People's Republic of Bangladesh

FY2020 Ex-Post Evaluation of Japanese ODA Loan

"Rural Electrification Upgradation Project"

External Evaluator: Hisae Takahashi, Ernst & Young ShinNihon LLC

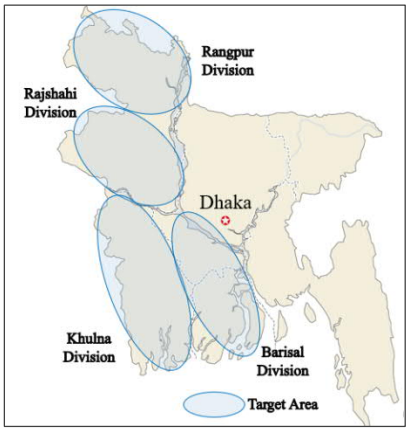
0. Summary

The project was implemented with aims to reduce power distribution loss and strengthen and stabilize the power supply systems, which make power supply efficient by constructing and rehabilitating the existing power distribution facilities, thereby contributing to the economic development and poverty reduction in the western and the southern part of Bangladesh and the greenhouse gas elimination.

The purpose of the project is in line with Bangladesh's development plan at the time of appraisal and ex-post evaluation, which has emphasized infrastructure development in the power sector, development needs to improve the demand-supply gap and distribution loss ratio and Japan's ODA policy, which has positioned the power sector as a priority area for assistance. Thus, its relevance is high. In implementing the project, although the project cost was within the plan, the project period exceeded the plan due to delays in consultant selection and bidding, as well as changes in the substation specifications and capacity. Therefore, efficiency of the project is fair. Implementing the project boosted the maximum output and power sales volume, reduced the extent of power outages and improved the distribution loss ratio, with targets mostly attained in all these areas. Moreover, thanks to various training, a change in the level of awareness of customers towards the need to use electricity efficiently and improvement of customer service by the Rural Electrification Society (Pali Bidyut Samity: PBS) was also apparent. The project also had an impact in terms of revitalizing the local economy and boosting the living environment and living standards of local residents, hence its effectiveness and impacts are high. In operation and maintenance terms, despite no problems in the technical aspect and the status of operation and maintenance, minor issues remain in the institutional/organizational and financial aspects. Therefore, sustainability of the project effects is fair.

In light of the above, this project is evaluated to be satisfactory.

1. Project Description



Project Locations

33/11kV Substation
(Barisal Division, Patuakhali PBS, Golachipa Substation)

1.1 Background

At the time of the appraisal, power shortages were one of the biggest bottlenecks to economic growth in Bangladesh. In response to the increased electricity demand that accompanied the economic growth at the time, the installed supply capacity was only about 70% of peak demand, resulting in forced power outages. In the power distribution sector, the power distribution facilities were being expanded and streamlined, in accordance with the sector reform plan formulated by the Ministry of Electricity in Bangladesh, but the power distribution loss ratio (15.6%) remained high nationwide due to aging facilities, losses due to extending low-voltage lines over long distances, poor meter reading and so on. In rural areas, the demand for electricity to operate irrigation facilities is high, particularly during the dry season and responding to it was considered a priority from a food security perspective. For the electricity supply to rural areas, the government established the Rural Electrification Board (REB) in 1977 and has been developing an electrification program. The REB has established PBSs, comprising local residents who receive electricity in each region and has commissioned PBSs the operation of the power distribution services to expand the electricity supply. While closing the gap in electrification rates between rural and urban areas (31 and 83% respectively) remained key, limited upstream power generation capacity meant streamlining and stabilizing the power supply by rehabilitating and upgrading existing distribution network facilities and boosting agricultural productivity were also priorities. In the rural areas west of the Jamuna River in particular, the power supply from system facilities was unable to meet demand for electricity due to the lack of power distribution networks. In response, this project was implemented as part of efforts to meet the soaring demand for power for irrigation facilities, particularly during the dry season, and help reduce high levels of poverty in the west of the country, by constructing and rehabilitating a power distribution network in the area.

1.2 Project Outline

The objective of this project is to reduce power distribution loss and strengthen and stabilize the power supply systems, which make power supply efficient by constructing and rehabilitating the existing power distribution facilities, thereby contributing to the economic development and poverty reduction in the western and the southern part of Bangladesh and the greenhouse gas elimination.

