Ex-Ante Evaluation (for Japanese ODA Loan)

South Asia Division 1, South Asia Department, JICA

1. Basic Information

Country: India
Project Name: Project for Renovation and Modernization of Umiam-Umtru Stage-III Hydroelectric Power Station
Loan Agreement: October 29, 2018

2. Background and Necessity of the Project

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

In India, energy consumption continues to increase along with rapid economic growth in recent years, and in 2015 it became the third largest electricity consuming country in the world after China and the US (Source: International Energy Agency). According to the Central Electricity Authority of India (Hereinafter referred to as "CEA"), the overall electricity supply and demand in India with actual values in fiscal 2016 are a supply shortage of 0.7% (the supply amount of 1,135,334 GWh in contrast with the demand amount of 1,142,929 GWh), and a supply capacity shortage at peak times of 1.6% (supply capacity of 156,934 MW in contrast with the demand amount of 159,542 MW), both of which have an improving tendency compared with those values of fiscal 2015 (a supply shortage of 2.1%, and a supply capacity shortage at peak times of 3.2%), but it is still in short supply. Furthermore, according to the Draft National Electricity Plan announced by the CEA in December 2016, it is anticipated that the overall electricity demand in India will be 2,132,000 GWh in 2026 and the peak demand will be 317,674 MW, both of which are about twice as large as those of fiscal 2016, making improvement in the power supply capacity an urgent task.

Located in the northeastern part of India, Meghalaya State has the 23rd largest land area (22,428 km^2) and the 23rd largest population (3,211,000 people as of 2016) out of the total of 29 states and 7 union territories in India. Development in the northeastern states including Meghalaya State is delayed compared with other regions, making power shortage a serious issue. Under these circumstances, the Government of India emphasizes the development of the northeastern states including Meghalaya State. It is also known that there are many hilly areas in the state and it is strongly affected by the monsoon, leading to an average annual rainfall of 12,000 mm (Source: State Government of Meghalaya) which is the highest in India and making the state rich in potential hydropower resources climatically/topographically. The total capacity of the facilities owned by the state is composed of hydropower/small hydropower; therefore, hydropower is the most important power source in the state. However, the total generation capacity of the state as of July 2017 is only about 350 MW (the practical capacity considering aged deterioration situation of each plant is about 311 MW) in contrast with the peak demand of about 410 MW (expected value for fiscal 2017), and an electric power supply shortage exceeding 5%-15% of the demand is still observed every year even now (Source: Preparatory survey report of the Project). To cover the electricity shortfalls, power interchange contracts are made with the NTPC, etc. to purchase relatively expensive electricity, creating the necessity to secure hydropower sources with low power generation cost. While it is anticipated that the electricity demand will increase to

2,049 GWh and the peak demand will increase to 444 MW in fiscal 2019, the state government is planning to increase the supply capacity by about 47 MW through the construction of new solar/small hydroelectric power plants, etc., but hydroelectric power generation has a large fluctuation of output depending on the season; therefore, it is urgent to repair the existing power plants in parallel in order to cover the demand increase.

Umiam-Umtru stage III hydroelectric power station (30 MW x 2 units) is one of the main hydraulic power sources that accounts for about 20% of the facility capacity of 350 MW held by the state, but aged deterioration has been progressing remarkably since the commencement of its operation in 1979. One of the two generator units is frequently shut down due to damages of the water turbines, etc., and the remaining unit often has unscheduled shutdowns. For this reason, the annual power generation amount has fallen to less than 40% of the original amount provided at the commencement of operation.

Joint action plan of the Ministry of Power in the Government of India and the State Government of Meghalaya (24 × 7 Power for All Meghalaya, in March 2015) clearly states the necessity for renovation of the Umiam-Umtru stage III hydroelectric power station (30 MW x 2 units) as the power supply improvement measures. Project for Renovation and Modernization of Umiam-Umtru Stage-III Hydroelectric Power Station (hereinafter referred to as “the Project”) is designed to improve the intrastate power supply capacity by carrying out the renovation of Umiam-Umtru stage III hydroelectric power station (30 MW x 2 units) around the basin of the Umiam River/Umtru River in the state of Meghalaya and to contribute to the industrial development and the improvement in living standards in the state, making the project itself positioned as an important approach in the development policy of the Government of India and the State Government of Meghalaya.

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

In Japan’s Country Assistance Policy for India (March 2016), promoting connectivity in the northeastern states region by developing infrastructure such as electricity is listed as the priority area as “reinforcement of connectivity.” Also, JICA Country Analysis Paper for India (March 2012) provides an analysis that an increase in power supply capacity and diversification of power supply are priority issues to accommodate rapidly increasing electricity demand, and the Project is consistent with these policies and analyses. Moreover, the Project is considered to contribute to Goal 7 of the SDGs “Ensure access to affordable, reliable, sustainable and modern energy for all” and Goal 13 “Take urgent action to combat climate change and its impacts.” Note that there were 80 ODA loan approval cases totaling 1,243.1 billion yen to the power sector in India as of September 2018.

(3) Other Donors’ Activity

The World Bank is providing support for the power transmission and distribution network reinforcement project in the northeastern states including Meghalaya State and Assam State. Moreover, the Asian Development Bank supports Assam State to reinforce its power sector, as well as providing assistance for the development of power transmission and distribution networks, enhancement of the capacity development of the Assam State Power Generation Company Limited, hydroelectric power generation, energy efficiency improvement, etc.

3. Project Description

(1) Project Objective

The objective of the Project is to improve the power shortage of Meghalaya by renovating, modernizing, and upgrading Umiam Umtru Stage III Hydroelectric Power Plant, situated by the Umtru River, thereby contributing to the industrial development and living standard improvement in the State and optimum utilization of water resources.

