

Ex-Ante Evaluation

Southeast Asia Division 2, Southeast Asia and Pacific Department Japan International Cooperation Agency

1. Name of the Project

Country: Kingdom of Cambodia

Project: Phnom Penh City Transmission and Distribution System Expansion Project (Phase 2) (II) / Project for Enhancement of Operation and Management of Cambodian Transmission System

Loan Agreement: May 28, 2018

2. Background and Necessity of the Project

(1) Current State and Issues of the Power Sector in Cambodia and the Priority of the Project

The Kingdom of Cambodia (hereinafter referred to as “Cambodia”) has maintained a high real GDP growth rate of around 7% per year on average for the last 10 years. This economic growth has been driven by the export-oriented sewing industry and service industries including sewing industry. Moreover, Cambodia has been a promising candidate for Thailand- or China-plus-one strategies since 2010, attracting automobile parts industry and other manufacturing industries. With this strong growth, power demand has also been rising rapidly, especially in the capital city of Phnom Penh, which is densely populated and heavily industrialized. Both peak power demand and power generation grew at a robust rate of more than 20% per year on average during the years between 2003 and 2016. Although power generation capacity has increased with the construction of large power plants, the limited transmission and distribution capacity has caused a bottleneck in power supply in Phnom Penh. In addition, the underdeveloped power control system makes it more likely that an accident will result in an extensive and prolonged power outage.

In response to these urgent problems, the Phnom Penh City Transmission and Distribution System Expansion Project (ODA Loan) was launched to build and expand substations and install transmission and distribution lines and communication cables to create a transmission loop system in central Phnom Penh. Now, the Phnom Penh City Transmission and Distribution System Expansion Project (Phase II) (ODA Loan; hereinafter referred to as “the Project”) is being implemented to introduce the country’s highest-ever voltage of 230 kV in the transmission loop system in central Phnom Penh to allow power supply at a higher voltage as well as further construct and expand substations and distribution networks to ensure stable power supply in a larger area.

(2) Japan and JICA’s Policy for the Power Sector and the Priority of the Project

The Government of Japan has identified the “Industrial Development” as a priority area in its Country Development Cooperation Policy for Cambodia (July 2017), whose Annex, Rolling Plan, suggests support to “promote the electricity supply

system which is an important factor in attracting Foreign Direct Investment.” JICA’s Country Analysis Paper for Cambodia (March 2014) also indicates that since power generation development is promoted mainly by independent power producers (hereinafter referred to as “IPPs”), JICA should keep focus on expanding power transmission and distribution networks and strengthening operation and maintenance capacity to improve the stability of power supply especially in the capital city where power demand is increasing. The Project is consistent with the above-mentioned policies and analysis. Moreover, the Project’s efforts to construct and expand substations and transmission and distribution networks to improve the stability of power supply in the capital city of Phnom Penh are expected to contribute to Goal 7 of the Sustainable Development Goals (ensure access to affordable, reliable, sustainable and modern energy for all).

(3) Other Donors’ Activities

In the power sector in Cambodia, the World Bank supported rural electrification through the Rural Electrification Fund (hereinafter referred to as “REF”) in 2004. This support was completed in 2012, and now the REF continues to function as a department of Electricité du Cambodge (hereinafter referred to as “EDC”). The Asian Development Bank (hereinafter referred to as “ADB”) has implemented a project since 2012 to install 2,110 km of 22 kV distribution lines in rural areas as well as strengthen the institutional capacity of EDC mainly in key operational areas including strategic corporate management, financial management / investment planning, and human resource management. Meanwhile, the Export-Import Bank of China is planning to finance the extension of transmission lines in rural areas.

3. Project Description

(1) Project Objective

The objective of the Project is to enhance the stability of electrical supply in Phnom Penh, by providing new substations, transmission lines, distribution lines and related facilities, and augmenting the existing substations, thereby contributing to sustainable economic growth in Cambodia.

(2) Project Site / Target Area

Phnom Penh

(3) Project Components

1) ODA Loan Project

- i) Substations (construction of two new substations and expansion of two existing substations)
- ii) Transmission and distribution system expansion (expansion of 230 kV overhead and 230 kV underground transmission lines and 22 kV distribution lines)
- iii) Consulting services (basic design, detailed design, tender assistance, construction supervision, etc.)