Loan Approved Amount/ Disbursed Amount	13,241million yen/13,144million yen
Exchange of Notes Date / Loan Agreement Signing Date	March 2010/March 2010
Terms and Conditions	Interest Rate 0.01% Repayment Period 40 years (Grace Period 10 years) Conditions for Procurement General Untied
Borrower / Executing Agency	Government of the People's Republic of Bangladesh / Rural Electrification Board
Project Completion	June 2016
Target Area	Rajshahi Division[1], Khulna Division, Barisal Division
Main Contractor (Over 1 billion yen)	–
Main Consultants (Over 100 million yen)	SMEC International Pty Ltd. (Australia)/ACE Consultants Ltd. (Bangladesh) /Niaz & Associates Ltd. (Bangladesh) (JV)
Related Studies (Feasibility Studies, etc.)	The Preparatory Survey Report for the Project for Rural Electrification Upgradation Project (2009)
Related Projects	[ODA Loan Project] ・ Area Coverage Rural Electrification Project (Phase IV-C) (1995) ・ Rural Electrification Project (5-B) (2001) ・ Power Distribution and Efficiency Enhancement Project (1999) [International Organization, Other Development Partners] ・ Asian Development Bank (ADB) : - Power Sector Development Program (2003) - Power System Efficiency Improvement Project (2011) ・ World Bank (WB) : - Power Sector Development Technical Assistances Project (2004) - Bangladesh Power Sector Development Policy Credit (2008)

[1] Since the Rajshahi district was divided into two districts, Rajshahi and Rangpur, in 2010, the area covered at the time of ex-post evaluation comprised the four districts of Rajshahi, Rangpur, Khulna and Barisal.

2. Outline of the Evaluation Study

2.1 External Evaluator

Hisae Takahashi, Ernst & Young ShinNihon LLC

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: November 2020 – January 2022

Duration of the Field Study: March and July 2021 (Conducted by the local assistant)

2.3 Constraints during the Evaluation Study

In this ex-post evaluation, the site survey could not be implemented by the evaluator due to the spread of COVID-19. For this reason, the site survey was implemented by local assistant under the direction of the evaluator, and the evaluator conducted a desktop evaluation based on the results of the information collected, beneficiary survey, and site inspections carried out by the local assistant.

3. Results of the Evaluation (Overall Rating: B[2])

3.1 Relevance (Rating: ③[3])

3.1.1 Consistency with the Development Plan of Bangladesh

Bangladesh's development plan at the time of the appraisal, the *Moving Ahead: National Strategy for Accelerated Poverty Reduction II (PRSP)* (2008), noted the need for power sector reform and identified the sector as a key infrastructure for economic growth that would help reduce poverty. Moreover, to eliminate the gap in electrification rates between rural and urban areas, rehabilitating and reinforcing existing distribution network facilities was identified as a priority. The long-term vision of the power and energy sector at that time, *Policy Guideline for Electricity and Energy Sector Reform* (2000), also set out three points as the long-term vision of the electricity sector: (a) ensuring a power supply capacity for all people by 2020, (b) a highly reliable electricity supply and (c) an electricity supply whose tariff deemed appropriate[4].

At the time of the ex-post evaluation, the country's development plan, the *Eighth Five-Year Plan* (FY2020-2025), has positioned the power and energy sector as one that underpins the country's economic growth and has identified boosting energy efficiency by further reducing transmission and distribution losses, as well as expanding power generation to meet demand, as a key strategy for the sector. Moreover, the *Revised Electricity and Energy Master Plan* (2016), a plan to develop the electricity and energy sectors, sets out a vision of how domestic resources

[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[3] ③: High, ②: Fair, ①: Low
[4] Source: *Eighth Five Year Plan* FY 2020 - FY 2025

can be used efficiently, large-scale power sources developed and high-quality and highly stable electricity provided to meet increasing demand for electricity in line with economic growth[5]. Moreover, under the Prime Minister's initiative, a goal of extending access to electricity to all households has been set in Bangladesh, which REB is promoting[6] in all sub districts[7].

As mentioned above, the national development plans of Bangladesh at the time of the appraisal and ex-post evaluation positioned the power and energy sector as a key field that boosts the country's economic growth. It also indicates its focus on improving power distribution efficiency and rural electrification rates, underlining a consistency with the project's objective, namely to ensure an efficient power supply by improving power distribution facilities in rural areas.

3.1.2 Consistency with the Development Needs of Bangladesh

At the time of the appraisal, the electricity supply in Bangladesh could not keep up with the increase in demand due to economic growth and the gap between supply and demand was widening, with electricity demand peaking at approximately 6,066 MW and installed capacity of approximately 4,037 MW in fiscal year of 2009. Moreover, although power transmission and distribution loss ratios were reduced by expanding and further streamlining facilities that had been promoted based on power sector reform, the need to improve the high power distribution loss ratio due to aging facilities, power distribution at low voltage, inspection flaws and theft of electricity remained issues to resolve.

Table 1 Transmission / Distribution Loss Rate (%) in Bangladesh as of the Appraisal

	2004	2005	2006	2007	2008
Transmission loss	3.5	3.6	4.5	4.1	3.5
Distribution loss	20.0	17.8	16.5	17.1	15.6

Source: World Bank "Project appraisal document for Siddhirganj Peaking Power Project" (October 2008), BPDB, Power Cell

Moreover, as well as the electrification rate in rural areas (31%) being lower than that in urban areas (83%) (2005), the electricity supply to urban areas such as Dhaka tended to be prioritized over that to rural areas, which ultimately highlighted the reduction in the electricity supply to rural areas as an issue. In the rural areas to the west of the Jamuna River, target of this project, supplying electricity to rural areas during the dry season has been prioritized, when the demand for electricity to operate irrigation facilities soars. However, the overload and high loss rate of power distribution had become hindrances to reducing the gap between supply and demand, as the aging and inefficient power distribution facilities were frequently overloaded, and the power supply had to be cut off.