(2) Project Site/Target Area

Meghalaya State

(3) Project Components

a) Procurement/installation/repair/trial operation of electric/mechanical equipment
b) Procurement/installation/repair of civil equipment (penstock/gates, etc.)
c) Consulting services: detailed design, bidding assistance, construction supervision, organizational capacity development, etc.

(4) Estimated Project Cost

7,088 million yen (of which, the ODA Loan amount is 5,497 million yen)

(5) Schedule

October 2018 – November 2023 (62 months in total). Completion of trial operation of power plants (in May 2023) shall be the completion of the project.

(6) Project Implementation Structure

1) Borrower: President of India
2) Guarantor: None
3) Executing agency: Meghalaya Power Generation Corporation Limited
4) Operation and Maintenance Agency: Meghalaya Power Generation Corporation Limited will continue to perform the operational maintenance and management after the completion of the Project.

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

As JICA supported the “Umiam Hydro Power Station Renovation Project” (completed in 2002) in 1997 and the “Umiam Stage II Hydro Power Station R&M Project” (completed in 2012) in 2004, the Project mutually complements these projects to contribute to stabilization/expansion of the amount of electricity supply in the state.

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

1) Environmental and Social Consideration
   (i) Category: C
   (ii) Reason for Categorization
   The Project is considered to impose minimum undesirable impacts on the environment according to the JICA Guidelines for Environmental and Social Considerations (April 2010).
2) Cross-cutting Issues:
   The Project is categorized as a project that contributes to climate change measures (mitigation). The estimated value of the mitigation effect (the amount of greenhouse gas emission reduction) through the Project is 126,385 tons/year of CO_2 equivalent.
3) Gender Category: (GI) (Gender Mainstreaming Needs Survey/Analysis Project)
   <Description of activities and reason for classification>
   Although needs for the gender mainstreaming were investigated in the preparatory survey, implementation of specific measures to contribute to

gender equality and women's empowerment was not carried out in the Project; therefore, it is categorized as a “Gender Mainstreaming Needs Survey/Analysis Project.”

(9) Other Important Issues
None in particular

4. Targeted Outcomes

(1) Quantitative Effects
Performance Indicators (Operation and Effect Indicator)

Indicator	Baseline (Actual value in 2017)		Target (2025) [Expected value 2 years after project completion]
Unplanned Outage Hours (hours/year)	Unit 1	7,613.18	88
	Unit 2	4,034.37	
Maximum Output (MW)	60*		66
Number of Circuit Breaker Trips and Equipment Failures Caused by Human Error (times)	Not measured		0
Repetition of training conducted by leader (times)	Not conducted		3
Certification of new leader by examination (persons)	Not conducted		6
Annual generation (GWh/year)**	65.3		157.5
Power Plant Operating Rate (%)**	14		30
Operating Time (hours/year)**	Unit 1	1,701	5,312
	Unit 2	3,160	
Overflow Amount Except for Times of Flooding (m^3)***	0		0

* Peak supply capacity is defined as “the maximum power output that can be supplied at peak times.” Although Unit 1 frequently stops due to failure, there was a period when it was operated temporarily, and therefore 60 MW is the baseline value according to the definition.

** It is measured as a reference value, since the amount of annual electric power generation, power plant operating rate, and operating time are under the influence of the water amount available for power generation.

*** The amount of overflow during the time of flooding is an indicator for the purpose of confirming the repair effect of civil engineering equipment and is considered to be a reference value.

(2) Qualitative Effect
Intrastate power supply stabilization, improvement in the living standards of residents, and industrial development of the state

(3) Internal Rate of Return
Under the conditions indicated below, the economic internal rate of return (EIRR) and the financial internal rate of return (FIRR) will be 13.6% and 5.0%, respectively.

[EIRR]
Cost: Project cost (excluding tax), operation and maintenance expenses

Benefits: Reduction of substitutional goods (amount of electricity purchased from power supply owned by the central government, operational maintenance and management cost)
Project Life: 35 years
[FIRR]
Cost: Project cost, operation and maintenance expenses
Benefits: Revenue from the sales of electricity obtained by the renovation
Project Life: 35 years

5. Prerequisites / External Factors

None in particular

6. Lessons Learned from Past Projects

The results of the ex-post evaluation of “Umiam Hydro Power Station Renovation Project” in India (Evaluation year: fiscal 2006), etc. list some necessities as a lesson such as the implementation of overhaul (disassembly, inspection, repair) and routine maintenance inspection/thorough data record that were carried out by the executing agency, in addition to the periodic renewal of major equipment/parts.

At Umiam-Umtru stage III hydroelectric power station, no overhaul has been conducted even once since the commencement of its operation, and inspections have not been carried out regularly. For this reason, the Project intends to develop the capacity for proper implementation of facility maintenance/management work through consulting services.

7. Evaluation Results

The Project, to renovate the Umiam-Umtru stage III hydroelectric power station that has an important role as an intrastate power source and to prevent its long-term downtime beforehand, is specified as a priority project in the electric power policy of the Government of India and the State Government of Meghalaya. It is also consistent with the support policies/analyses of Japan and JICA that set forth the infrastructure support such as electricity in the northeastern states. Furthermore, since it is considered to contribute to Goal 7of the SDGs “ensuring access to affordable, reliable, sustainable, and modern energy for all,” and Goal 13 “urgent action to deal with climate change and its impacts,” it is highly necessary for JICA to support the implementation of the Project.

8. Plan for Future Evaluation

(1) Indicators to be Used
Same as 4. (1) - (3)
(2) Timing of the Next Evaluation
Ex-post evaluation: 2 years after project completion

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