ENERGY R&D INVESTMENT DIRECTION FOR NATIONAL GREEN GROWTH ECONOMY IN KOREA

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ABSTRACT

Climate change due to global warming is a global issue and a top priority in the international community. Recently, we try to find new growth engine to overcome the continuous decline of Korea's economic growth rate and world's top Korean-exporting items. In order to respond proactively to the global issue of climate change and find national growth engine, the Korean government continues to pursue strenghthening the national economy by green growth. In this paper, we introduce the change of energy technology policy which is the core of green growth and new growth engine, and the investment direction of national R&D. In 2014, approximately 1.6 billion USD has been invested in energy-related R&D in the order of renewable energy (36.8%), nuclear energy (26.3%), and electric power(14.1%). Following the shift of energy policy paradigm from supply-side to demand-side management, the government plans to focused support on innovative technology such as ICT-based distributed power & energy-demand management, to secure tech-competitiveness of future energy. Green growth and creative economy, which is the national vision of the current government in Korea, both aims for national economic growth. Therefore, in order to continue green growth through creative economy and lead global green growth, currently stagnant energy R&D need to be increased continuously. Especially, to improve investment efficiency with limited resources, strategic selection and concentration is required in greenhouse gas reduction and industrialization technologies

Keywords: *energy, green economy, green growth, R&D*

1. INTRODUCTION

Climate change due to global warming is worsening as time goes by. And it is a global issue and a top priority. On December 2015, COP21(United Nations Climate Change Conference) was held in Paris, France. The conference negotiated the Paris Agreement, a global agreement on the reduction of climate change (*shutter, 2015*). Due to that, differing liabilities on greenhouse gas reduction is charged to corresponding all countries. On April 2016, 174 countries signed the agreement in New York., and began adopting it within their own legal systems through ratification, acceptance, approval, or accession (*Falk, 2016*).

Korea entered into a state of low growth. The economic growth rate has been gradually dropping since the '90s. And the world's top Korean-exporting items also have been gradually decreasing (No. of top rank items: (′09) 73 → (′10) 71→ …→ (′14) 64) (*UN Comtrade Database, 2016*). So increasing attention to the reduction of growth potential and environmental problems leads us to pursue new economic development model (Green Growth) for the

coexistence of the environment and economy. Therefore, in order to continue green growth through creative economy and lead global green growth, currently stagnant energy R&D need to be increased continuously. In this paper, we analysized the investment direction & priorities, and also suggest the desiable strategic direction of goverment R&D in Korea.

2. CURRENT STATUS OF GREEN GROWTH IN KOREA

The concept of Green Growth is harmonious and balanced growth between the economy and environment. Considering environmental conservation and economic growth simultaneously, development of green technology will be the core of national competitiveness in Korea (fig. 1).

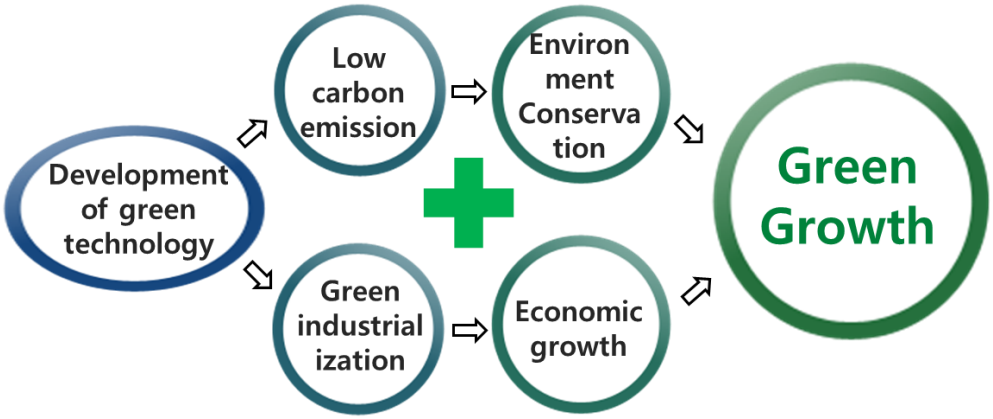

Figure 1: The Concept of Green Growth (Green Growth: Concept, 2009, modified)

The Korean government prepared and attracted various organizations to support the government's strong commitment for Green growth (fig. 2) (*Brief history, 2016)*. In February 2009, the Presidential Committee on Green Growth was launched to coordinate and evaluate the Green Growth policies. In June 2010, the Global Green growth Institute, GGGI was launched to support a global spread of the Green Growth Model. In March 2012, the Green Technology Center, GTC was launched to support green technology policy planning. In December 2013, Headquarters of the GCF (Green Climate Fund Operation) was opened in Songdo, Korea. Its role is for green climate fund operation. And KISTEP support the national R&D budget coordination including green technology, such as energy resources, environment, and so on.