[5] Source: *Power System Master Plan 2016 Final Report*
[6] Source: REB *Annual Report* 2019-2020
[7] In Bangladesh, it is known as Upazilla: an administrative unit under a district.

At the time of the ex-post evaluation, the gap between supply and demand had improved significantly (power demand at peak time is about 13,300 MW and the installed supply capacity is about 20,383 MW) and the transmission and distribution losses (transmission loss ratio : 2.9%, distribution loss ratio : 8.7%, in 2019)[8] have also improved compared to the time of the appraisal. The power distribution loss ratio in the area covered by the REB (mainly rural areas) has also been reduced from 14.8% (2009) at the time of appraisal to 9.9% (2019) at the time of ex-post evaluation[9]. The country has also been promoting electrification in rural areas to allow all citizens access to power, which has seen the rate of electrification in such areas soar (85.1%) (2018)[10]. However, as the country's economy continues to grow, peak demand is expected to increase in future and there is a need to secure a supply capable of meeting ever-increasing demand and providing a stable electricity supply. Accordingly, in addition to sufficient power capacity, it can be said that the need to develop power distribution network facilities capable of providing a stable power supply remains high.

3.1.3 Consistency with Japan's ODA Policy

At the time of the appraisal, the *Country Assistance Program for Bangladesh* (2006) highlighted inadequate capital investment, inefficient management, inappropriate electricity tariff levels and others as issues in the power sector and focused on "support for policy, management, operational and financial improvements in the sector as a whole," "expansion of generation capacity to reduce the gap between supply and demand" and "support for reform efforts in the transmission and distribution sectors." Moreover, in the *Country Assistance Strategy for Bangladesh* (2006), one of the priority targets for support to Bangladesh was economic growth and the power sector was identified as a priority area for developing economic infrastructure. This project aims to further streamline the electricity supply in rural areas of Bangladesh by developing a power distribution network, which is consistent with Japan's ODA policy.

3.1.4 Appropriateness of the Project Plan and Approach

Although some changes were made to the project output (the total extension of the power distribution network was reduced to 93% of the plan), the changes were within a scope that did not unduly affect the expected result. Therefore, it can be concluded that there are no particular problems in the planning, design, logic, and approach of the project.

In light of the above, this project has been highly relevant to the Bangladesh's development plan

[8] Source: Questionnaire answers from the executing agency
[9] Source: REB *Annual Report* 2009, 2019
[10] Source: Bangladesh Bureau of Statistics, *Statistical Yearbook* 2020

and development needs, as well as Japan's ODA policy. Therefore, its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The planned major outputs of the project consisted of the upgradation and construction of medium- and low-voltage lines, construction and augmentation of substations and provision of consulting services. The major planned and actual outputs are shown in Table 2.

Table 2 Planned and Actual Output

	Plan	Actual
1. Upgradation and construction of medium- and low-voltage lines [Note 1]		
33kV line upgradation	1,184 km	882 km
11kV line upgradation	1,579 km	1,975 km
33kV line construction	885 km	852 km
11kV line construction	1,536 km	1,135 km
Total extension	**5,184 km**	**4,844 km**
2. Construction and augmentation of substations [Note 2]		
New construction	50 unit	As planned
Augmentation	30 unit	As planned
3. Foreign and local trainings		
Foreign trainings	46 persons	48 persons
Local trainings	183 persons	As planned
4. Consulting service		
DSM [Note 3] consultant	210 man-months Detailed design, follow up for tendering, construction supervision, formulation of operation and maintenance plan for distribution facilities, training implementation, baseline survey/monitoring/evaluation for socio-economic impact, training implementation for awareness of residents, etc.	477 man-months Scope of the support was as planned.
SDCS [Note 4] consultant	510 man-months Data collection/draft preparation of detailed design, area mapping, fields investigation, construction supervision, etc.	688 man-months Scope of the support was as planned.

Source: Documents provided by JICA and the questionnaire answers from the executing agency

Note 1：Development of medium- and low-voltage lines includes installation and replacement of Automatic Voltage Regulator (AVR), circuit breaker for wiring, etc.

Note 2：Development of substations include the installation of capacitors, Automatic Circuit Recloser (ACR), disconnecting switch, lightning arrester, etc.

Note 3：Abbreviation of Design, Supervision and Management

Note 4：Abbreviation of Survey, Design and Construction Supervision

As shown in Table 2, although local and overseas training proceeded mostly as planned, there were increases and decreases mainly in the total length of medium- and low-voltage lines and its upgrading and construction, and the number of man-months of consulting services assigned. The details of each change and reasons are as follows:

Total length of medium- and low-voltage lines upgraded and constructed

The preparatory survey for this project was conducted in 2009, followed by the construction work in earnest in 2013. Meanwhile, the lines which needed upgrading so urgently were constructed by leveraging other funding. At the same time, construction of sections that were outside the scope of this project but had a high degree of urgency at the time of start of construction was added. As a result of these adjustments, the total length of the upgradation and construction of medium- and low-voltage lines was shortened from the plan. This is because some of the urgent sections were constructed or upgraded with other funds after appraising this project and before commencing construction, meaning certain areas were excluded. The new section was also upgraded within the budget to meet local needs, which can be seen as a flexible response based on the urgency of the development of the power distribution network.

