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## **Transmission Line Project Linking the Russian Far East with the DPRK (Chongjin)**

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The project is currently in the very early stages of development. Consequently, many of its parameters are tentative. Nevertheless, we believe that the timeliness of the project and the significance of the problems it is intended to solve, not to mention the opportunities that it will open up will be of great interest to the participants of this conference.

### **The problem**

The power supply shortages from which the DPRK began to suffer in the mid-1990s have become the principal obstacle to national development, exacerbating the economic and humanitarian crisis within the country and contributing somewhat to maintaining the international tension in Northeast Asia. We are of the opinion that solving this problem will not only be in the interests of the DPRK, but will also promote economic development and stability in Northeast Asia as a whole.

### **Scenarios for solving the problem**

Until now, neither the DPRK's own efforts nor the few international attempts that have been made to solve the problem of power shortages by constructing new generating facilities have yielded successful outcomes. In our opinion, such initiatives are unable to provide fast and fruitful solutions:

- **TPS:** the finance and fossil fuels available are insufficient to allow the construction of new thermal power stations.
- **APS:** the KEDO program has been suspended for at least a year with only a very dim prospect of resumption, particularly given that the available APS is too small.
- **HPS:** the DPRK's existing hydraulic power stations require reconstruction or the replacement of equipment. The construction of new and bigger HPSs requires large-scale investment and a longer completion period.

A speedy alternative solution might be the construction of a 500kV transmission line linking the Russian Far East (Vladivostok) with the northern part of the DPRK (Chongjin). The construction of new generating facilities would inevitably take more time than the construction of a power transmission line. This factor is no less significant than the financial aspect.

### **The essence of the project**

The project essentially involves the construction of a 500kV cross-border transmission line between the Russian Far East and the DPRK and the provision of power supplies to the consumers in the northern part of the DPRK.

The advantages of such a project are that it is unarguably in the interests of the *DPRK*, allowing it to overcome its acute shortage of power supplies, while being in the interests of *Russia*, enabling it to solve problems in stabilizing both its energy sector and the loads of its thermal power generation facilities, not to mention being in the interests of *all the countries of Northeast Asia*.

The proposed infrastructure project, which involves the construction of a power transmission line during the period 2004–2007, would facilitate the development of the DPRK economy as well as contributing to easing political tension in the region.

The successful accomplishment of this infrastructure project with the participation of international organizations is a prerequisite for implementing larger-scale infrastructure projects in the region.

### **Project parameters**

The projected transmission line is a 500kV 50hz AC line with a total length of 380 km. The Russian section will run 250km from Vladivostok to Kraskino, while the DPRK section will run 130 km from Kraskino to Chongjin.

The conditions along the route that the transmission line is due to take make its construction rather challenging, as it is planned that it will pass through a narrow strip of land between the sea and the border with China, crossing several national parks and national nature reserves.

Those sections of the transmission line that pass through national nature reserves are subject to special requirements. As the ecological regulations restrict the expansion of the high voltage transmission line, it will be extremely difficult to obtain an ecology license if a problem arises that necessitates the laying of an additional transmission line. This situation means that special multipurpose pylons that can carry several power lines simultaneously, including one for AC and another for DC, must be erected in the several sections of the line that are subject to ecological regulations. This will allow the masts to be used to carry the wires for the power line to the ROK that may eventually be built. It is hoped that one thing that will work in the plan's favor, as far as the regulations are concerned, is the fact that the passage that will have to be cut through the forest for the transmission line will help to prevent the spread of forest fires.

- **Power consumers:**

- The Rason economic trade zone, close to the border between Russia and the DPRK;
- The railway line that passes close to the route of the power transmission line;
- A projected oil pipeline;
- Chongjin consumers of the 500 MW load provided by the project.

Taking into consideration existing plans for joint Russian – Korean projects, including plans to modernize the railway, the program for the feasibility study of the transmission line will also look at the construction of an intermediate 500kV substation at Kraskino, close to the border with the DPRK.

- The volume of the power supply from Russia to the DPRK:

	Unit	Volume of supply	Period when the power supply is estimated to begin
Electric power	Million kwh/year	1500 — 2500	2006—2007
Load	MW	300 — 500	2006—2007

- The cost of constructing the Russia – DPRK transmission line is estimated at about US\$160 – 180 million, which includes the cost of conducting studies and designing the line.
- From the design stage, the project will take 3-4 years to complete.
- The investment repayment period should not exceed 8-10 years; the actual time required for repayments will depend on the actual volume of power supplied.