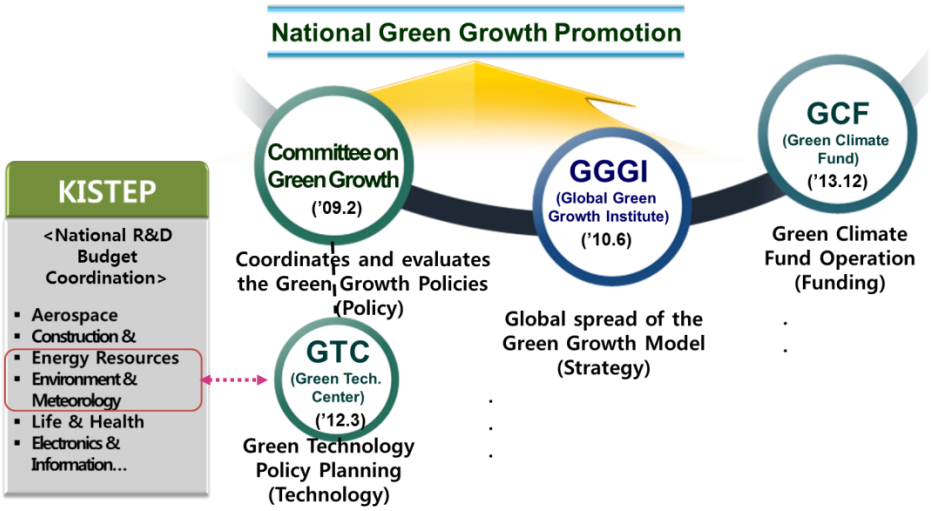

Figure 2: The history of National Green Growth Promotion

The progress of Green Growth is the same as follows *(Brief history, 2016)*. The starting point of Green Growth policy in Korea is the declaration of Korea′s Green Growth Vision in August 2008. In January 2009, the Presidential Committee on Green Growth was launched. In July 2009, the National Green Growth Strategy and Five-year Plan were set. In January 2010, the Comprehensive Framework Act and enforcement Decree were established to drive Green Growth efficiently and systematically. The brief history of National Green Growth Policy in Korea is shown in Table 1.

Key milestone	Date
Declaration of Korea's Green Growth Vision	Aug. 2008
The Presidential Committee on Green Growth which supervises and coordinates Green Growth policies was launched	Jan. 2009
Establishment of 1st 5 year plan for Green Growth	July. 2009
The Comprehensive Framework Act and Enforcement Decree were established to drive Green Growth efficiently and systematically	Jan. 2010
Global Green Growth Institute (GGGI) was launched	Jun. 2010
Korea's Greenhouse Gas Mitigation Target was announced ※ 30% Reduction in 2020 against BAU	Jul. 2011
Green Technology Center(GTC) was launched	Mar. 2013
Opening the GCF's headquarters in Songdo	Dec. 2013
Establishment of the 2nd 5 year plan for Green Growth	Jun. 2014
National Emission Allocation Program was passed	Sep. 2014
Korea's Greenhouse Gas Mitigation Target was updated and re-announced ※ 37% Reduction in 2030 against BAU(851 Mton)	Jun. 2015
Reformation Plan of Climate Change Response System was prepared for the effective implementation of the Paris Agreement	Feb. 2016

Table 1: brief history of National Green Growth Policy in Korea (Brief history, 2016)

Major accomplishments of the 1st green growth 5 year plan in Korea are the same as follows(*2nd 5 year plan for Green Growth, 2014, p. 7-8*). First, Green Growth was adopted as a national development agenda. Declaration of 'Low-Carbon Green Growth' where climate change is upgraded from an environmental agenda to the Korea's new national development vision(Aug. 2008). Second, an institutional foundation was established for the green growth promotion system on a national level such as formation of the Presidential Committee on Green Growth(′09), enactment of the Enforcement Decree and the Framework Act on Low Carbon Green Growth(′10). Third, Greenhouse Gas Mitigation Target, 30% Reduction in 2020 against BAU(Jul. 2011, Cabinet Meeting), and its System was proactively setup. Fourth, R&D investment has been increased to strenghthening the future growth engine through green technology development. Green technology R&D investment(proportion out of total government R&D investment) is increased from 1.3 billion USD(13.3%) to 2.5 billon USD(17.1%) from 2008 to 2012. Fifth, government attracted & established international organizations, such as GCF and GGGI, to upgrade Green Growth as a global agenda.
The fig.3 shows the comparison the first and second green growth 5 year plan (*The 2nd 5 year plan for Green Growth, 2014, p. 27*). The 1st plan focused on the establishment of an institutional foundation. On the contrary, the 2nd plan focused on the substantial achievement to settle the green growth system in Korea.