2) Technical Cooperation Project related to ODA Loan

i) Inputs

A) Japanese Side

- Experts (short-term experts; 98M/M)
 - Chief Advisor / Power System Planning (Facilities Planning)
 - Transmission and Substation Facilities Operation
 - Power System Planning (Power System Simulation for Engineering (PSS/E) and Institute of Electrical Science (IES))
 - Power System Operation (PSS/E, National Control Center Operation Plan, Restoration)
 - Relay Setting
 - Transmission Line Facilities (Maintenance, Restoration, IES)
 - Substation Facilities (Maintenance, IES / Procurement)
 - Organisation Development
 - Organisation Development / Coordinator
- Provision of substation training equipment (transformers, transformation systems, etc.)
- Counterpart training in Japan and / or Third Countries (Power System Planning, Operation, Maintenance, etc.)
- Local operation cost

B) Cambodian Side

- Counterpart personnel
 - Project Director: EDC Deputy Managing Director (Planning and Technique)
 - Project Manager: EDC Director of Corporate Planning & Projects Department
 - Project Co-manager: EDC Director of Transmission Department
 - Project Co-manager: Director of IES
 - Other counterpart personnel: Technical staff in charge of Cambodian Transmission System planning and operation from Corporate Planning & Projects Department, Transmission Department, Generation Department, Business & Distribution Department and trainers of IES
- Provision of office for JICA experts
- Preparation of necessary equipment
- Operation cost

ii) Project Purpose / Indicators

The Cambodian Transmission System is properly and effectively planned, operated, and managed by EDC

Indicator 1. Power system plan is adequately updated and revised based on power system analysis.

Indicator 2. Power system plan is harmonized with facilities designing and construction in order to make facilities and equipment to be newly constructed, replaced, and/or expanded function in CTS in a well-

coordinated manner.

Indicator 3. Power system operation plan is adequately updated and revised based on results of power system analysis.

Indicator 4. The number of failures and defects found on EDC-owned facilities is reduced at post completion inspection and/or after handover to the Transmission Department. (necessary to set baseline and target value)

Indicator 5. Time duration in drills of early restoration from power outage is reduced to XX from the time at the first exercise. (necessary to set baseline and target value)

iii) Outputs

Output 1. Organisation capacity on managing CTS is strengthened.

Output 2. Training systems on CTS are enhanced

Output 3. Staff's capacity is improved on power system network planning, operation, and maintenance.

Output 4. Staff's capacity for early restoration from power outage is improved.

iv) Beneficiaries (Target Group)

Direct beneficiaries: Engineering staff from the EDC Corporate Planning & Project and Transmission Departments and IES Lecturers

Indirect beneficiaries: All people living in Cambodia (Population: 14.7 million)

(4) Estimated Project Cost

Yen Loan Amount: 27,003 million yen (Yen Loan Amount for the Project: 9,216 million yen)

(5) Project Schedule

ODA Loan Project: March 2015 (L/A signed for the Project (I)) to May 2022 (total 87 months). The Project will be deemed complete when the service starts (planned in June 2021).

(6) Project Implementation Structure

1) Borrower: The Royal Government of Cambodia

2) Executing Agency: Electricité du Cambodge (EDC)

3) Operation and Maintenance Agency: EDC

(7) Collaboration and Division of Roles with Other Projects and Donors

1) Japan's Assistance Activities

JICA has assisted in strengthening the operation and maintenance of transmission and substation facilities and EDC's system operation capacity through the Project for Improvement of Transmission System Operation and Maintenance (Technical Cooperation; from 2013 to 2015) and the Project for Enhancement of Operation and Management of Cambodian Transmission System (Technical Cooperation Project related to ODA Loan; from 2017 to 2021). The outcomes of these projects are expected to facilitate the proper operation and maintenance of the facilities being developed in the Project.

2) Other Donors' Assistance Activities

None in particular

(8) Environmental and Social Consideration / Poverty Reduction / Social Development

1) Environmental and Social Consideration

- i) Category B
- ii) Reason for Categorization: The Project is not located in a sensitive area, nor has sensitive characteristics, nor falls into sensitive sectors under the JICA Guidelines for Environmental and Social Considerations (April 2010), and its potential adverse impact on the environment are not likely to be significant.
- iii) Environmental Permit: The Initial Environmental and Social Impact Assessment (hereinafter referred to as "IESIA") report for the Project was approved by the Ministry of Environment on January 6, 2016.
- iv) Anti-Pollution Measures: During construction, the contractors will take air and noise pollution measures, such as sprinkling water to prevent dust and using low-noise equipment and construction methods, to minimize the adverse impact on the environment.
- v) Natural Environment: The Project is likely to have a minimal adverse impact on the natural environment since the Project site is not located in sensitive areas or their vicinity, such as national parks.
- vi) Social Environment: The Project needs to acquire 4.6 ha of land and causes involuntary resettlement of three households (15 persons). The land of 4.4 ha for expanded substations has been already acquired. As for the acquisition of the remaining 0.2 ha for steel poles for 230 kV overhead transmission lines and the involuntary resettlement of three households living within the Right of Way, the Resettlement Action Plan (hereinafter referred to as "RAP") will be modified based on detailed design results and then implemented in accordance with the JICA Guidelines and Cambodian laws and regulations.
- vii) Other / Monitoring: In the Project, the contractors will monitor air quality and noise levels under the supervision of EDC during construction, and EDC will monitor safety management and soil and water quality after handover. EDC will also monitor the land acquisition and involuntary resettlement processes.