Substation: Examine scope to introduce indoor models and boost capacity

In Bangladesh, although outdoor-type substations were normally used, the installation of and replacement by indoor-type substations was considered in this project with the approval of the Technical Specification Committee (TSC) when the Development Project Proposal (DPP) was formulated, with securing the security in mind. In fact, due to cost and space issues, the proposal to install indoor-type substations proved infeasible and only some substations were installed with semi-indoor-type substations. Furthermore, the economic growth and changes in people's lives have led to the increased electricity demand since 2009 when the preparatory survey was conducted, and the substation capacity was increased. Though this change delayed the progress of the project, the increase in capacity to meet demand was considered an appropriate change, in line with local conditions.

Increase in staffing for consulting services

・ Increase in man-months of DSM consultants assigned

The actual number of man-months of deployed consultants more than doubled the planned number. One of the reasons for this increase is the fact that the work scope of the DSM consultant has been expanded to examine the installation of indoor-type substations instead of the outdoor type used in Bangladesh. Moreover, the contract for the DSM consultant was originally planned to last until June 2015, but along with the project postponement, the contract period was also extended until June 2016, which also affected the increase in man-months. In addition, the consultant had to coordinate, monitor and supervise the quality and proper

placement of equipment and materials at all sites (80 substations), which affected to increase their man-months[11].

・ Increase in man-months of SDCS consultants assigned

Initially, the project planned to assign a consultant to each of the 11 management zones. However, it is geographically burdensome for one consultant to manage multiple PBSs. Thus, consultants were assigned to each of the 33 PBSs rather than to each management zones to provide more precise follow up in each area. Consequently, although the number of consultant man-months increased, it facilitated more effective and smoother implementation of the project by assigning a consultant who was familiar with each PBS[12]. The change was made to support each region more effectively and was deemed appropriate, since effective support was actually provided.

Photo Newly Constructed Medium- and Low-Voltage Lines (33 kV Line)
(Rangpur Division, Dinajpur PBS-2)

3.2.2 Project Inputs

3.2.2.1 Project Cost

The total project cost was 17,184 million yen (of which the yen loan portion was 13,144 million yen), lower than the originally planned cost of 18,436 million yen (of which the yen loan portion was 13,241 million yen) (93% of the original plan).

Table 3 Planned and Actual Project Cost [Note 1]

(Unit: million yen)

	Plan			Actual		
	Total	Japanese portion	Bangladesh portion	Total	Japanese portion	Bangladesh portion
Material & construction	12,789	10,375	2,054	14,180	12,702	1,478
Vehicles for maintenance	60	60	0	57	57	0
Trainings	82	82	0	63	63	0
Consulting service	641	641	0	430	430	0
Price escalation	1,288	1,122	166	0	0	0
Contingency	711	600	111	0	0	0
Interest during construction	3	0	3	0		0
Land acquisition and compensation	71	0	71	46	0	46

[11] Source: Questionnaire answers from the executing agency and interview survey
[12] Source: Questionnaire answers from the executing agency

Administration cost	782	0	782	328	0	328
Tax	2,009	0	2,009	2,021	0	2,021
Total	18,436	13,240	5,196	17,125 Note1	13,253 Note1	3,873 Note1

Source: Document provided by JICA, questionnaire answers from the executing agency

Note 1: There is a difference between the data provided by the executing agency and that provided by JICA, but this is considered attributable to errors arising when converting the exchange rate and commission fees and so on. While the amounts shown in the table are the actual amounts provided by the executing agency, the data provided by JICA shows that the actual amounts for Japan and Bangladesh are 13,144 million yen and 4,040 million yen respectively, for a total project cost of 17,184 million yen.

Note 2: Exchange rate Plan: 1 taka = 1.33 yen, Actual: 1 taka = 1.29 yen (Average rate by International Financial Statistics of IMF during the project implementing period)

The main reason why the project cost was within the plan was due to exchange rate fluctuations and bid prices for training and consulting services that were lower than estimated. With regard to construction costs, the fact that some medium- and low-voltage line improvements were excluded from the project scope and no price escalation or contingency costs were incurred, also helped keep the project cost within the plan. As described in "3.2.1 Project Output," while the number of DSM and SDCS consulting man-months doubled, the cost of consulting services was lower than planned. This was due to a lower bidding price than expected, as well as a significant increase in man-months for local consultants, the unit cost for whom was lower than that of the originally contracted consultants, because of the increased number of areas where consultants were assigned.

3.2.2.2 Project Period

The project period[13] was planned to be 58 months, from March 2010 to December 2014, as opposed to an actual 76 months, from March 2010 to June 2016, which was longer than planned (131% of the plan).