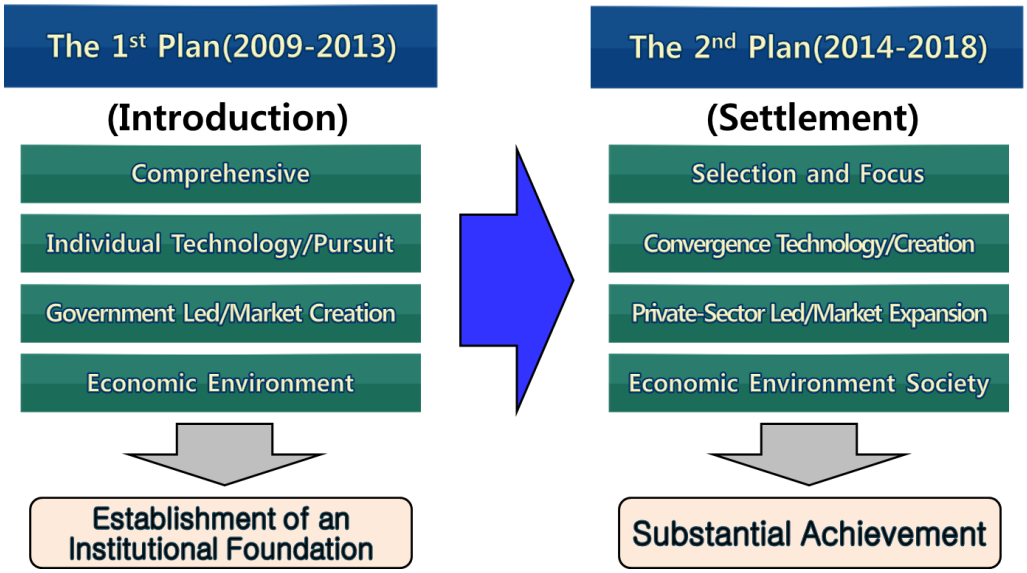

Figure 3: comparison the first and second green growth 5 year plan

The fig.4 shows the detail of 2nd Green Growth 5 Year Plan (*2nd 5 year plan for Green Growth, 2014, p. 28*). It contains 5 policy directions and 20 priorities. The 5 policy directions include effective reduction of greenhouse gas, establishing a sustainable energy system, building an ecosystem of green creative industries, implementing a sustainable green community, and reinforcing global green cooperation. To pursue these 5 policy directions effectively, detailed priorities were set as follows.

