

***A Strategic Approach for Electric Power Interconnection
in North-East Asia***

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Abstract

In spite of regional closeness, energy cooperation in the Northeast Asia (NEA) region has remained unexplored. However, this situation appears to be changing with the inception of natural gas pipeline projects and electric power interconnection plans. This study analyzes the possibility of NEA's electric power interconnection, and suggests a strategic approach to implement this project. For this purpose, a scenario of electric power interconnection of Far East Russia-North Korea-South Korea is set up. Based on the scenario, this paper presents several aspects to examine the feasibility of electric power interconnection among these countries: electricity market structure; the prospects for electric power industry restructuring in the Russian Federation and South Korea; and the political issues related to North Korea.

This study compares two possible options to accomplish a proposed electric power interconnection project: inter-government project, and a project financing scheme primarily led by the private sector. The latter appears to be more feasible. This is because this kind of international project might have many uncertainties and obstacles involved, and it would take too much time to solve these matters through an inter-government project. With project financing, we could prove the economic feasibility of the concerned project in the marketplace, and secure its viability through various commercial contracts imbedded in the project financing scheme. One of key tasks by the NEA governments is to create a stable climate for energy investments. In addition, the first step will be to create NEA Energy Charter Treaty.

1. Introduction

In spite of regional closeness, energy cooperation in the Northeast Asia (NEA) region has remained unexplored. Energy cooperation in NEA, especially in the power sector, has so far been considered only a subject for discussion and research among related professionals. Power sector cooperation has been specifically enforced with good results in Europe, South-East Asia, South America, North America, and even in Africa. It has also been shown that the benefits between the countries are jointly owned. However, even though power sector cooperation in NEA has a great potential, there has not been much progress.

Regarding the possibility of energy cooperation in NEA, we could say there is a complementary relation in the energy production and consumption structure (Bae, 2004). That is, the Russian Federation is the only country in the region with energy capacity to export to other countries. While China, Japan, the Democratic People's Republic of Korea (North Korea) and the Republic of Korea (South Korea), as energy consuming countries, are seeking stable energy sources within the region by diversifying their traditional energy sources.

Nevertheless, the heterogeneous structures between NEA countries as well as the differences in economic development are some factors impeding energy cooperation including power sector cooperation. Especially, a disagreement due to the division of North Korea and South Korea is another important factor that acts to impede peace and economic cooperation in NEA compared to other areas in the world. However, these impeding factors, to the contrary, can produce more profits through cooperation. In other words, energy cooperation could contribute to NEA peace, relieve tensions between North and South Korea, and allow these countries to enjoy the accompanying economic benefits. In this regard, the significance in using energy that we use everyday may be put to good use as a tool for peace.

Currently, the situation appears to be changing with the inception of natural gas pipeline projects and electric power interconnection plans. The common interests of NEA countries are converging toward energy cooperation. Of course, the development of gas fields in Sakhalin, or the Korean Peninsula Energy Development Organization (KEDO) project in North Korea can be considered as large-scale energy cooperative projects progressing in NEA. Fortunately, through the professional meeting in

Khabarovsk, Russia in October 2001, a joint declaration was drawn, reflecting the opinions of NEA countries. There is an article on the major agendas of the declaration, which states that a cooperative committee will be formed with government officials to deliver a realistic cooperation plan on energy, including power sector cooperation. Also, a preliminary meeting to form the committee was held in Seoul, South Korea. Even though there has been no indication of progress after this preliminary meeting, it is significant in that there was a specific attempt to form the committee in a short period of time.¹

There is no doubt that there are economic, social and environmental benefits to reap from any power interconnection project. That is, the power interconnection will help lower financial requirement for infrastructure development, improve energy resource allocation for environment, and bring in monetary gains from regionally competitive pricing. Not only these measurable benefits, but also such intangible benefits as strengthening energy security and regional ties with neighboring countries may well be generated from the project.

