides most of the energy required for steelmaking processes and surplus byproduct gas is used for in house power generation. For example, 69 percent of the electricity consumed by the Head Office building, as well as the Pohang and Gwangyang Works in 2009 was supplied by the byproduct gas power plant, energy recovery facilities (CDQ and TRT), and LNG fired combined cycle plant. The remaining 31 percent was outsourced.

In addition to developing the new technology, POSCO founded the "POSCO Volunteers for Clean Ocean" for the preservation and purification of the marine ecosystem on November 25. The Volunteers for Clean Ocean was expanded from the scuba diving club comprised of about 100 members from employees and their families. They retrieve discarded fishing nets, tires and tents from the sea. The Volunteers for Clean Ocean plans to undertake sea surface and underwater cleaning volunteer work every month at Pohang and Gwangyang, and once every half-year, they will visit issue areas for large scale volunteer work.

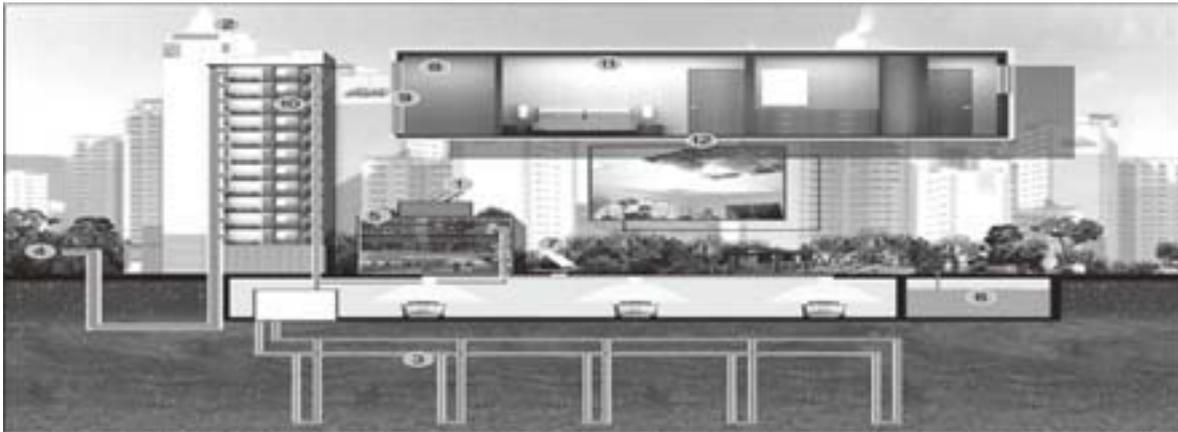
2. Daelim Construction Industry

Daelim construction industry is the first major construction company that began R&D Project of Energy Reduction in Apartment Complex. Wind power system sent the energy collected through direct current (DC) and current conversion device are used to power street lights, parking lot lights in the complex.

Daelim declared the pursuit of a 'green construction' environment management plan to reduce CO₂ gas emissions and construction waste at its project sites at home and abroad under the new project site management system. The company said it will adopt the new project management system at its Shindang "e-Convenient World" project site to reduce CO₂ gas emissions and energy used at its offices by assigning specialists to carry out the company's new project site management policy. The jobsite offices will use high-degree heat resistant materials for interiors and paints that cut off sunlight reflection to minimize the loss of heat created by sunlight. They will also install solar-heated water tanks that can hold 300 liters of water each on the rooftops for use in the offices and toilets. The company will also install wind and solar power generators that can produce 16 kwh of electricity to light offices and also install an air cleaning system using geothermal energy.

The company also plans to reduce CO₂ emissions further by using solar power for security lights at jobsites and reuse rainwater. The company also plans to assign environment watchmen to its project sites to take care of issues related to cutting down on wastes from apartment construction sites under its "100 percent waste separation

<Figure 9> Daelim eco-3L house model



Notice : ① solar cell power ② wind power system ③ geothermal power system ④ underground duct system ⑤ green roof ⑥ rainwater tank ⑦ natural light ⑧ superior outer insulation ⑨ high-efficiency windows ⑩ ventilation system ⑪ LED light ⑫ vibration reduction floor

Daelim has 'Green Habit' campaign in progress that includes energy save action guideline such as 'Do not use disposable product', 'unplug a computer when you go home' and so on. The campaign is estimated by me or by co-worker.

and collection operation plan" to make all of its project sites environmentally friendly.

The company plans to complete the development of "Eco-3L House" which means the minimum energy for cooling and heating. The renowned builder declared a roadmap for the development of environmentally friendly and low-carbon technology at its Yongin Technology Research Institute. The declaration included the introduction of 3-liter house idea for the first time in the country which specially designed apartment that supplies heating and air conditioning with 3L fuel per square meter for year. This application idea in a residential house was first used in December, 2005. In September, 2006, the company applied the 3-liter house idea to a model house in Daejeon.

