Issues in Climate Change and Energy Security in Northeast Asia

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1. Introduction

Traditionally, energy security concerns are related with the quantity risk, such as geopolitical or strategic energy supply disruptions. Some countermeasures are proposed to diversify import sources and fuels and to increase storage capacity. Recent experience of crude oil price hikes in the international oil markets and increasing concerns of a slowdown of the world economy broadened energy security concepts to include economic security. Economic security concerns price risk as well as quantity risk. Recent experiences of fast-rising oil prices and increased volatility in the world oil markets can be considered as examples of the lowered economic security in energy. Optimal storage and participation in overseas resource developments to share the profits of energy exporting countries has been suggested as an effective measure to improve economic security in energy.

With the mounting evidences of global warming and its impacts on humans and the ecosystem, climate change has become one of the new and increasingly important issues to be handled globally. The IPCC 4th report has clearly identified human economic activities as the main cause of global climate change. CO2 emissions from fossil fuels combustion constitute 80% of the GHGs emitted and accumulated in the atmosphere, causing unprecedented global warming in the past few thousand years. To slow down or even reverse the global warming trends, the use of fossil fuels needs to be drastically reduced or switched to the use of non-fossil fuels in the immediate future. Therefore, the climate change issue is directly linked with energy issues, and climate change policies affect individual country's global energy security, directly or indirectly.

IEA (2004) addressed the interaction of energy security and climate change policies. IEA (2004) identified the issues as follows;

Since the emergence of climate change as a new and increasingly important element

in energy policy, more attention has been given to the need to adopt integrated approaches to energy policy making, with climate change and energy security appearing as important drivers for future energy policy. This is reflected in the energy policy strategies of most, if not all, IEA member countries and their insistence on finding ways to balance the so-called '3 Es': energy security, economic efficiency, and environmental acceptability.

Japan is an Annex I country in the Kyoto Protocol, which implies that it has to reduce the average emissions of greenhouse gases in the first commitment period, 2008~2012, to 94% of those in 1990. On the other hand, China and Korea, non-Annex I countries, have experienced rapid growth of energy consumptions since 1990 due to high economic growth. Energy consumptions of these countries are expected to continue for the next 20 years. China will continue to be the largest CO2 emitting country in the next few decades if no dramatic measures to reverse the trend of CO2 emissions in the near future are taken.

The economies of the countries in Northeast Asia are more vulnerable to the oil price hikes because most of the energy resources are imported abroad, as manifested in the recent high oil price shock. Japan, China and Korea are the top oil importers in the world, and most of the oil is imported from the Middle East. Diversification of the importing sources and development of domestic energy sources in addition to diversification of the energy mix are other tasks to be completed for improvement of energy security, as mentioned above.

Countries in Northeast Asia have adopted integrated approaches as suggested by the IEA to address climate change and energy security. For example, the Korean government announced the 1st National Basic Energy Plan in 2008. It has made *Energy Security, Energy Efficiency and Environmental Protection* the three principal bases of energy policy for the next 20 years. Major policies and measures in the 1st National Basic Energy Plan include energy efficiency improvement, an increase in the share of renewable energy, and lowering the share of petroleum in primary energy consumption.

These policies and measures are generally accepted to improve the energy security of Korea and to reduce the emission of GHGs from fossil fuel use. However, there are some issues requiring more careful examination, which will be done in the following sections. These are the utilization of the domestically reserved energy sources, technology related issues, and the economic advantage of new energy sources, among others. These issues are examined in turn in this paper.

2. Energy and CO2 emissions in Northeast Asia

With rapid economic growth, the use of fossil fuels and the resulting CO2 emissions from China and Korea have grown very rapidly since 1990. According to the IEA (2008) report, China became the largest emitter from energy-related CO2 in 2007. As of 2006, China's emissions share in global emissions is about 20%. CO2 emissions have more than doubled between 1990 and 2006. The increases in CO2 emissions have been especially large in the last four years. About 50% of CO2 was emitted in electricity and heat generation in 2006. Coal is the major fuel in electricity generation. About 98% of CO2 emissions in power generation is from coal combustion. The demands for electricity and for heat are expected to grow continuously in the next decade.

