Ex-Ante Evaluation (for Japanese ODA Loan)

South America Division, Latin America and the Caribbean Department, JICA

1. Basic information

Country: The Republic of Paraguay (Paraguay)

Project name: Project for Improving Efficiency of the National Electric Power System

Loan Agreement: August 18, 2021

2. Background and Necessity of the Project

(1) Current State and Issues of the Electric Power Sector in Paraguay

In the Republic of Paraguay (Hereinafter referred to as "Paraguay"), an average growth rate of 4.5% was recorded for real GDP from 2011 to 2017, and electric power demand grew by an average of 7.0% yearly from 2011 to 2018 (maximum electric power demand in 2018 was 3,226 MW). The Administración Nacional de Electricidad (ANDE), which is the executing agency of this Project, is collectively in charge of development and operation/maintenance of power generation and transmission facilities in Paraguay. In the long-term plan up to 2030 that ANDE created in 2019, the average rate of increase in electric power demand is assumed to be 7.7%, and the electric power demand is set to exceed the existing electrical power plant capacity (approx. 8,810 MW) in 2030. Paraguay has also experienced an economic slowdown due to the global spread of COVID-19, and while it is expected that ANDE will reexamine its long-term plan, it is also anticipated that trends in electric power demand will remain unchanged, and will continue increasing in the future.

The challenge with ANDE's electric power business lies in efficiency, and the biggest challenge is the inefficiency of transmission and stable power supply to the Asunción metropolitan area, which accounts for 58% of electric power demand in Paraguay. ANDE's suppliers for electric power are Itaipu Binacional and Entidad Binacional Yacyretá, which are bilateral public corporations, and electric power from both power plants are transmitted through 500kV transmission lines, respectively, to the Villa Hayes Substation located in the northern part of the Asunción metropolitan area. Nearly all metropolitan electric power demand is supplied from this Substation through a 200kV transmission line. There are no other high-voltage power transmission routes to the metropolitan area that do not go through this Substation, and thus, with the growth of demand for electric power in the metropolitan area, there is an overload on the Villa Hayes Substation, resulting in an increase in the number of power outages in the metropolitan area in recent years. Although a long-distance power grid is connected to

the metropolitan area at medium voltage (220kV), the transmission loss is large and inefficient.
Presently, nearly the total amount of electric power in Paraguay is supplied based on inexpensive renewable energy (hydropower). To strengthen the capacity to supply stable electric power and maintain balanced supply-demand in the future and avoiding power outages, ANDE seeks to promote energy efficient facilities to reduce power consumption and improve the efficiency of power systems.

This Project aims to improve the efficiency of the national electric power system, by developing a 500kV transmission line (Yguazú to Valenzuela) in the eastern region of Paraguay, and replacing the street lights in Asunción as well as lighting fixtures, air-conditioning equipment, etc. in public facilities with energy efficient equipment.

(2) Japan's and JICA's Cooperation Policy and Operations in the Electric Power Sector
In its Country Assistance Policy for the Republic of Paraguay (April 2012), the Government of Japan regards the overall vulnerability of the economic and social infrastructure, including the electric power in Paraguay, as an impediment to development, and supports the development of power generation facilities, etc. for stable power supply. This Project, which promotes stable power supply and energy efficiency, is oriented as an "economic infrastructure enhancement program" in the priority area of "sustainable economic development" as outlined in this Policy.
With the objective of supporting climate change measures in the Latin America/Caribbean region, JICA established set up a co-financing framework, known as Co-financing for Renewable Energy and Energy Efficiency (CORE) for this region with the Inter-American Development Bank (IDB) in 2012. In March 2021, this was renewed as the "Cooperation for Economic Recovery and Social Inclusion" that includes climate change measures and promotion of high-quality infrastructure, etc. This Project is carried out under the Framework based on co-financing with IDB.

(3) Other Donors' Activities
IDB has been implementing three financing projects (total amount committed: Approx. $242 million) in relation to the electric power sector in Paraguay since 2006. There is also a plan to lend a total of approximately $300 million to ANDE over a three-year period in the future, and this Project is the first matter in that process. Other international agencies such as the Development Bank of Latin America (CAF) and the OPEC Fund for

International Development (OPIC) are also constructing substations, etc. to improve electric power systems in Paraguay.

3. Project Description

(1) Project Objective

The objective of the Project is to provide stable and efficient power supply to the metropolitan area by constructing 500kV transmission line between Yguazú and Valenzuela as well as implement energy efficient equipment for public facilities in the area, thereby contributing to the efficient electric power system and the sustainable economic development of the country.