The company also experimented with solar and earth heat and other newly recycled energy. In April, 2008, Daelim experimented with e-convenient living system with the Ulsan apartments, built with such materials as new heat-resistant materials, along with highly-functional condensing boilers and triple-window glasses. Daelim will completely finish the development of 'eco-3L house' and reduce annual fuel use by 82%.

3. LG Chemical Co.

LG chem developed mid-long term plans (1st phase for 2000-2005, 2nd phase for 2006-2010). First phase plan resulted in overall energy reduction of KRW 75.4 billion, overshooting target of KRW 63.7 billion by KRW 11.7 billion. Under second-phase plan, LG Chem have so far cut KRW 177.4 billion in energy cost by 2008. The company select energy innovation projects every year and follow up with monitoring activities, and utilize energy sharing meetings to share technological advancements and performances across their sites.

Also, the 'Climate TFT' has been in operation since December 2004 which was placed under the Environment & Safety Team in the head office. The Climate TFT comprises four personnel from the HQ and representatives from 10 business sites. The site representatives are charged with

collecting, compiling, reporting information and data on the GHG emission sources and emission activities in their plants along with developing greenhouse gas abatement projects, while the head office take responsibilities for global trend analysis, government interface, data collection, training and mid-to long-term strategy development.

The global emissions trading market is growing at a rapid pace every year. Acknowledging a need to take internal measures to prepare LG Chem for the emerging low-carbon era, LG chem signed a memorandum of understanding (MOU) with the Ministry of Knowledge Economy in February 2006 to set up an internal emissions trading system, and have since run an in-house emissions trading system over the last three years till 2009. The system is intended to help companies adapt themselves to local and global carbon trading markets and learn in advance the necessary skills for trading in the future.

In 2009, LG chemical Co. took a credit & incentive approach on trading their carbon credits internally across their sites, using the credits obtained from abatement projects. As a result, a total 210 abatement projects were registered, credits issued and traded after implementation levels were assessed and managed. From 2010 onwards, the company is planning to set up a GHG inventory for their Chinese sites and seek third-party verification and certification.

This November LG Electronics promised to support operation fund equivalent to approximately 8 billion won in total for 3 years to cultivate preliminary Social enterprise in Green field by inviting and selecting companies necessary for financial aid every year. In addition, in order to improve management capacity for Social enterpriser, LG Electronics will proceed 'education program for Social enterprise's enterpriser' modified from Executive education course in LG Electronics two times every year and support 'consulting for improvement of productivity' for over 6 months at least by selecting two Social enterprise every year under cooperation with labor union of LG Electronics. Besides, LG Electronics is scheduled to provide a

comprehensive support for cultivating Social enterprises through active cultivation of sales routes etc. inducing PR and supply agreement for affiliates of LG (partner firms).

IV. Conclusion

The paradigm of economic growth in the past should be changed from manufacturing based economic growth to the 'green growth'. Developed countries such as Japan, Germany, UK, and the Netherland are moving toward to the green industry and have started to green racing already. The announcement of vision for green growth in Korea was very timely and crucial for Korean economy. Government need to establish a firm framework for greening all aspects of the society, with concrete achievement targets and mandates implementation, business economic incentives, and reform environmental tax and subsidy policies.⁸ This report indicated Korean Movement and Business Sector's Response and Korean Business Movement.

Green growth is a win-win strategy for the economy and the environment. The environment cannot be sustained without the economic stability, while the economy must take environmental concerns into account to sustain its competitiveness. Also, Greening key industries and spread of green management system will be improved through process innovation in energy-intensive sectors. Korea will seek to strategically develop and globalize a host of eco-friendly industries including environmental service, contaminated land recovery and water management.

Korea's R&D investments in green tech will increase more than double by 2013 from the current level. These financial incentives will be provided for green companies while policy-based financial support for R&D investment in green industries will be expanded and become a global leader in green technology. If Korea really want to show successful green growth to the world, Korean government must have long term plan by setting up effective and efficient implementation plan, and having innovative green policy, and more than any thing else, have people's willingness and self commitment by changing their life style

There are some companies which has plans to activated green growth business in South Korea. The whole POSCO family is actively involved in the renewable energy business, such as fuel cells for power generation, wind power, turning waste to fuel, and synthetic natural gas (SNG). POSCO plans to expand the scope to include small and medium nuclear reactors, smart grids, turning CO₂ into

a resource, and the general materials sector. Daerim has new plan to reduce CO₂ emission by using solar energy planned system and hire energy management who develop new program to reduce CO₂ emission in their office. LG try to maximize energy savings and reduction of greenhouse gases by having action plans and policies. They have internal emission trading system over the past 4 years.

[Original English version as written by author]

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⁸ 'Green Jobs, 2008 Working for People and the Environment' Michael Renner, Sean Sweeney and Jill Kubi, 2008