This study analyzes the possibility of electric power interconnection in the NEA region, and suggests a strategic approach to implement this project. For this purpose, a scenario of electric power interconnection of Far East Russia-North Korea-South Korea is set up as shown in Figure 1. Simply, this scenario assumes trading of electricity between Far-East Russia and South Korea with the construction of high voltage direct current (HVDC) transmission lines passing through North Korea.²

Compared with alternative scenarios of Russia-China-North Korea-South Korea route or Russia-Japan-South Korea route, this scenario has received much attention from academic scholars and practitioners in recent years. Based on the scenario, this paper presents several aspects to be considered for examining the feasibility of electric

¹ Starting from December 2002 to November of 2005, the South Korean Ministry of Commerce, Industry and Energy (MOCIE) has sponsored a comprehensive project titled as “Development of Cooperational Infrastructure for North-East Asia Region Electrical System Ties (NEAREST).” This project includes construction of data base, technical feasibility, economic feasibility, and market feasibility of NEAREST (<http://nearest.keri.re.kr>). The current paper is an excerpt from the market feasibility analysis performed in the first year.

² HVDC is a proven technology employed for power transmission (APERC, 2000; KERI, 2003).

power interconnection among these countries: electricity market structure; the prospects for electric power industry restructuring in the Russian Federation and South Korea; and the political issues related to North Korea. To accomplish the proposed electric power interconnection project, this study compares two options: an inter-government project, and a project financing scheme primarily led by the private sector. Finally, the paper describes some obstacles anticipated in the progress of NEA's electric power interconnection project.

Figure 1. Alternative Scenarios of Power Interconnection in NEA



Source: Park, et al. (2004)

2. NEA's Electricity Markets

Electricity Demand Derived from Economic Growth

NEA countries have begun full-fledged political, economic and social exchanges since the end of 1980s. It was after abandoning the adversarial relations that were persistent throughout the most part of the 20th century. The volume of personnel exchange and commodity trade has demonstrated robust growth over the last two decades. As a consequence of the increased economic activities, NEA countries have witnessed the rapid growth of energy consumption and anticipate the continued growth for the next couple of decades. In particular, the high potential for economic growth from the inter-regional trade is likely to accelerate the regional economic growth

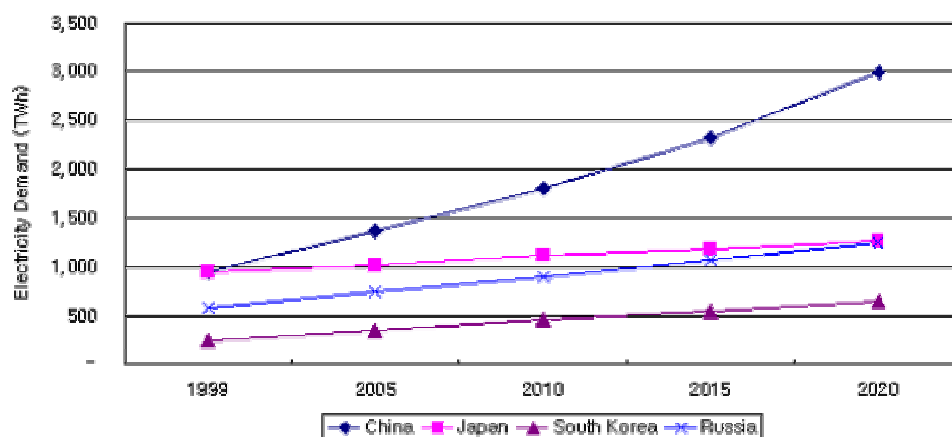
Based on the currently available statistics on the power sector in NEA countries, electricity demand and consumption is rapidly increasing. Total consumption in 2000

for six NEA countries amounted to 2,418 TWh (terawatt hours) per year.³ Of this figure, 1,084 TWh per year, or 45% of the regional total, is attributable to China. The total current electricity generation capacities of the six countries in 2000 amounted to 627 GW (gigawatts). This figure approximates that of the European Union and the United States, and the rapid expansion is predicted in the next two decades. These background figures show that the urgency needed in addressing the issue of electricity interconnection (Belyaev and Podkovalnikov, 2001).

In the case of South Korea, electricity demand has increased rapidly with high economic growth. Peak demand in 2003 reached 47 GW, and electricity sales were 322 TWh. The growth of power consumption was recorded at about 10% annually between 1973 and 2003. The installed capacity that coped with peak load in 2003 was 56 GW. On the other hand, based on the figures from 2003, the fuel mix for generation was composed of nuclear (28%), coal (28%), gas (26%), oil (8%), and hydropower (7%) (KEEI, 2004).