(2) Project Site / Target Area

1) Construction of 500 kV transmission line: Approx. 210 km, from Yguazú city in Alto Paraná Department to Valenzuela in Cordillera Department

2) Replacement/installation of energy efficient equipment: In Asunción city

(3) Project Components

1) 500kV transmission line:

Construction of core transmission line (Yguazú to Valenzuela (approx.. 210 km))

2) Replacement/installation of energy efficient equipment:

Replacement of lighting fixtures, air-conditioning equipment, etc. in public facilities in Asunción city with energy efficient equipment.

3) Consulting services:

Detailed design, bid support and construction management related to transmission line construction, organizational reinforcement of ANDE, etc.

(4) Estimated Project Cost (Loan Amount)

The total project cost is 16.948 billion yen (of which 9.294 billion yen is covered by the ODA loan)

(5) Schedule

August 2021 to December 2026 (total of 64 months). The project will be completed upon installation of energy efficient equipment (December 2026).

(6) Project Implementation Structure

1) Borrower: La Administración Nacional de Electricidad (ANDE)

2) Guarantor: The Republic of Paraguay
3) Executing agency: ANDE
4) Operation and Maintenance agency: ANDE

(7) Cooperation and Sharing of Roles with Other Donors

The Project will be under the supervision of the IDB, the co-financer, based on the Framework Agreement of the CORE scheme.

(8) Environmental and Social Consideration / Cross-Cutting Issues / Category of Gender

1) Environment and Social Considerations

(i) Category: B

(ii) Reason for Categorization: The Project is unlikely to have a significant negative impact on the environment because it does not involve any sensitive sector, characteristic, or area as illustrated in the JICA Guidelines for Environmental and Social Considerations, announced in April 2010.

(iii) Environmental Permit: By Paraguayan law, it is mandatory to prepare an Environmental and Social Impact Assessment (EIAS) report related to construction of 500 kV transmission lines as is being done in this Project, and this report was created in November 2019. In November 2020, environmental approvals and licenses were obtained from the Ministry of Environment and Sustainable Development (MADES). It is not mandatory to create an EIAS report related to replacement/installation of energy efficient equipment.

(iv) Anti-Pollution Measures: It is anticipated that there will be impacts caused by air pollution (dust/exhaust gas), water quality, noise/vibration, waste, etc. during construction. Impacts are expected to be kept to a minimum through appropriate maintenance and speed limitation of construction vehicles, appropriate waste disposal, water quality monitoring of wastewater and of water areas into which wastewater is discharged, safe storage of waste and appropriate disposal, etc. that follows domestic laws. In addition, with regard to replacement and installation of energy efficient equipment, there is the possibility that mercury treatment is necessary for some public lighting that is planned on being replaced. Since there is presently no industrial waste disposal company for mercury in Paraguay, ANDE is planning on handling the process based on instructions from MADES after submitting the initial environmental examination (IEE).

(v) Natural Environment: Part of the transmission line in this Project is located 170 m from the Ypeti Nature Reserve. By installing bird gliding roundabouts, etc., impacts are expected to be minimized. Discussions are being carried out with NGOs dealing exclusively with birds in the implementation stage, and the environmental management plan, etc. will be amended where necessary.

(vi) Social Environment: Compensation will be implemented in accordance with domestic laws and IDB/JICA guidelines, as there are expectations for this Project to be accompanied by usage restrictions under the transmission line and relocation of two households. There are no dissenting opinions in particular regarding the Project from affected residents.

(vii) Other/Monitoring: ANDE will carry out monitoring every half-period regarding the air quality, water quality, noise/vibration and waste during construction as well as noise/vibration during periods of shared use in the ecosystem and bird collision accidents.

2) Cross-Cutting Issues:

Upon reducing power transmission loss, etc. in Paraguay mainly through this Project, the mitigation effect of climate change through this Project (approximation of GHG emission reduction) is anticipated to be 90,016 tons (CO_2 conversion) in 2025, when the transmission line project will be completed, in cases where it is assumed that thermal power generation of neighboring countries can be reduced, and Paraguay exports renewable energy (derived from hydropower) to neighboring countries. Starting the following year, this amount becomes proportional to the amount of transmission loss reduced, followed by a maximum value of 278,810 tons starting in 2030, when this amount becomes constant.

3) Category of Gender: [Gender-responsive project] GI (S) (gender integrated project)

Description of Activities and Reason for Categorization: Based on IDB technology support, which targets ANDE, a current state oriented towards promotion of a gender-equal system, including appointment of women in technical jobs within ANDE, etc., has been verified. A gender action plan is being formulated for this Project.