In addition to the heavy use of coal for electricity and heat generation, it is very clear that CO2 emission will continue to grow in the future even though the growth rate has slowed. The World Energy Outlook has projected that Chinese CO2 emissions will grow at the lowered rate of 3.1% per annum up to 2030 in the Reference Scenario. Even with this slower growth, emissions in 2030 will be twice those in 2006.[1]

CO2 emissions from Korea also have more than doubled between 1990 and 2006. CO2 emissions in 2006 were 476.1 million tons of CO2, up from 229.3 million tons of CO2 in 1990. CO2 emissions from electricity and heat generation amounted to 175.70, which was about 37% of energy-related CO2 emissions in 2006. About 75% of CO2 emissions in 2006 were from the use of coal in electricity and heat generation. Heavy use of coal in electricity generation and large growth of demand for electricity and heat are responsible for the two-fold increase of CO2 emissions from fossil fuel combustion since 1990. According to the 1st National Basic Energy Plan, energy consumption in 2030 will be about 553 million toe (ton of oil equivalent) which will be more than twice that of 2007 if there is no improvement of energy efficiency after 2007.

China, Japan, and Korea heavily depend on oil imports from the Middle East. As of 2003 Korea imported about 80% of its oil from the Middle East. About 87% of the oil in Japan was imported from the Middle East, too. The heavy dependence of oil imports on the Middle East keeps raising the concerns of energy security for the countries in Northeast Asia resulting from the political conflicts in the Middle East and high transportation risks in the

[1] IEA(2008),

Malacca Strait. In addition to the possibility of supply interruption, heavy dependence on the Middle East in their import of oil is responsible for the "Asian premium." The countries in Northeast Asia have paid about $1/bbl more for imported oil than the buyers from other regions.

Energy Security issues due to the heavy dependence on oil in energy consumption and the heavy reliance of oil imports of nations in Northeast Asia on the Middle East are the motives for the diversification of energy import sources to Eastern Siberia and the Far East of Russia. Eastern Siberia and the Far East of Russia are believed to be very rich in oil and gas reserves, yet need to be explored and developed. With suitable arrangements among the major oil and gas consuming countries and the potential suppliers in the region, the security in energy supply could be enhanced in the region. This will successfully diversify the import sources and reduce the percentage of fossil fuels in the energy mix of consuming nations.

Russia also benefits from regional energy cooperation, through which a new export market is created. Exploration, development and transportation of energy resources in the less developed areas in Eastern Siberia and Far Eastern Russia can contribute to regional economic development. This win-win outcome from energy cooperation is clear and well presented in published reports. The Korean government proposed to establish an intergovernmental framework to discuss energy cooperation in Northeast Asia to improve energy security in the region in June 2001.

The proposed intergovernmental meeting is a multilateral cooperation body in Northeast Asia, where the governments in the region play the leading role in promotion of cooperation in energy related issues. Since 2001, several meetings were held, including one informal Task Force on Energy meeting in Bangkok in September 2004, and the first Senior Officers' Meeting in Task Force on Energy meeting in Khabarovsk in December 2004, even though we do not have a concrete outcome yet.

On the other hand, China has a large amount of reserved coal in its territory and the share of coal in the primary energy consumption has been more than 60% as mentioned before. Coal, as well as nuclear energy, is the major energy source in power generation in Korea also. This implies that coal use is an effective measure to improve energy security in these countries. However coal is a major source of CO2 emissions, which needs to be limited in use to lower CO2 emission increase as part of the global CO2 mitigation efforts.