Table 4 Planned and Actual Project Period by Item

	Plan	Actual
L/A	March 2010	March 2010
Selection of consultant	January 2010 - September 2010	April 2010 - June 2011
Detail design	October 2010 - March 2011	August 2011 - March 2012
Tender and contract	October 2010 - December 2011	September 2011 - November 2012
Manufacture and construction	June 2011 - December 2014	September 2011 - June 2016
Consulting services	September 2010 - December 2014	July 2011 - June 2016
Project completion	December 2014	June 2016
Project period	58 months	76 months

Source: Document provided by JICA, questionnaire answers from the executing agency

[13] The project period is defined as the period from the month in which the L/A is signed to the month in which the facilities were provided.

The main reasons for the delays were delays in selecting consultants, delays in bidding for procurement and delays related to examining substation design changes. The details of each factor are as follows:

Delays in selecting DSM consultants

From the expression of interest stage to the contracting stage in selecting DSM consultants, all relevant documents, including the expression of interest, request for proposals, documents related to technical and financial evaluations, meeting minutes, including the recommendation of purchase proposals of the REB board, draft contracts, contracts, etc., had to be submitted to the JICA field office for approval and then to the headquarters for approval[14]. The approval process required considerable time than expected, which exceeded the planned period[15].

Delays in bidding for procurement

- The selection of the DSM consultant was delayed because the bidding documents could not be agreed before the DSM consultant was assigned in JICA, hence REB had to wait a long time for the DSM consultant to be assigned.
- The upgrading and constructing the medium and low voltage lines were procured and constructed in seven packages, but no contractors in Bangladesh could handle the work for several of the packages, whereupon they had to be split up and re-bid for. Meanwhile, it took four months to obtain concurrence of JICA, which exceeded the expected period.

Delays related to examining the substation design and having to increase capacity

When installing the substation, scope to adopt indoor-type substations instead of the outdoor type usually used nationwide was examined as well as scope to increase capacity. When these changes were made, design was revised and civil works as well as electrical work were increased, which led to project delays.

3.2.3 Results of Calculations for Internal Rates of Return (Reference Only)

As for the internal rate of return calculated at the time of the appraisal, the details could not be confirmed from the calculation sheet and the basis for the calculation was unclear. Therefore, at the time of ex-post evaluation, it was recalculated on the basis described in the PCR[16]. Each internal rate of return and the relevant conditions are shown in Table 5 below.

[14] Regarding the process of consent and application for hiring consultants explained by the executing agency, JICA pointed out that this was considered to be a factual error, as there is no institutional requirement to obtain further approval from JICA headquarters after consent from the local office.
[15] Source: Questionnaire answers from the executing agency and interviews with the executing agency
[16] The estimated rate shown in PCR are based on the revised outputs.

Table 5　IRR and Condition

	Financial Internal Rate of Return (FIRR)	Economic Internal Rate of Return (EIRR)
IRR	At the time of modification [Note 1]: 17.54% At the time of the ex-post evaluation: 38.1%	At the time of modification:23.0% At the time of the ex-post evaluation: 36.7%
Cost	Project cost, operation and maintenance cost	Project cost (excluding taxes), operation and maintenance cost
Benefit	Revenue from sale of energy	Revenue from sale of energy based on the expected power price
Project life	30 years	

Source: Prepared by the evaluator based on the documents provided by JICA and the executing agency, and PCR.
Note 1: IRR estimate based on the plan described in PCR. Based on the plan after the output change.

(1) Financial Internal Rate of Return (FIRR)

The recalculated rate of FIRR at the time of ex-post evaluation was 38.1%, which was higher than estimated by the PCR[17]. This is because electricity sales increased significantly in all target areas, as described in "3.3.1 Effectiveness" below.

(2) Economic Internal Rate of Return (EIRR)

As for the EIRR, the concept of the cost is basically the same as the FIRR, except that taxes are excluded from the project cost and the recalculated rate at the time of ex-post evaluation is 36.7%, which exceeds the PCR estimate. This is due to a significant increase in electricity sales as well as FIRR, which confirms the high cost-effectiveness of this project.

In light of the above, although the project cost was within the plan, the project period exceeded the plan. Therefore, efficiency of the project is fair.

3.3 Effectiveness and Impacts[18] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

Table 6 summarizes the actual data since the year of project completion for each of the operation and effect indicators established at the time of the appraisal of the project. The target for the operation and effect indicators set at the time of the appraisal were expected to be achieved two years after the completion of the project. Since this project was completed in 2016, the achievement of the target is analysed based on the actual data in 2018.

[17] The electricity rate used in the recalculation is the average unit price of all PBSs. However, since the target area includes a large number of households as customers, the unit price of electricity charges is actually lower than the average, and the IRR is also expected to be lower than the IRR obtained in the recalculation.
[18] Sub-rating for Effectiveness is to be put with consideration of Impacts.

