Power Grid Interconnection for a Nuclear Free Korean Peninsula

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I. Introduction

Jungmin Kang, an independent nuclear policy analyst in Seoul and Associate of the Nautilus Institute, writes: "Via the implementation of the ROK-DPRK-RFE power grid interconnection, the energy support to the DPRK could get the DPRK involved in the multilateral energy cooperation system, reduce political tension around the Korean peninsula, and thereby bring a positive effect in resolving the DPRK nuclear conundrum."

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II. Essay by Jungmin Kang

-"Power Grid Interconnection for a Nuclear Free Korean Peninsula"

By Jungmin Kang

Introduction

Even though the third round of six-party talks, held in Beijing during June 23-26, 2004, stressed the need to take first steps toward de-nuclearization of the Korean peninsula as soon as possible, large differences remain between the United States and North Korea over the extent and timing of dismantlement of the North Korean nuclear program, verification provisions, and several other critical issues. No breakthrough is expected in the US- North Korea nuclear discussions due to serious lack of mutual trust. About the energy issue, fortunately, the United States agreed to propose other parties - ROK, Japan, China or Russia - provide energy assistance to the DPRK if the DPRK would agree to commit to the dismantlement of its nuclear program. It would be worthwhile to consider a new strategy to have the DPRK go de-nuclearization by providing energy support to the DPRK before its commitments to dismantling its nuclear programs. The energy support to the DPRK could result positive effect in resolving the DPRK nuclear conundrum since it could contribute in reducing political tensions surrounding the Korean peninsula.

The ROK-DPRK-RFE Power Grid Interconnection

The regional energy cooperation could provide various benefits to all participating countries, hence could contribute to increase the energy security of all participating countries by increasing optimal use of existing resources, technology, etc. and by improving energy market efficiency and secure cost-effective energy supply through energy market integration and system interconnection.

The regional power grid interconnection is a good example of the regional energy cooperation. The advantage of regional power grid interconnections are as follows: reduction of capacity reserve for the future so as to save the investment cost; reduction of operating reserve so as to reduce the operating cost; resolve the location problem; resolve the environmental problem; etc. Hence, the regional power grid interconnections bring economical as well as environmental benefits to all participating countries. However, many challenges are anticipated in realizing the regional power grid interconnections for the Korean peninsula, such as follows: high capital costs and investment risks; no regional financing mechanism; absence of legal systems that deals with different processes for enforcing contracts and resolving dispute; and different technical specifications including different operating voltage and frequency of neighboring power grids..

There are several examples of the regional power interconnections in worldwide. The largest regional power grid interconnection in the world is located in Europe: unification of national energy systems of western European countries interconnected with central European international power system; and interconnected national grids of north European countries. Besides those, where is also power grid interconnection between Canada and the United States, which connect cascades of Canadian hydro power stations with the US electricity consumers, and among the ASEAN countries.

As a feasible example of the regional power grid interconnection for the Korean peninsula, the

electricity transmission interconnection between the RFE and the ROK, passing through the DPRK would allow the RFE to export power generated at existing and new hydro power stations to the ROK. David von Hippel of Nautilus Institute estimated the capacity of the line could be up to 3 GWe and be activated in 2010, and would cost about $2.5 billion. This line could serve to allow two pressurized water reactors (PWRs) that were under construction by the Korean Peninsula Energy Organization (KEDO) at Sinpo in the DPRK to be operated safely.

Benefits of the RFE

The RFE will be the major source of electricity to be exported to the ROK via the DPRK. Recently, the RFE has been expressing that it wants to export electricity through the DPRK to the ROK. As of the end of 2003, installed capacity of electricity of RFE is 7.2 GWe and is estimated about 9.1 GWe in 2010. According to a REF analysis in 2004, the RFE could supply up to 3 GWe through the DPRK to the ROK using 500 kV transmission line from Vladivostok to Chongjin, northern part of the DPRK, and extension of the transmission line to the border of the ROK and further south. The RFE gets revenue from the export of its abundant electricity to the ROK.

Benefits of the DPRK

Suffering serious energy shortage, the DPRK recently has been shown an aggressive attitude in participating in the ROK-DPRK-RFE power grid interconnection. In May 2004, delegate of the DPRK mentioned about a power-sharing arrangement in the Korean peninsula at a forum held in Seoul as followings: The DPRK was already building a new power-sharing system with Russia; Connecting the system with the power grid in the ROK would make the sharing more successful; and, The relevant governments should discuss actual action plans to realize the regional power network. Upon participating to the ROK-DPRK-RFE power grid interconnection, the DPRK could receive either an annual lump-sum or some amount of electricity agreed-upon per-kWh-transferred payment for hosting the transmission line.