Improvement in energy security and the mitigation of CO2 emissions could be

achieved if cleaner technology for coal use is introduced at low cost, and the substitution of coal with renewable energy sources is accelerated. Of course, the improvement of efficiency in energy use and a decrease in energy demand are the other effective measures on the demand side. In the next section, the energy policy of Korea will be explored, focusing on energy security and CO2 emission mitigation.

3. National Energy Plan for Energy Security and Climate Change

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Korean President Lee Myung-Bak in 2008 announced “Low Carbon Green Growth” as the national vision for the next 60 years. It aims to promote R&D and investments in green technology, and to develop green industries as the new engine of economic growth. Korea is expected to lower the GHGs emissions and to increase economic growth in the near future. Several national plans and declarations have been developed since then.

The 1st National Energy Plan was announced in September 2009. The basis of the national energy plan is the balancing of the 3E’s: energy security, energy efficiency and environmental protection, as in figure 1.

[Figure 1] Basis of 1st National Energy Plan

Improvement of energy efficiency and increasing the share of renewable energy sources and nuclear power will lead to improved energy security and lowering of CO2 emissions. Key policy targets from now to 2030 are set as follows:

- Energy efficiency improvement: 46% increase in energy consumption per unit of GDP
- Energy independency: Increase in the share of energy developed in foreign countries from 4.1% (2005) to 40% (2030).
- Increase the share of renewable energy from 2.1% (2005) to 11% (2030)
- Decrease the share of oil from 43.6% (2005) to 33% (2030)
- Develop energy technology to 90% level of the most advanced countries by 2030

Energy saving or improving efficiency in energy use is the best way to improve energy security, because it decreases import demand for energy itself and lowers greenhouse gas emissions because it reduces the use of fossil fuels. With strong and effective policies and measures, the Korean government plans to lower the increase in energy consumption from 553.2 million toe to 300.4 million toe in 2030. The annual improvement of energy efficiency will be 2.6% if energy efficiency is improved as planned. This improvement is not easy to achieve if we consider that improvement has been 1.3% per year for the last 10 years.

To meet the energy efficiency targets, sectoral allocations of the needed energy efficiency improvements have been set. The energy demand in the industrial sector will be lowered by 17 million toe from that of Business-as-usual. The policies and measures are the introduction of negotiated agreement, tax credits, and preferential interest rates for investments in improving the energy efficiency of industrial sectors, among others. Negotiated agreement is a more stringent energy efficiency improvement measure than voluntary agreement, because the target is set through negotiations between the government and the private sectors, and incentives will be given after the efficiency improvement or emission reduction is verified.

Energy consumption in the transportation sector will be reduced in the amount of 7 million toe through fuel efficiency improvement, promotion of hybrid cars and the use of public transportation, as well as the expansion of the BRT (bus rapid transit) system. Without

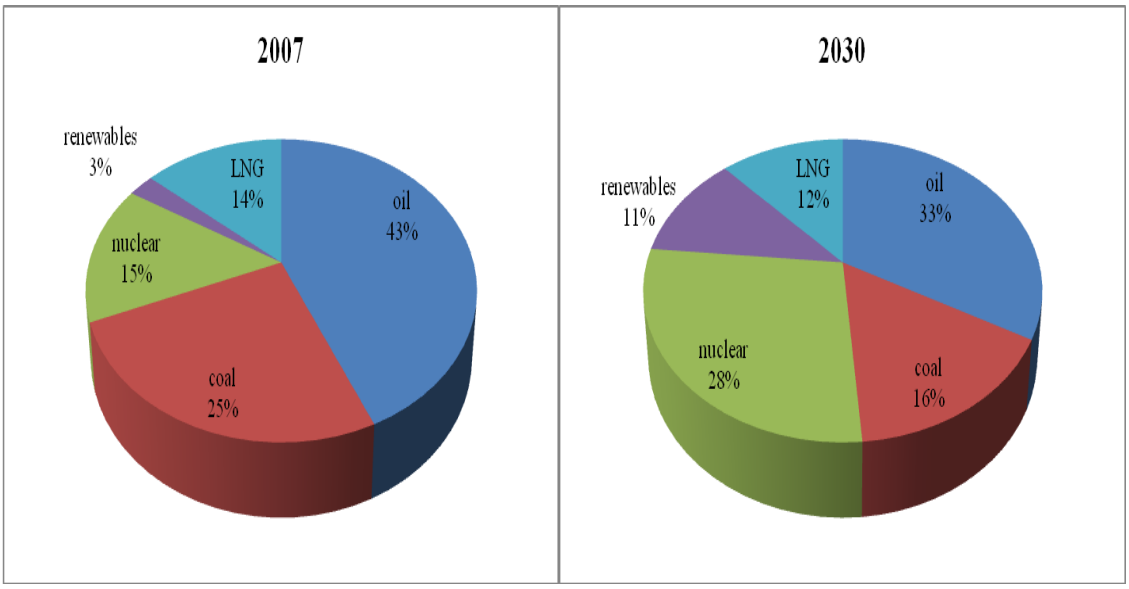
these measures, the growth of energy consumption per annum would be 1.0%.