As shown in Figure 2, electricity demand is projected to grow fast in NEA, especially in China. Due mainly to intensified industrialization and urbanization with rising personal income in the region, demand for electricity will grow faster than that of primary energy. In order to cope with rising electricity demand, NEA countries have actively implemented their own long-term energy and/or electricity demand and supply plans, which were carefully crafted to achieve long-term efficiency.

Figure 2. Long-term Forecast of Electricity Demand in NEA



Source: APERC (2002)

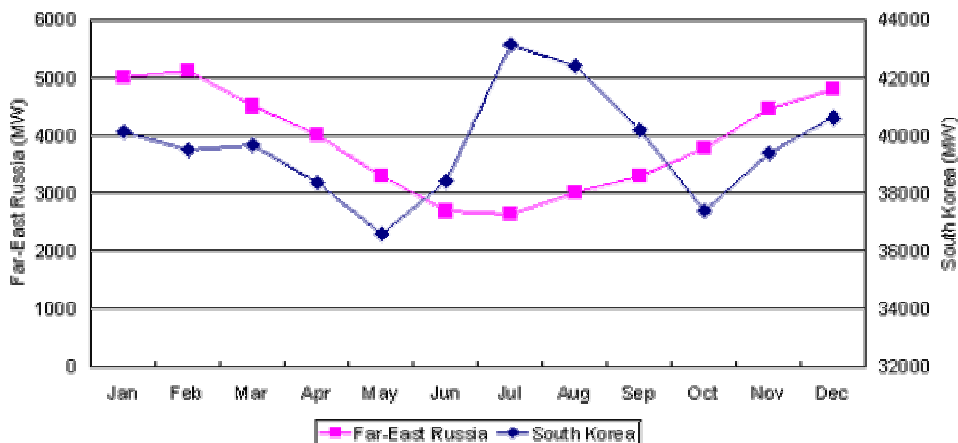
³ The six countries include China, Japan, Mongolia, North Korea, Russian Federation, and South Korea.

Load Difference and Electricity Tariffs

One of primary benefits from electric power interconnection between countries would be the reduction of generating cost according to peak load differences. The demand for electricity differs by hour, day, and month, and shows typical regional differences as well. If economic dispatch is enforced using such peak load differences, power production costs can be reduced. In other words, by utilizing electricity produced by inexpensive foreign generators at peak times, and exporting during low points, mutual benefits can be realized. In addition, it is expected that power sector cooperation will greatly help in resolving power plant siting problems in South Korea, which results from limited land and public protests.

Figure 3. shows the seasonal difference in load curve between Far-East Russia region and South Korea. Even though NEA countries are situated in the Northern hemisphere, there are notable differences in climate. For example, the electricity demand peaks during summer in South Korea and Japan, Far-East Russia has a demand peak during winter.

Figure 3. Seasonal Difference in Load Curve



The Russian Federation and China have revealed their plans to create a national level wholesale market for electricity after unbundling the vertically integrated electricity utilities into generation, transmission and distribution, and sales of electricity. At the same time, they plan to connect all local power networks into a single transmission network run by independent system operators. It is not difficult to anticipate that electricity tariffs will fall in the long-run, eventually converging to

international market prices once these plans are implemented seamless.

However, in the short run, electricity tariffs could rise due to temporarily increased transactions cost from the forced transition. In the case of the Russian Federation, electricity tariffs will, almost certainly, rise within about 10 years as the government has announced its plan to relinquish government subsidies for electricity and lift price controls on generation fuels, in particular, natural gas. The Russia Federation carried out legislative efforts to create or revise necessary laws and regulations to support electricity sector reform.

Investing in energy projects can be highly risky, because of technical, economic and geo-political factors. The growing inter-linkages between energy projects, such as gas pipelines and power plants increase these risks. On the other hand, it is argued that the current level of electricity tariffs in the Russian Federation and South Korea are below marginal costs and the services are implicitly and heavily subsidized. These will introduce additional uncertainties for investment toward power sector (Hasnie, 2004).

Electricity tariff is a core issue for electric power interconnection. The average generation cost and the level of power prices in the receiving market will be the benchmark for imported power. Competition among suppliers in power market will become stronger along with the introduction of bidding mechanism. However, when electricity tariff does not include externality costs such as environmental costs associated with generation and transmission, the competition could be distorted. Thus, it is argued that the environmental and social benefits derived from the cleaner energy supply and avoided social contradictions, should be internalized to the electricity tariffs.