(9) Other Important Issues: N/A

4. Targeted Outcomes

(1) Quantitative Effects

1) Performance Indicators (Operation and Effect Indicators)

Indicator name	Baseline (2018)	Target (2026)*
Reduction of greenhouse gases (t/year)	-	90,016 *
500kV transmission capacity (MVA)	4,400	6,600
Reduction of loss due to power outage (DEENS) (MWh/year)	-	12,284
Transmission loss (%/year)	5.36	4.98
Reduction of electric power consumption Street lights (MWh/year)	-	15,447
Reduction of electric power consumption ANDE facilities (kWh/m^2)	-	50

* The target is to be achieved by 2026 in line with the target year for the IDB..

* By reducing transmission loss, it is possible for more electric power to be exported to neighboring countries such as Brazil (during off-peak hours), and this number is based on reduction of electric power generation through thermal power generation in the export destination countries.

(2) Qualitative Effects

Improved efficiency of power system as a whole, continued economic development of Paraguay.

(3) Internal Rate of Return

Based on the prerequisites below, the economic internal rate of return (EIRR) of the project to construct a 500 kV transmission line is 28.78% and the financial internal rate of return (FIRR) is 8.07%; the EIRR for the project to replace/install energy efficient equipment is 10.68% and the FIRR is 10.76%. The project life is anticipated to be 20 years.

1) Construction of 500 kV transmission line

[EIRR]

Costs: Project costs, operation and maintenance costs, etc. (both exclusive of tax)

Benefits: Reduction of opportunity loss caused by power outages, suppression of decline in power export through reduced transmission loss, etc.

[FIRR]

Costs: Project costs, operation and maintenance costs, etc.

Benefits: Reduction of decreased fee revenue caused by power outages, reduction of

power purchased from Itaipu Binacional and Entidad Binacional Yacyretá, salvage value, etc.
2) Replacement/installation of energy efficient equipment
[EIRR]
Costs: Project costs, operation and maintenance costs, etc. (both exclusive of tax)
Benefits: Reduction of opportunity loss associated with reduced power outages through decline in power consumption, etc.
[FIRR]
Costs: Project costs, operation and maintenance costs, etc.
Benefits: Increased revenue associated with reduction of uncollected electricity fees, etc.

5. External Factors and Risk Control	

(1) Preconditions: Consensus is formed regarding usage restrictions under power transmission lines and relocation of residents.
(2) External Factors: Procedure for approval by the Congress of Paraguay for E/N and L/A related to implementation of this Project is not significantly delayed.

6. Lessons Learned from Past Projects

In the ex post factor evaluation of the yen loan project for Vietnam, "Phu My-Ho Chi Minh City 500kV Transmission Line Project (FY evaluated: 2008)", regarding connection of the project system to existing facilities, it is reported that since agreement was not between the overseeing agencies regarding the technical specifications of the connection areas during the project preparation stage, difficulties arose regarding connection. The Yguazú Substation that is to be connected in this current Project is under construction based on financing from CAF, and the Valenzuela Substation based on funding from Fonplata. The Yguazú Substation is planned on being completed in December 2022 and the Valenzuela Substation in December 2023. The completion of both Substations is a necessary condition to manifest the development effects of this Project, and agreement has been reached with ANDE regarding the sharing of the state of progress of each with JICA through minutes of monitoring meetings held by each agency, project monitoring sheets, etc. The construction projects for both substations are projects implemented by ANDE, and so there are no major concerns regarding alignment of technical specifications and system of communication among the parties involved.

In the ex-post evaluation of the Japanese ODA loan project for Paraguay, "Asuncion Power Transmission and Distribution Network Improvement Project (FY evaluated:

2012)", it is indicated that a change in plans, including installing lines underground, changing the route, etc., became necessary due to difficulties with land use (a city which had initially agreed to construction of a facility decided to use the land for other purposes) and opposition from residents living near part of the 220 kV transmission line in the Asunción metropolitan area. In this current Project, three stakeholder meetings (multiple venues) have been held thus far for neighboring residents, and there have been no particular oppositions against this Project. There are also plans to continue providing thorough explanations regarding the Project and compensation in census surveys, etc. that will be conducted during the detailed design stage.

7. Evaluation Results

The Project is consistent with the development policies of Paraguay as well as Japan's and JICA's cooperation policies. It will also contribute to Goal 7 of the SDGs (affordable and clean energy). Therefore, it is highly necessary to support the implementation of the Project.

8. Plan for Future Evaluation

(1) Indicators to be used

As indicated in sections 4. (1) to (3).

(2) Timing

Ex-post evaluation: Determined upon discussing with IDB.

End