High growth, 2.1% per annum, of energy consumption is expected in household and commercial sectors due to the increase in household income and the growth of the service industries for the next 20 years. Currently, the share of energy consumption in the household sector and in the commercial sector is about 20%. Energy consumption will be lowered by 12 million toe. The promotion of energy efficient electrical equipment and home appliances will be implemented, in addition to updated and more stringent energy efficiency standards. For example, the Korean government announced the ban of the use of incandescent bulbs from 2013 and 30% of light bulbs will be replaced with LED bulbs. Higher standards in the insulation of buildings are to be set.

Price distortion or cross subsidy is also responsible for the energy intensive industrial structure. Energy prices will be determined based on the production and supply cost and the cross subsidy among different energy uses will be removed. In addition to the introduction of competition in the energy sector, price controls such as price ceilings will be removed gradually.

In addition to the policies and measures to lower the increase in energy consumption, the share of the renewables and nuclear energy will be increased to 11.5% and 27.8% of the total primary energy consumption in 2030, respectively, as in Figure 2. The shares of the renewables and nuclear energy are 2.5% and 15% in 2007.

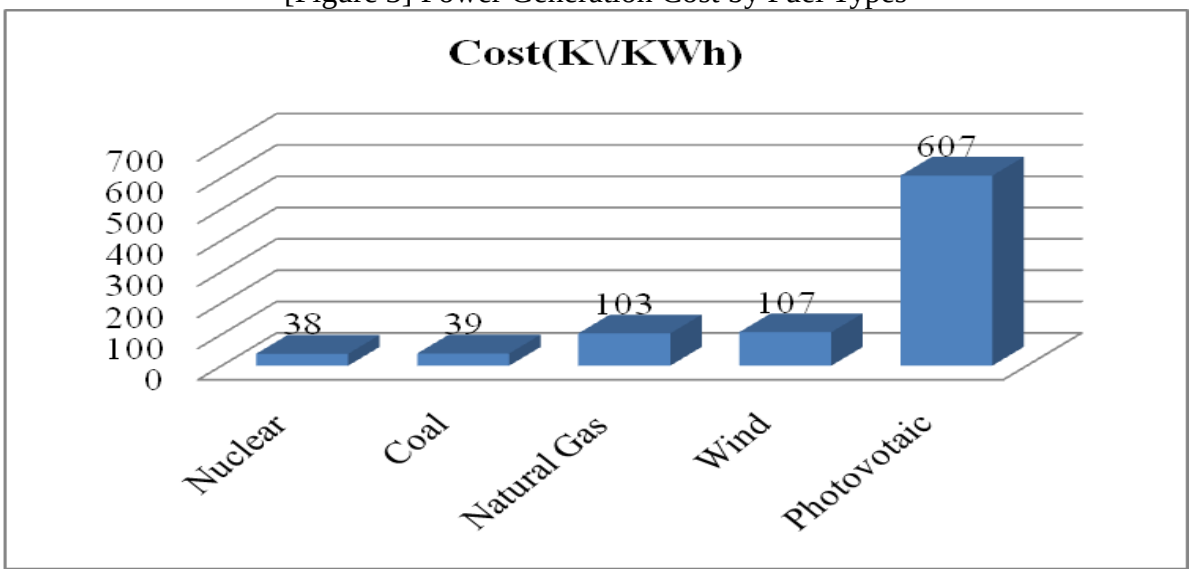
[Figure 2] Changes in Share of Energies



The share of oil will be lowered to 33% in 2030 from 43% in 2007. The share of coal will also be reduced to 16% in 2030 from 25% in 2007. The total share of fossil fuels, which are mostly imported from foreign countries, will be 61% in 2030, and was 83% in 2007. These changes will significantly improve the energy security of Korea and will contribute to lowering the emission of CO2 from fossil fuel combustion. In addition to the policies and measures to lower the increase in energy demand of the various economic sectors in Korea, the changes in energy mix to meet the increasing demand are the key factors, if successfully implemented as planned, to improve energy security and to lower GHGs emission to combat climate change.

Several barriers are identified to be overcome for the successful implementation of the 1st National Basic Energy Plan. The increase in the shares of renewables is costly and most technologies are not domestically available. For the last several years, Korea has promoted the installation of wind power generation equipment and photovoltaic power generation equipment with some degree of success. Currently, however, most of the components and technologies are imported. For example, 99.6% of installed wind power equipments are imported products. For photovoltaic power, 75% of the installed equipment is imported. The level of domestic technology is 50~85% of the most advanced countries.