Table 6 Operation and Effect Indicators of the Project

Divisions / Indicators	Baseline	Target	Actual				
	2008		2016	2017	**2018**	2019	2020
		2 years after completion	Completion year	1 year	**2 years** after completion	3 years	4 years
Barisal (6PBS)							
Maximum output capacity (MW)	96.0	162.9	182	222	**244**	276	323
SAIDI per household (minutes) Note1	8.25	3.02	N.A.	N.A.	N.A.	N.A.	N.A.
(Alternative indicator) SAIDI	N.A.	N.A.	13,620	10,344	**8,111**	3,944	4,136
Distribution system loss (%) Note2	19.0	13.0	16.2	13.8	**14.7**	14.9	12.1
Electricity sales (MWh)	27,619	50,774	605,459	727,161	**830,384**	1,000,901	1,153,837
Khuluna (9PBS)							
Maximum output capacity (MW)	273.9	484.7	366	456	**513**	537	595
SAIDI per household (minutes) Note1	8.25	3.02	N.A.	N.A.	N.A.	N.A.	N.A.
(Alternative indicator) SAIDI	N.A.	N.A.	7,864	6,858	**10,935**	5,842	5,163
Distribution system loss (%)	15.7	11.9	12.5	12.3	**11.7**	12.9	11.2
Electricity sales (MWh)	71,470	131,394	1,943,163	2,231,399	**2,542,672**	2,984,401	3,228,241
Rajshahi (18PBS)							
Maximum output capacity (MW)	892.2	1,025.2	1,122	1,331	**1,561**	1,708	1,827
SAIDI per household (minutes) Note1	24.2	13.3	N.A.	N.A.	N.A.	N.A.	N.A.
(Alternative indicator) SAIDI	N.A.	N.A.	15,595	15,252	**24,287**	13,074	11,469
Distribution system loss (%)	14.2	11.5	13.5	12.6	**12.6**	12.7	12.1
Electricity sales (MWh)	169,490	321,472	4,289,690	4,696,697	**5,203,039**	6,086,637	6,448,137

Source: Documents provided by JICA and the executing agency

Note 1: The System Average Interruption Duration Index (SAIDI) set at the time of appraisal was the SAIDI per customer at the target PBS. Since the SAIDI per customer were unavailable at the time of the ex-post evaluation, the total SAIDI hours were used as an alternative indicator.

Note 2: Although the target values have been set for each PBS, the average values for PBS in each division are shown for convenience.

The maximum outputs in 2018 (two years after project completion) exceeded the target in all three divisions. The distribution system losses for the same year were achieved in Khulna division, 72% and 59% of the targets in Barisal and Rajshahi divisions respectively[19]. Subsequently, by 2020, the target was achieved in Barisal division and also reached 78% in Rajshahi division. Although it was slightly below 80% of the target, it can be said that supply

[19] The achieved value of the distribution system loss indicates the extent to which the actual reduction rate was achieved against the target value from the baseline. (Barisal: Target reduction rate (19 - 13) / 19 * 100 = 31.6%, Actual reduction rate (19 - 14.7) / 19 * 100 = 22.6%, Rajshahi: The target reduction rate (14.2 - 11.5) / 14.2 * 100 = 19%, the actual reduction rate (14.2-12.6) / 14.2 * 100 = 11.3%)

capacity was secured, and distribution losses were reduced as expected by installing and augmenting substations and developing 33/11 kV lines.

It was requested that the executing agency provide the actual data of the annual System Average Interruption Duration Index (SAIDI) per customer, which was set at the time of the appraisal, but this could not be obtained at the time of the ex-post evaluation. As available data, the annual data of SAIDIs at the target PBSs are used, but even for the same data, data before 2016 was unavailable in the executing agency. Since the month of completion of the construction work for this project was June 2016, it is thought that the effects of the project have already begun to appear in the same year. Accordingly, it is not possible to understand the effect strictly. In terms of SAIDI, however, data for 2016 and subsequent years helped confirm whether it had decreased by 2020. SAIDI in 2018, two years after project completion, decreased to 60% of 2016 and 30% in 2020 in Barisal division. In both Khulna and Rajshahi divisions, while it increased in 2018 due to the natural disaster, it subsequently declined, decreasing to 66% and 74% respectively in 2020. As described in "3.2.2.1 Intended Impact (2) Qualitative Effects" as below, beneficiaries reported a decrease in power outage hours after the project implementation, so a certain effect on the decrease in power outage hours can be confirmed.

In terms of electricity sales, the Barisal and Rajshahi divisions had achieved 16 times the target as of 2018, while the Khuluna division achieved 19 times the target. As for the increase in electricity sales, which was far higher than originally expected, the executing agency cited that the per capita income in 2020 (US$ 1,998) was 2.8 times higher than the same figure in 2009 (US$ 702)[20] and that the amount of electricity used had increased significantly due to the change in people's lifestyles. Furthermore, implementing this project has increased customer numbers, extended the power line development, boosted substation capacity and reduced distribution system losses, all of which have significantly boosted the electricity sales[21].

Furthermore, REB has also been implementing electrification projects in the target areas with the support of the Government and ADB with the aim of achieving 100% electrification rate[22]. Therefore, it is considered that the effects of the implementation of these projects have also affect the performance of the operation and effect indicators of this project, and the amount of electricity sales in particular is a factor in exceeding the target value.