2) Cross-Cutting Issues

- i) Climate Change-related Projects: The Project is expected to contribute to climate change mitigation (Estimated CO₂ emissions reduction from the Project as a whole: 6,846 tons per year)
- ii) Poverty Reduction and Considerations: None in particular
- iii) Measures for Infectious Diseases Including HIV/AIDS: The executing agency will require the construction contractors to take HIV/AIDS prevention measures for construction workers and local residents.
- iv) Participatory Development: None in particular
- v) Consideration for the Handicapped, etc.: None in particular

3) Gender Classification: Not applicable

Activities / Reason for Classification: The Project is not subject because it is unlikely to include specific actions that can contribute to gender equality.

(9) Other Important Issues

None in particular

4. Targeted Outcomes

(1) Quantitative Effects

1) Outcome (Operation and Effect Indicators)

Indicator	Facility	Baseline	Target (2023) [Expected value 2 years after project completion]
Transformer availability factor (%)	National Control Center	-	98
	Toul Kork Substation	-	99
Electricity supply (MWh year)	National Control Center	-	89,104
	Toul Kork Substation	-	90,119
Outage times of substation (times/year)*	GS5 Substation	-	0
	National Control Center	-	0

* This does not include outages attributable to natural and man-made disasters.

(2) Qualitative Effects

Stabilization of domestic power supply, promotion of investments, revitalization of the industry, etc.

(3) Internal Rate of Return

Based on the conditions indicated below, the Economic Rate of Return (EIRR) of the Project is estimated at 15.4%, and the Financial Rate of Return (FIRR) is estimated at 11.1%.

[EIRR]

Cost: Project costs and operation and maintenance expenses (both excluding tax; including the increased cost of purchasing electricity by IPP to cover the increased electricity sales volume)

Benefit: Reduction in the cost assuming that private electricity suppliers provide the increased electricity sales volume

Project Life: 30 years

[FIRR]

Cost: Project costs and operation and maintenance expenses (including the increased cost of purchasing electricity by IPP to cover the increased electricity

sales volume)

Benefit: Increased electricity sale income from the increased electricity sales volume

Project Life: 30 years

5. Prerequisites and External Factors

(1) Prerequisites

None in particular

(2) External Factors

None in particular

6. Lessons Learned from Past Projects

The ex-post evaluation of the Power Distribution Reinforcement Project in Thailand (evaluated in 2009) suggests that because the increasing sophistication of distribution system operations necessitates continuous human resource development, it is desirable to further promote employee skill development with an eye towards the automation of the distribution system in order to ensure the effective use of the infrastructure developed by the project.

The Project also needs to strengthen the capacity of EDC staff responsible for maintenance in the Transmission and Business & Distribution Departments. Therefore, the Project for Improvement of Transmission System Operation and Maintenance (Technical Cooperation) was implemented from 2013 to 2015 to enhance EDC's capacity to operate and maintain transmission and substation facilities, develop maintenance standards, and perform inspection operations as well as develop trainer certificate standards, train trainers, and transfer techniques. This was followed by another project, the Project for Enhancement of Operation and Management of Cambodian Transmission System (Technical Cooperation Project related to ODA Loan; from 2017 to 2021), which aims to develop a system that will enable EDC to work autonomously on operational improvements by reviewing and discussing standards and strengthening internal training systems. Thus, support is being extended to enhance EDC's system operation capacity in order to further strengthen the transmission and distribution facilities being developed in the Project.

7. Evaluation Results

The Project, aimed at improving the stability of power supply in the densely populated and heavily industrialized capital city of Phnom Penh, is deemed to conform to the development issues and policies of Cambodia and the assistance policies and analysis of Japan and JICA as well as contribute to Goal 7 of the Sustainable Development Goals. In addition, the Project is expected to underpin the business activities of Japanese firms in the Cambodian market. Therefore, it is highly necessary to support the implementation of the Project.

8. Plan for Future Evaluation

(1) Indicators to be Used

Per 4. (1) – (3)

(2) Timing

Ex-post evaluation: 2 years after project completion (The ODA loan project and the technical cooperation project related to ODA loan will be evaluated integrally)