3. Electric Power Industry Restructuring

Status of Electric Power Industry Restructuring

The process of the Russian Federation's electric power industry restructuring has showed a confusing situation that there were ten times changes in related policies for the period of early 1990 to 2001. During 2000 to winter of 2001, there was a severe power interruption, and the necessity for restructuring was invoked. In May 2001, the Russian government approved the restructuring plan to unbundle the United Energy Systems (UES) into generation, transmission, and distribution sectors.

The power sector in South Korea is now in the initial stage of the restructuring, privatization and liberalization process. The government announced the “Basic Plan for Restructuring the Electricity Supply Industry” in January 1999. This basic plan contains four stages of restructuring. The first stage was to go to the end of 1999. The second phase denotes the generating competition stage, which is to be completed by the end of 2002, but it is delayed to 2004 or 2005.⁴ The third phase is the wholesale competition stage to be completed by 2009. The fourth phase is the retail competition stage set after 2009. However, it is uncertain whether even the schedule will be fully carried out.

As described above, despite the strong governments’ will for electricity sector reform, the road ahead may well be bumpy as witnessed in several developed countries. Electricity sector is only a part of the industry fabric interwoven socio-economically with many other sectors in a society. Its reform could have some repercussion on other groups or sectors in the society. Thus in some cases, the reform effort will face societal resistance, which could place a prohibitively high transactions cost.

For example in the Russian Federation, the frequent political discord between the Federal government and Duma, and the lack of coordination among different government agencies may pose an insurmountable stumbling block for the reform. The large financial requirement for the reform will constitute an additional obstacle. For South Korea, there has been already a delay in the process of electric power industry restructuring. One of most severe obstacles has been stemming from the KEPCO’s trade-union.

Effects of Electric Power Industry Restructuring

Electricity sector reforms in NEA countries would display an encouraging sign for the regional power interconnection. Once competition is introduced in electricity market, market participants will put all available options on the table and select the very best option to survive in the market. Once the domestic power network is completed, a cross-border power interconnection will become an unmistakable next step for consideration by the electricity suppliers and traders. In addition, the reform in power industry would make it easier to determine the appropriate price of bulk electricity.

Up to now, NEA countries have never experience the “competition” in real

⁴ The privatization of the generating companies was scheduled to start in 2002, and by the end of 2002, the distribution companies were supposed to be unbundled.

sense because of institutional inflexibility that they were unable or, at times, unwilling to look for opportunities beyond the national border. Electricity sector reform in NEA countries will advance the cross-border projects more rapidly. However, there is one important condition that the current political stalemate is resolved regarding the North Korea, which happens to be located geographically at the very center of NEA.

Since the power market can provide a basic framework for power trade, we could expect that power cooperation will be actively carried out. One of the European Union's objectives concerning electric power industry restructuring is to make one huge power market. In this context, the formation of a domestic power market in each country is needed as a first step into the power interconnection of NEA region. When the transparency in power trade and the efficiency of power system operations would increase through power market, it is anticipated that power sector cooperation among the countries will follow naturally.

Moreover, through power industry restructuring, the industry itself will operate privately from public initiation. This will help attract private funds into the power industry. Promoting power sector cooperation would need a large-scale investment, and restructuring electricity supply industry will act positively rather than negatively towards this end. On the other hand, we should notice that it might be difficult to promote large-scale investment due to a strict evaluation on economic feasibility and increased investment risks on the side of private sector.

In sum, the introduction of competition through electric power industry restructuring would achieve many benefits. One of them includes the power trade through regional interconnection, which could arise naturally. One thing we should remember is that even before power industry restructuring took place (before 1990) significant benefits were achieved through regional trading arrangement as in Norway, the United States, and Australia.

4. Political Issues

In March 1995, in order to implement the Agreed Framework between the United States and North Korea, the KEDO was created, under which North Korea agreed to freeze and ultimately dismantle its existing nuclear program. In return, the KEDO was to provide North Korea with alternative sources of energy, in the form of

two 1,000 megawatt light-water reactors, by a target date of 2003, and 500,000 metric tons of heavy fuel oil annually until the reactors were operational, to replace the potential energy supply from the suspect nuclear projects on which North Korea was to suspend construction under the Agreed Framework. Upon completion of the reactors, North Korea was to begin repaying the cost of these new reactors over seventeen years, after a three-year grace period.