### **Project phases**

Current estimates of the various phases in the realization of this project are as follows:

- 2004: Feasibility study completed
- July 2005: Design of the transmission line completed
- July 2005: Construction of the transmission line begins
- December 2006: Construction of the transmission line completed
- January 2007: 220kV transmission line commissioned
- December 2007: 500kV transmission line connected

These dates are estimates and may therefore be revised in the event of any delays, arising from such problems as those encountered in securing sources of finance for the pre-feasibility studies.

In 2001, following an enquiry concerning the possibility of supplying power to the DPRK, «UES of Russia» initiated a study of the effectiveness of power exports from the Russian Far East to the DPRK. Preliminary studies have demonstrated the sales price boundaries and minimum volumes required to ensure that the investment is repaid and the intercountry transmission line functions efficiently. Preparations are now being made to conduct a feasibility study of the 500kV Russia – DPRK transmission line, which should be completed in 2004, once a source of financing has been found.

The first practical step in the cooperation between Russia and the DPRK is to be a training course for technicians and team leaders from the DPRK, which is due to take place in 2004 on the site where the transmission line is being constructed, in the southern part of the Russian Far East. The course is being organized by the Vostokenergo representation of «UES of Russia», following Cabinet approval of a request by the DPRK's Ministry of Electric Power and Coal Industry, but some issues have yet to be settled.

### **The current status of work**

The preliminary studies conducted by «UES of Russia» show that the project would be sufficiently effective as long as the price gradually increased to US\$0.05 per kWh and the volume of power supplied was about 2,500 – 3,000 MWh. Taking into consideration solvent demand, this would ensure the profitability of the investment in constructing the transmission line and the substations, and provide the project with a competitive advantage over the alternative proposal involving the construction of new generating facilities.

Vostokenergo has been conducting negotiations with the DPRK's Ministry of Electric Power and Coal Industry, looking at all possible problems that may arise in implementing the project. Seven meetings have taken place since October 2001. Work has already begun on the pre-feasibility studies of the transmission line.

### **Power generation in the southern Far Eastern region**

The question arises as to whether or not Russia is able to supply the necessary quantity of power to the DPRK. Our estimates are based on current power generation levels and plans to develop new generation facilities and transmission lines in the United Energy System of the East.

	2003 (report)	2007 (estimate)
Installed capacity, MW	7270	9200
Electric power generation, billion kWh	26.0	31.0
500 kV transmission lines, km	1800	2800

The growth of internal power consumption in eastern Russia is estimated to be rather high: about 3% per year. If energy-saving measures are taken into consideration, this corresponds to an internal regional product growth rate of 6-7%. It is evident that the plans to commission the Bureya hydropower generation facilities and transmission lines are necessary in order to meet the demand that will result from the growth of the Russian economy.

The general strategy for renewing the capital of the electrical power sector in the Russian Far East envisages the development of the region's hydroelectric potential, with more hydroelectric power stations being built and their share in the energy balance of the region being increased. Should there be considerable growth in the demand for electric power from foreign consumers, thermal power stations can also be assigned additional loads via the cross-border interconnection.

The Russian program for constructing new generation facilities and modernizing existing plants could be modified by including the total potential power demand after a decision on the construction of the 500kV Vladivostok – Chongjin transmission line has been taken and large-scale exports of power have been organized.

It should be noted that the potential offered by the numerous rivers in the Russian Far East has been explored, with pre-feasibility studies of promising hydroelectric power stations having been conducted.

The existing power potential of the United Power System of the East (the southern portion of the Russian Far East) would allow up to 2-3 billion kWh to be exported

annually. After construction of the Bureya HPS is completed in 2007, 4-5 billion kWh will eventually be exported, as long as adequate voltage transmission lines have been constructed, including a DC transmission line of  $\pm 500$ -600kW to the Republic of Korea. New HPSs will have to be built if demand for power increases, as these HPS projects were developed in earlier years.

It should be noted that the possibility is already being examined of implementing HPS projects with a total capacity of 1,500 MW, which will eventually generate a total of 6 billion kWh, and the appropriate pre-project documents have already been drawn up.