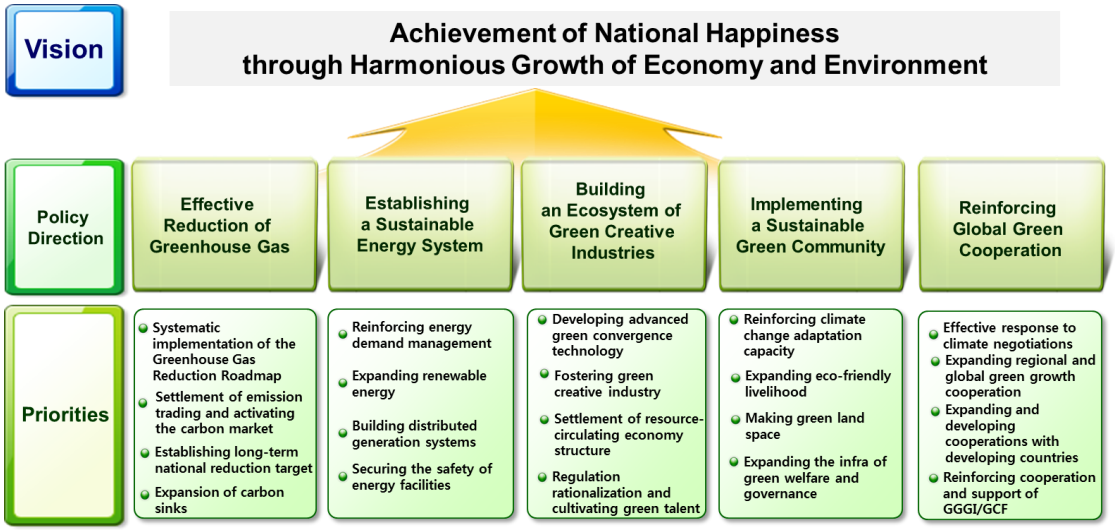

Figure 4: policy directions and priorities 2nd Green Growth 5 Year Plan

The green technology area was classified into 5 types (Fig. 5) (*Byun, Sun-Chun, 2009, p. 3*). Most green technologies belong to energy and environment technology area. Especially energy-related technologies are dominant, such as prediction and adaption, energy source, high efficiency technology. So, discussion is focused on the energy-related technology.

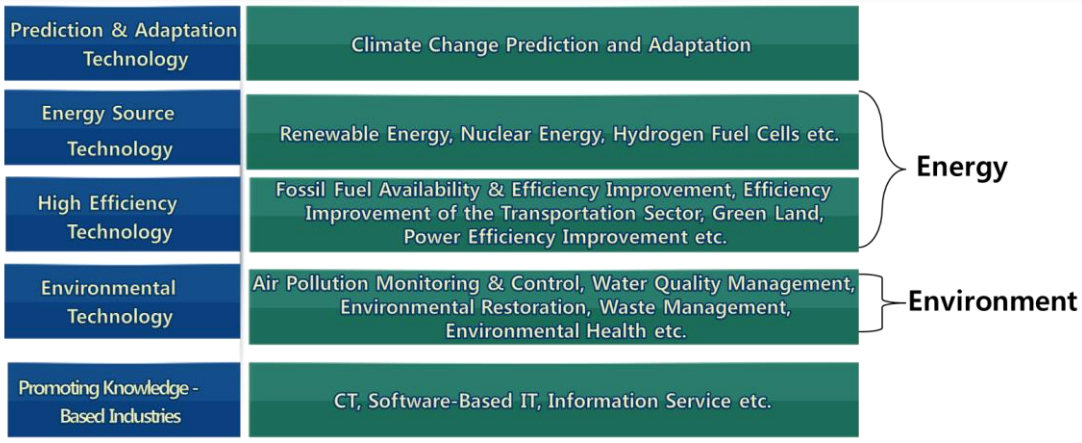

Figure 5: Green Technology Area

3. ENERGY R&D INVESTMENT DIRECTION

The key circumstantial change is increased demand of energy innovation technology development for the future, such as demand-side management and distributed power generation (Fig. 6) (*2nd 5 year plan for Green Growth, 2014, p. 61-85, modified*).

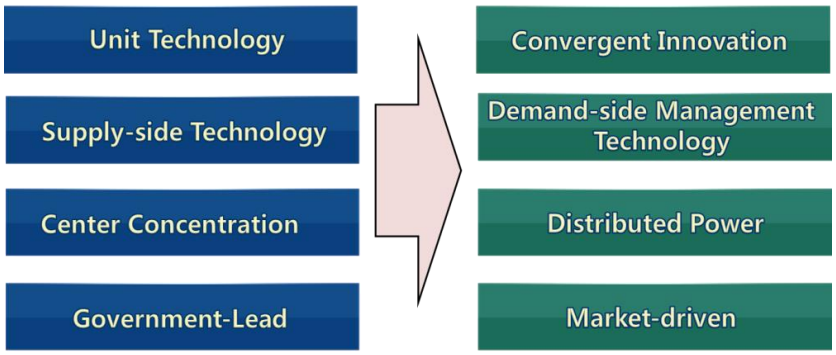

Figure 6: Energy-related Circumstantial Change

3.1. Investment Status

Government R&D investment in the field of energy and resources technology increased continuously from 1.44 billion dollars to 1.61 billion dollars from 2010 to 2014(*Survey of Research and Development Report, 2011-2015, Database*). Fig. 7 shows the government R&D investment for each technology sector. Investment is mostly in the power sector such as renewable energy and nuclear power.