[Figure 3] Power Generation Cost by Fuel Types



Related with dependency of technology is the high cost of power generation from renewables, as shown in Figure 3. The power generation cost of coal as a fuel is almost the same as the cost of nuclear power generation. Wind power generation costs 107 Korean Won per KWh, which is 104% of LNG power generation cost, reflecting recent price increases of natural gas in the international markets. Photovoltaic power generation still costs 607 Korean Won per KWh, which is almost six times higher than that of LNG power generation and 15 times higher than that of coal-powered generation.

Promotion of renewables certainly improves energy security and reduces CO2 emissions. High dependency on technology from foreign sources is not sufficient for a secure energy supply. The high costs of supplying renewables is not an effective solution to improve a broadened concept of energy security that includes economic security. Therefore, it is necessary to develop competitive renewable technology as planned in the National Strategies of Green Growth in Korea. Of course, these efforts to develop renewable technology could be sought jointly with foreign partners to share the benefits of the final products. From the perspectives of energy security and climate change mitigation, it is needed to add to the new technology ‘public good’ flavor. Technology could be researched and developed jointly in order to share the benefits of the outcomes or allow developing countries to have access to the financial resources to install new technology, improve energy security and to control the increase of CO2 emissions to meet the derived energy demand from economic development.

4. Remarks

The energy security issue has been one of the main determinants of energy policy in countries in Northeast Asia, including Korea. Those countries are heavily dependent upon foreign sources in their energy supply. In implementing the Kyoto Protocol to reduce GHGs emissions to below 1990 levels in 2008, climate change mitigation is another factor to be seriously considered in national energy policy. China and Korea are not Annex I countries in the first commitment period. China is expected to become the largest CO2 emitting country in the near future and Korea is already a member of the OECD. These countries need to commit themselves to take their fair share of responsibility in global efforts to combat climate change.

Considering the potential of economic development in the next few decades and limited access to the most advanced low emission technologies in these countries, it is not an easy task to achieve the two different targets--energy security and climate change mitigation--simultaneously. There is a clear need to seek a cooperative solution for these problems. Development and deployment of new technologies is in the heart of the solutions. The tasks need to be addressed cooperatively in the region.