[20] Source: Documents provided by the executing agency

[21] Compared to the 30 years before implementing this project up to 2008 and in the 12 years thereafter from 2009 to 2020, customer numbers have increased eightfold, the number of power lines developed has increased by 3.5 times, the capacity of substations has increased by 5.5 times, the amount of electricity supplied has increased by 3.5 times and system losses have improved by 8%. (Source: Documents provided by REB)

[22] Rural Electrification expansion Program with support of the Government (2014 - 2019), Distribution Network Expansion for 100% Rural Electrification with support of the Government (2017 - 2021) and Upgradation Rehabilitation and Intensification of Distribution system with support of ADB (2016 - 2020)

3.3.1.2 Qualitative Effects (Other Effects)

At the time of the appraisal, the qualitative effects of this project were assumed to help develop the local economy, improve the living environment of residents and boost their living standards. Since these contents correspond to the impact of the project objectives, they are determined and analysed in the impact part rather than as qualitative effects of effectiveness.

In this project, local residents were given training sessions to raise awareness of their responsibilities and roles of residents/customers (PBS members), efficient use of electricity and energy conservation, while for REB/PBS staff, support was provided to strengthen their capacity in conducting these training sessions for local residents. Accordingly, interviews with local residents/customers were conducted around the PBS where the site visit was conducted to determine how their awareness of using electricity efficiently had changed, such as power saving and improvements in customer service by the PBS and the following changes could be confirmed[23].

Changing understanding on efficient use of electricity

Through awareness activities such as meetings and distributing leaflets and posters for PBS members, a change on understanding of the efficient use of electricity was confirmed, with local residents and customers reporting changes in their daily lives that would contribute to energy conservation. In addition to the project's efforts, NGOs and local governments also conducted awareness-raising activities, so this cannot be considered the sole effect of this project. However, for example, some residents changed their behaviour such as using Compact Fluorescent Lamps (CFL)[24] instead of incandescent or fluorescent lamps, turning off unnecessary lights and fans and using energy-efficient home appliances. Moreover, efforts are being made to let in maximum daylight through windows and skylights. They are also promoting the use of electricity during off-peak hours when power pumps for irrigation and welding machines are not in operation.

Improving PBS's customer service

Thanks to the training, interviews with PBS staff received the following comments as feedback on the improvement of services: "applications for new connection procedures are handled within two to three days," "complaints (billing issues and inquiries about power outages) are answered within one to two hours," "maintenance manuals are followed up and maintenance work is

[23] Site visits were conducted from March 14 to 22 and July 16 to 20, 2021 at Patuakhali PBS (Barishal division), Jessore PBS-1 (Khulna division), Joypurhat PBS (Rajshahi division) and Dinajpur PBS-2 (Rangpur division). In each division, interviews at PBSs and site visits at substations and other facilities were conducted, and interviews to a total of 36 customers were conducted. During the site visit in March, a lockdown was started to prevent the spread of COVID-19 in Bangladesh, thus it was temporarily suspended. When it resumed in July, it was difficult to conduct face-to-face interviews with customers, therefore, 21 staffs/customers of Joypurhat PBS, Rajshahi PBS and Dinajpur PBS - 2 were interviewed by telephone.

[24] Power consumption of CFL bulbs is about one-fifth that of conventional incandescent bulbs, thus the power saving effect is expected. In addition, they can be purchased at half the price of LED bulbs.

improved". In interviews with residents, all respondents also indicated that customer service at PBS had improved compared to previous years. Moreover, according to the results of a survey conducted among approximately 21,000 customers of PBSs on completion of the project, 27% of the respondents were "very satisfied" and 48% were "satisfied" with the services. Although comparisons before and after implementing the project were not presented, these survey results are thought to indicate a high level of customer satisfaction on completion of the project.

3.3.2 Impacts

3.3.2.1 Intended Impacts

(1) Quantitative impact: Increase in production of agricultural products

As mentioned above, the background to the implementation of this project was that it was assumed to help improve livelihoods in rural areas by addressing the soaring demand for electricity to operate irrigation facilities, particularly during the dry season. At the time of the ex-post evaluation, the yield of rice, a major crop in the target area, had increased significantly compared to before the project implementation and the rate of increase was high compared to the national rice yield, as shown in the table below. The stable electricity supply is thought to support the increase in rice production by providing the right amount of irrigation water at the right time by operating irrigation pumps during the dry season and increasing the amount of time spent on farming due to the lights.

Table 7 Rice Yield (Aus Season [Note]) in the Target Area (Estimated)

(Unit: million tons)

Division	① 2010 / 11	② 2017 / 18	③ 2018 / 19	Comparison before and after project implementation (③ / ①)
Barisal	268,736	443,921	474,172	1.76
Khuluna	46,626	407,612	409,957	8.79
Rajshahi	340,706	567,811	710,084	2.08
Bangladesh	1,739,278	2,709,643	2,775,478	1.60

Source: Bangladesh Bureau of Statistics, *Yearbook of Agricultural Statistics* 2012 and 2019

Note: It is planted in the pre-monsoon season (April - May) and harvested around July.