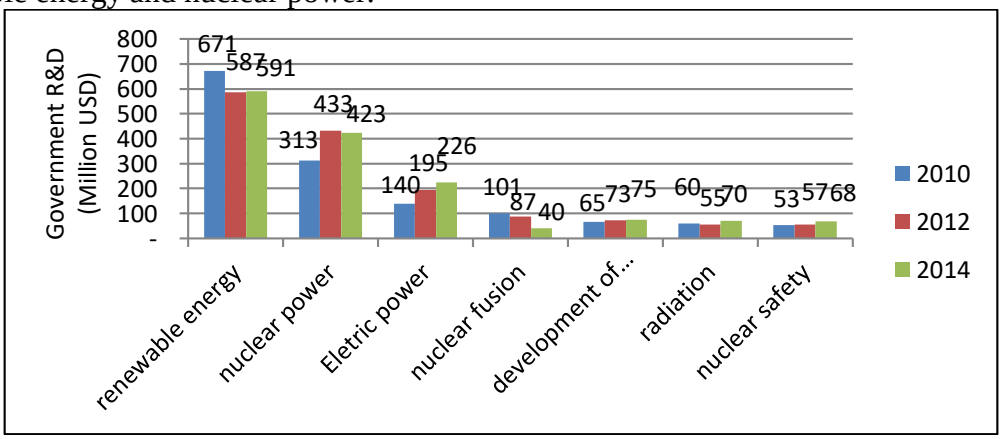

Figure 7: Government R&D investment in the field of energy/resources

3.2. Outcome and Evaluation of R&D Investment

The main outcome is that contribution in reducing the technology gap with developed countries and creating new growth engine through continuous increase of government R&D investment. It is reported that technology gap between Korea and the leading country was continuously decreased from 6.6yrs(′08) to 4.7yrs(′12) (*Choi, 2013, p. ii*).

Some improvement direction is same as follows. Some key technologies of the energy industry have been secured, but commercialization & new tech for the safety of nuclear power plants (fully passive safety design etc.) is still needed. For example, 3MW offshore wind energy system development & acquisition of international certification, localization of dependent nuclear technologies. However, efforts to change to future energy systems are still required. Especially, practical application in energy networks and distribution is essential for the transition to cutting-edge energy technologies such as smart grid, ESS, CCS etc.

3.3. Investment Direction in FY 2017

Government R&D investment direction is focusing on following three key areas. (*Government R&D Investment Direction and Criteria FY 2017, 2016*, p. 54-56).

The renewable energy sector will invest in core technologies that can overcome performance limitations of existing technologies and be linked to commercialization for the improvement of climate change response and new market opportunities in energy sector. Above all, the investment of next-generation technologies focusing on key technology of climate change response for new market will be strategically and efficiently strengthened, especially for a major clean energy sector mainly focusing on renewable energy. In addition, the sector of hydrogen energy and marine energy will continue to invest in infrastructure to promote the dissemination and commercialization.

Greenhouse gas sector will invest integrated demonstration technology development of CO_2 capture and storage in order to respond to competition of market preemption, and a marketable sector will be induced for expansion of private sector. In particular, the investment will be strengthened with CO_2 capture technology focusing on a low cost and high efficiency technology and CO_2 storage technologies focusing on large-scale demonstration.
Nuclear power sector is strengthening investment in decommissioning of Nuclear Power Plant (NPP) and future nuclear plant technologies for the sustainable usage of nuclear power, and commercial nuclear power plant focusing on new type NPP mainly for export will be efficiently invested. Specifically, the investment of the nuclear decommissioning wastes process and spent fuel transport and storage technologies is strengthened, and the investment of Sodium-cooled Fast Reactor and pyro-processing technologies for the timely demonstration continues. In addition, commercial NPP construction and performance improvement technologies will enhance investment efficiency based on support of SMEs sector and demonstration of the next generation NPP including small and medium-sized reactors, new nuclear power plants.

4. CONSLUSION

Since the announcement of the Green Growth as National Vision in 2008, domestic and international organizations were established, and national plans for green growth were developed and implemented to secure balanced and harmonious growth in environment and economy. The continuous increase in investment in energy R&D is needed to lead national green growth and contribute to a creative economy, which is the national vision of the current government in Korea. Especially, to improve investment efficiency with limited resources, strategic selection and concentration is required in greenhouse gas reduction and industrialization technologies. Moreover, investment should be focused on energy innovation

technology for the future and environmental quality improvement technology. And, discovering and enhancing the green technology cooperation agenda, such as Yellow dust, fine dust, northeast-asian climate prediction, nuclear plant accidents etc., is required to secure our environmental communities in Korea and other countries.

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