There has been an effort to meet regional needs to improve energy security and to lower the increase of GHGs emission in Northeast Asia as mentioned above. There are geographical merits in Northeast Asia, such as the coexistence of a big potential supplier and significant markets for energy resources. There are substantial energy reserves in China, Mongolia, and Siberia and Sakhalin of the Russian Federation, and appropriate capital and technology to exploit these reserves are available in Japan, China and Korea. There is an enormous potential for cooperative development in Northeast Asia's energy sector through the complementary relationship between the energy-consuming countries and the resource-reserving countries in the region.

Korea proposed the establishment of an intergovernmental body among the countries in the region to implement a multilateral and cooperative approach to the Russian energy resource among countries in Northeast Asia. This intergovernmental body can play a central role in promoting the development and investment of the energy resources in East Siberia and Far Eastern Russia. In other words, this intergovernmental body could serve as a mechanism

to lower the project risks and to bring the economic benefits ultimately to the energy resource supplier and to the importing countries.

However, efforts to improve energy security through access to energy resources in Eastern Siberia and Far Eastern Russia by countries in Northeast Asia have not been taken in the proposed ways. Countries in Northeast Asia approach Russian energy resources bilaterally. Bilateral cooperation in accessing the Russian energy resources by an importing country has a high chance of falling into the Prisoner's Dilemma, whose outcome is not the best in terms of the cost of acquiring the energy resources or securely supplied amount of resources.

There have been some remarks on the importance of lowering energy demand increases in China by improving energy efficiency in various international seminars. This is one of the most important areas in energy cooperation in Northeast Asia. Energy saving by substituting energy efficient technology for inefficient ones is an effective policy to provide energy security in a sustainable way. As a prerequisite for cooperative projects, information exchange and policy coordination to improve energy efficiency through multilateral cooperation in Northeast Asia can be one of the main agendas in intergovernmental meetings. It is also needed to coordinate energy conservation policies among nations in Northeast Asia, if necessary. Based upon the outcome of these meetings, countries in Northeast Asia need to work together to find ways to facilitate the transfer of energy efficient technologies and to promote the trade of energy efficient products and services. This effort is in accordance with international efforts to mitigate global climate change as well as to improve energy security.

In short, countries in Northeast Asia have already redefined energy security to imply stable and cost-effective energy supply systems and environmentally acceptable energy use and transportation. To improve this extended energy security, some efforts on the regional level need to be made in an organized and cooperative manner to lower the rate of growth in energy demand and stop inefficient use of energy, as well as to develop and transfer new technology in the energy supply system. Intergovernmental cooperation in energy could be a key mechanism in identifying region-wide opportunities to lower greenhouse gas emissions voluntarily, mobilize international investment on energy efficiency and on needed projects to reduce greenhouse gases emission of the countries, such as clean coal technology.

References

Andrews-Speed, Philip, *Climate Change and Energy Security: The Case of China*, presented in International Workshop

Asia Society, *A Roadmap for U.S.-China Cooperation on Energy and Climate Change*, 2009.

Blyth, William and Nicolas Lefevre, *Energy Security and Climate Change Policy Interactions: An Assessment Framework*, IEA Information Paper, December 2004.

Ford, Melanie, Andrew Gurney, Edwina Heyhoe and Don Gunasekera, *Energy Security, Clean -Technology Development and Climate Change: Addressing the Future Challenges in APEC*, ABARE Research Report, September 2007

Huntington, Hillard G. and Stephen P.A. Brown, *Energy Security and Global Climate Change Mitigation*, Working paper, October 2003

IEA, *CO2 Emissions from Fuel Combustion*, 2008 Edition, 2008

Ministry of Knowledge Economy, *1st National Basic Energy Plan*, 2008

Smith, Paul J., *Climate Change, Energy Security and China's Development Dilemma*, a Proceedings Paper International Studies Association Annual Meeting, 2009,