Benefits of the ROK

The ROK will be the major recipient of electricity to be imported from the RFE via the DPRK. The ROK government showed an interest in the power sharing arrangement for the Korean peninsula at the Seoul forum of May 2004. Since the ROK have met difficulty in building new power plants in its land due to strong objects by local communities that concern environmental impacts, the ROK would be able to take advantage of the RFE's electricity supply to meet its surging energy demand as well as to obtain environmental and economic benefits.

Since the first commercial operation of a nuclear power plant (NPP) in the ROK in 1978, the ROK has placed fifteen units of PWRs and four units of CANDU (Canadian Deuterium Uranium) reactors in operation, as of mid-Aug. 2004. One more PWRs are under construction, with eight additional PWRs to be deployed by the year 2015. However, due to strongly growing "anti-nuke" movements by local residents and NGOs, it will be difficult for the ROK to deploy all the planned PWRs by 2015. Furthermore, there is no site designated for two PWRs that are planned to be deployed in 2014 and 2015 and even for thermal power plants after 2015. It would be likely to assume that more than two PWRs might not be deployed as originally planed in the ROK by 2015. Therefore, the ROK should seriously consider how to complement its electricity deficiency more than 2 GWe by 2015. The RFE's electricity supply to the ROK utilizing ROK-DPRK-RFE power grid interconnection could be a measure to meet the ROK's electricity demand in the long-term.

If the ROK import the electricity generated from 2 GWe of capacity in the RFE via ROK-DPRK-RFE power grid interconnection, it could replace the deployment of two 1 GWe PWRs, and as such could

provide environmental and economic benefits to the ROK by reducing the generation of nuclear wastes such as spent nuclear fuel, Low and Intermediate Level Waste (LILW), and radioactive waste arising from decommissioning of reactors.

Assuming 1 GWe of nuclear capacity, 90% of capacity factor, 34.9% of average thermal efficiency, and 44,000 MWd/tHM of average burnup, the annual amount of spent fuel discharged from 1 GWe PWR is 21.4tHM. The 1 GWe PWR would discharge about 856 or 1,284 tHM of spent fuel during its lifetime of 40 or 60 years with life-extension, respectively. The average annual volume of LILW discharged from 1 GWe PWR in the ROK is about 28 m3. The 1 GWe PWR would discharge about 1,120 or 1,680 m3 of LILW during its lifetime of 40 or 60 years, respectively. The weight of radioactive waste arising from decommissioning of the 1 GWe PWR is estimated about 10,000t, according to an OECD/NEA analysis in 2003. Therefore, the electricity supply generated from 2 GWe of capacity in the RFE to the ROK will provide significant environmental benefit to the ROK by reducing significant amount of those hazardous radioactive wastes discharged from reactors.

Cost savings related to the storage and disposition of those radioactive wastes are anticipated for the case of no deployment of two 1 GWe PWRs in the ROK. This study assumes that the unit cost for storage and disposition of PWR spent fuel, decommissioning of PWR, and disposition of LILW are 100-200USD/kgHM, 320 million USD per a 1 GWe PWR, and 1,600-3,200USD/m3 LILW, respectively. Based on the above cost assumptions, the cost savings relating to the nuclear wastes generation for the case of no deployment of 1 GWe PWR are approximately 1.0-1.1 billion USD or 1.4-1.5 billion USD (total undiscounted costs) for its lifetime of 40 or 60 years, respectively. Therefore, the electricity supply generated from 2 GWe of capacity in the RFE to the ROK will provide significant economic benefit to the ROK by saving those costs. Moreover, the ROK can save construction cost of the two 1GWe PWRs. The construction cost of 1 GWe PWR is about 1.6 billion USD.

If we assume that the import of the electricity generated 2 GWe of capacity in the RFE could replace the electricity generated the same capacity of thermal power plants in the ROK, it would also provide significant reduction of air pollutants (such as SO2, NOx and particulate) and greenhouse gas (such as CO2) emissions.

Conclusions

Even though there would be many challenges in realizing the regional power grid interconnections, the ROK-DPRK-RFE power grid interconnection could bring a win-win opportunity to the ROK, the DPRK and the RFE by providing environmental and economic benefits to all three countries, if implemented. Via the implementation of the ROK-DPRK-RFE power grid interconnection, the energy support to the DPRK could get the DPRK involved in the multilateral energy cooperation system, reduce political tension around the Korean peninsula, and thereby bring a positive effect in resolving the DPRK nuclear conundrum.

III. Nautilus Invites Your Responses

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