When the KEDO operated in North Korea, North Korea did not normalized relations with the global society. We should have considered the possibility of suspension or even termination of the project caused by political instability (In fact, the worst scenario happened recently). Therefore, when considering this kind of multinational project, we must consider such exceptional risks in the planning stage. Related to this, North Korea should notice that resolving the nuclear weapons program could be a starting point for joint business with foreign countries in the future. That is, if North Korea can solve nuclear issue, the international community would support such project as a part of an aid program.

Calder (2004) proposed a post-KEDO energy development body for North Korea, which include all the nations involved at present as central members of that organization, with a central role for the United States. This proposal is focused on the developmental issues such as trans-national natural-gas and electric-power grids that naturally involve neighboring nations as well as North Korea. According to Calder, by including all the nations now involved in the six-party talks on the North Korean nuclear crisis, a "KEDO II" could also appropriately institutionalize that six-party forum to promote the long-term energy development of the NEA region as a whole. All such planning, of course, needs to be contingent on a resolution of the nuclear crisis consistent with the imperatives of global security.

Under such unclear conditions containing high political risks, a consortium of government and private sector would be realistic. Countries in NEA know the importance of substantial cooperation, especially in the energy sector. However, the political instability of North Korea makes such cooperation difficult. Moreover, it is inevitable to cooperate with the United States that has become the superpower even in NEA. As a result, it is important to build a council among countries to secure stability, and at the same time a kind of government-private consortium should be promoted as North Korea gradually achieves its political stability.

In addition, South and North Korean power cooperation would bring about mutual economic benefits. It is an important priority that creates the foundation for energy resource trade through power networks. For this reason, a continuous dialogue between South and North Korea is needed for power sector cooperation.

5. Strategic Approach for NEA Electric Power Interconnection

Feasible Option for Implementing

Economic feasibility of a power interconnection project depends on financial feasibility, priority in national policies, and economic impact on other industries. Even a financially infeasible project could become economically feasible if it is of high priority in national policies and/or it has positive ripple effect on other industries. Besides, intangible political and environmental benefits can also improve the economic feasibility. Therefore, a decision on whether the project is economically feasible cannot be purely objective. In order to carry out cross-border projects in a seamless manner, at least the followings have to be well thought out and made operative: harmonized national policies, transparent law, rules and regulations, and reciprocally agreeable dispute settlement process.

In order to implement the electric power interconnection project in NEA, we should decide whether the proposed project should be public investment or private investment. Related to this issue, we need to define the nature of project as a pure commercial project rather than government level cooperation. This option should be accompanied by governmental cooperation in the aspects of political and energy security. The reason for this argument is based on the fact that governmental projects usually involve longer time in resolving political and institutional obstacles in advance before launching a project (We are currently witnessing the KEDO case).

Contrary to this, a commercial project mainly driven by the private sector, for example, a scheme of project financing or multinational consortium has an advantage that the economic feasibility of project could be easily verified by the market in the first place. Also, if implemented in terms of private and onerous contracts, the project could be protected by legal binding related to electricity trading and transmission usage.

One of frameworks for project financing is summarized as follows. Based on the

scenario of Far East Russia-North Korea-South Korea route, the transmission lines would be constructed with various sources of external investments. The investors would recover their investments in terms of direct costs and fair returns on the investment for the lifetime of network facilities. These three countries could participate in the construction works. North Korea would collect the transit fees or the tariffs for land usage of transmission lines. The Russian Federation and South Korea would pay for the tariffs of using power system network.

Political uncertainty or risks should also be considered in the current case of project financing. Especially, it is necessary for North Korea to sign on a contract that is designed to guarantee the stable use of transmission lines on the side of South Korea. With this arrangement, there would be little harmful situation to South Korea in using power system network even though some political turbulence occurs. According to Higashi (2004), there is some consensus on the soundness of macro-economic situations for international financing in NEA except North Korea.

Energy Charter Treaty as Back-Up Measure

Regardless of the potential benefits from power sector cooperation described before, there are many issues to resolve if electric power interconnection and trade in NEA are to be realized. There could be technological problems due to differences in standards and quality of power by country, such as different frequencies and voltages. In addition, the question of how to procure the fund for construction of transmission lines remains unanswered. Nevertheless, it seems that institutional differences are the biggest obstacle in implementing power interconnection in NEA.