Other proposals have already been prepared, in case there is an even greater demand for power; these involve a hydropower complex on the Uchur River and the Timpton River in South Yakutia, with a total capacity of 5,000 MW and which will eventually generate a total of 23,450 million kWh.

A pre-feasibility study of the Tugur tidal power station in the Khabarovsk Region assessed its capacity at 6,800 MW, with a generation volume of 16,200 million kWh. It seems unlikely that there will be any demand for these projects in the Russian Far East until at least 2020 and their development will only be possible within the context of international cooperation with neighboring countries interested in importing power from Russia. Such countries would have to agree to invest in the construction of high-capacity environmentally friendly energy complexes that do not use fossil fuels, located in the southern part of the Russian Far East.

The figures cited with regard to power and possible generation volumes allow us to draw conclusions with regard to the potential for larger scale trans-boundary power flows and the practicality of further developing cross-border power interconnection in Northeast Asia.

### **Uncertainties**

1. The foreign policy situation on the Korean Peninsula.
2. Legislation and investment protection in the DPRK. The DPRK has adopted a number of laws and regulations on the matter.
3. Estimates of the volumes, the structure and solvent electric power demand of the DPRK. The price of the electric power supplied by Russia to the DPRK.

As a part of the work on estimating the potential for power consumption in the DPRK, an analysis of the external trade of the DPRK has been conducted.

This analysis confirms that growth will take place in energy-consuming industries: mining, fishery, timber cutting and woodworking. Enterprises in these industries could potentially balance out solvent demand for electric power in the very near future.

A joint venture is the preferred organizational form for the enterprise conducting the construction and maintenance of the transmission line. As the project is an infrastructure venture and is significant for the country as a whole, it is essential to obtain support and preferential treatment for the electric supply venture being created.

For reference only: five special territorial economic and trade zones being formed in the DPRK have been granted preferential operating regulations. These include the Rason (Rajin-Sonbong) free economic and trade zone, which is located on the eastern coast of

the DPRK close to the border with Russia and through which the proposed route of the power transmission line runs.

The exact price of the power delivered will be determined once the results of the feasibility study have been disclosed.

The market will determine the price, based on the cost of establishing cross-border power interconnection and expanding cross-border power supplies.

### **Project participants and their functions**

- «UES of Russia»
- DPRK Ministry of Electric Power and Coal Industry
- Large corporate power consumers in the DPRK
- Private companies willing to act as co-investors
- Project trustees: the state and senior political officials (representatives) of the Russian Federation, the DPRK and, eventually, other countries in Northeast Asia.

«UES of Russia» holds the initiative and the guidance of the project. A managing company in Russia or another country, or a specially formed bilateral (or multilateral) joint venture may be designated as the operator of the newly established property.

A Russian company may be designated as the subcontractor for all of the project work in the relevant bilateral agreements between Russia and the DPRK. If the investors insist, the work may be put out to tender.

Any company may be designated as the electric power supplier for export, within the framework of the existing legislative and regulatory system; this makes it reasonable to continue examining the potential for reforming the price zone of the Vostok Unified Energy System, as well as developing adequate mechanisms for determining the objective price, procedures for concluding transactions and securing guarantees that transaction obligations will be fulfilled, including obligations relating to spot transactions.

The investors will be determined depending on the degree of the political guarantees that can be given, both in connection with the project and within the scope of dialogue between Russia and the DPRK. At most, one may rely on long-term, relatively inexpensive credits from the international financial market. A more realistic version would involve attracting the Russian funds by providing investors with certain incentives.

### **Opportunities resulting from the project**

There is potential for supplying power to the ROK; this would require the transmission line, supplying about 2.5-3.0 GW of 500-600kV DC power, to be extended about 900km to the ROK border and beyond.

### **Factors conducive to the success of the project**

- The existence of private business as a solvent consumer in the territory of the DPRK (the Rason free trade zone).
- The interest of guiding organizations in the DPRK, confirmed by the minutes of the negotiations and practical organizational undertakings (training of specialists).
- The support to the project extended by top officials in the Far East Federal District of Russia.
- The potential held by the power sector in the Far East of Russia and the role of «UES of Russia» in the project.

- The fact that the project would require less time and money to complete than any of the alternatives.
- Cooperation with international organizations such as UN ESCAP, UN ESC and ERINA, and their support for and participation in the project.