Considering the institutional differences, there would be a great difficulty in agreeing on the transmission tariffs and transit charge. In a country where there are many cross-subsidization policies on energy, it is difficult to collect a return on investment since the electricity tariffs in the concerned countries are relatively low. And, it would be difficult to attract external investment since the government controls investors' profit by regulating the return on investment. In addition, like natural gas, there is a possibility of confrontation regarding transit fees. This is due to the fact that transmission lines must go through North Korean territory.

In fact, the fundamental elements of energy cooperation such as the electric power interconnection in NEA would require many practical considerations. First, we

need to build up confidence, trust and consensus among countries through informal and formal consultative process. In particular, a governmental consultative framework will provide for the design of regional power cooperation. Second, we should form legal frameworks and institutional arrangements, and then contractual frameworks. Major subjects of legal frameworks, focusing on inter-governmental policies and measures, would mitigate or share the political and financial risks involved in a cross-border project. The legal frameworks and institutional arrangements are important since more of the capital needed for energy projects will have to come from private and foreign sources than in the past. Private capital flows are also very sensitive to macroeconomic conditions and to the nature and stability of government policies (IEA, 2003).

One of key tasks by the NEA governments involved in energy cooperation would be to create a stable climate for energy investments. In doing so, they could reduce the level of non-commercial risks associated with the energy projects in NEA. Regarding to this issue, the first step we could consider would be to create NEA Energy Charter Treaty (ECT).⁵ The key feature of the ECT is legally-binding rules for economic cooperation based on transparency and non-discrimination. Main areas of coverage include trade, transit, investment, energy efficiency, dispute settlement procedures, etc.

From a legal perspective, the most significant outcome of the Khabarovsk meeting was to create a Working Group to study the need for the NEA ECT (Bradbrook, 2002).⁶ The participants of the meeting showed a strong awareness of the advantages of the European Energy Charter. At the same time, they recognized that a separate agreement would be necessary in NEA power cooperation. Thus, there will need to be an “Asian solution” to this problem, which will be significantly different from the past negotiations on energy cooperation elsewhere.

⁵ The Energy Charter Treaty was created against background of mutual interest in energy cooperation in post-Soviet Eurasia. OECD energy consumer countries were looking for new energy supply sources, and Russia/CIS was eager for foreign investments and development of markets. Currently, the ECT is facing challenges. That is, the Russian Federation has signed, but not yet ratified the ECT. Thus, the Russian Federation’s ratification would be essential if the ECT is to realize its full potential.

⁶ The document of the Khabarovsk Communiqué is attached to the Annex in Bradbrook (2002).

7. Conclusions

It is perhaps too early to speak about the development of energy cooperation in NEA region, such as power interconnection. We do have still too many “*ifs*” and “*whens*.” Nevertheless, considering the impact of NEA energy cooperation on world energy security, it is clear that future development of NEA energy cooperation will have a positive influence on global energy situation. The scope will be of great scale because of the size of energy sector of the region in the world.

The more difficult challenge is financing of power interconnection projects in NEA region. In many developing and transition countries, the domestic banking sector and capital markets are unable to provide the necessary funding for such large-scale energy projects. As a result, much of this sort of investment will have to be financed by capital inflows from industrialized countries. However, the external financier faces not only the sovereign, geopolitical, and regulatory risks, but also economic risks which are typical for developing countries (like an immature market, inflation, risks of currency exchange risks, etc.).

The challenge for the governments of the Russian Federation and South Korea involved in the proposed electric power interconnection project will be to foster the development of their internal capital markets and to create confidence with international investors. This could be done by defining a clear energy policy implemented by independent regulators, and establishing a fair and transparent dispute resolution mechanism. These countries may also need to draw on support from developed countries in their efforts to mobilize financing from international investors. Any potential investor will need assurances of the sincerity of upstream and downstream contracts and a credible dispute resolution mechanism in order to secure financing.

One of major obstacles in the NEA electricity sector cooperation is the lack of any overall trade agreement or convention, such as the GATT, binding all the involved countries. In addition, there is no trade organization of these countries as members, such as APEC or the WTO. Therefore, any agreement to develop electric power interconnection in this region must start from scratch. One of feasible solutions for this matter would be to create the NEA Energy Charter Treaty, which is relevant to the specific conditions of NEA power sector.

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