(2) Qualitative impact

[Revitalization of local economic activities]

After implementing this project, it was confirmed that the impacts contributing to the revitalization of local economic activities, such as promoting employment, expanding agricultural activities and boosting profits, by reducing the time of power outages and providing a stable electricity supply had been realized.

・ Promotion of employment

By implementing this project, opportunities for both skilled and unskilled employment have

been expanded in 33 PBSs. For example, at Jessore PBS, 113 new jobs were created for operation and maintenance activities. They also reported an increase in employment, not only in PBS but also in the targeted areas by reducing the duration and frequency of power outages. For example, at the jute factory in Jessore, the number of staff has doubled with the increase in operating hours. The presence of home industries having expanded with the benefit of electricity has also helped create new jobs.

・ Expansion of agricultural activities

As described in the Quantitative Effects section, access to stable electricity is available, then by using electric power pumps for irrigation and obtaining the necessary water after the implementation of the project, the cultivation pattern has been expanded, helping promote employment and boost crop production. It also paves the way to use lights at night, which increases working hours and helps increase production.

・ Increased profits of shops and factories

With access to electricity, the opening hours of markets and stores and the operating hours of factories were extended by using lighting at night time after the implementation of the project. Most of the markets used to close at 20:00 in summer and 19:00 in winter, but the opening hours were extended to 23:00 after the project was implemented. Various factories have been able to work without downtime, due to reduced power outages and stabilized voltage, boosting both product quality and profits. For example, the interviewee reported an increase in operating hours due to fewer power outages[25] and an increase in profits of about 10% at the rice mill and about 13% at the jute mill.

[Improving the living environment and quality of life for local residents]

Through interviews with customers, the following impacts were reported: improved quality of life by using electrical appliances, evening and online learning made possible by using electricity, improved access to information and improved safety due to night lighting.

・ Impact on daily life

The use of electricity, fans, refrigerators, washing machines, televisions, etc. has improved the quality of life and comfort of the local residents. Work formerly done manually has been mechanized and the comfort and productivity of household work has gradually been increased.

・ Impact on education

An increased time spent studying in the evenings (about two hours on average) and taking online classes was also observed.

・ Impact on security

The availability of lighting in the evenings has improved public safety. Women can now go

[25] Before implementing the project, the rice and jute mills (Patuakhali and Jessore PBS) experienced power outages of two and four hours per day respectively, while in operation. However, there were no more power outages except for those planned for maintenance after the project was implemented. (Source: Interview survey)

out safely with peace of mind.

・ Others

Access to wide-ranging information is now possible via TV and the Internet.

Electric Power Pump for Irrigation
(Jessor PBS, Khuluna Division)

Rice Mill Factory
(Patuakhali PBS, Khuluna Division)

3.3.2.2 Other Positive and Negative Impacts

(1) Impacts on the Natural Environment

In accordance with the *JBIC Guidelines for Confirmation of Environmental and Social Considerations* (April 2002), the project falls into Environmental Category B, with less significant undesirable effects on the environment. According to the documents at the time of the appraisal, the Environmental Impact Assessment (EIA) report was to be prepared primarily by the REB after the detailed design and approved by the Environment Department, Ministry of Environment and Forests before the civil works. Also planned were measures to deal with air quality, waste, soil contamination and noise, such as sprinkling water during work, recycling used electric wires, etc., soil sampling surveys when reusing land, development of residual soil and informing nearby residents during construction. However, EIA approval was not obtained in implementing this project. According to the executing agency, at the time of the appraisal of this project, to obtain EIA approval and to implement the above-mentioned measures were not mandatory under the national law and were not specified in the DPP. Therefore, it has not been implemented in this project. At the time of ex-post evaluation, it was mandatory for all projects implemented by REB to obtain EIA approval. However, it was confirmed by the REB and the PBSs visited that no negative environmental impact related to the implementation of this project has occurred either during construction or after completion. In addition, monitoring of air quality, waste, soil pollution and noise has been conducted at each substation at the time of the ex-post evaluation[26].

[26] Source: Interview with the executing agency

(2) Resettlement and Land Acquisition

15.84 acres of land was acquired to construct new substations by implementing this project[27]. In the REB, the Deputy Commissioner (DC) office estimates the land cost and approval for site acquisition would be obtained after obtaining approval from the relevant government ministries and agencies. Subsequently, the DC office sends the estimate of the compensation amount to REB and REB pays compensation to DC office. According to that rule, land would be handed over to REB after the DC office finishes paying it to the landowner. The land acquisition for this project was also carried out in accordance with this rule. No resettlement occurred when implementing this project[28].

(3) Unintended Positive/Negative Impacts

Gender considerations and promotion of employment opportunities for women

The target PBS was expected to maintain a certain percentage and status of women among the board members and promote female employment in the billing department. In fact, PBSs have women in billing and cashier positions, as well as appointing female managers[29]. Moreover, the stable electricity supply in rural areas helps increase in the hours that women spend engaged in income-generating activities (poultry farming, livestock rearing, handicraft, etc.) and promote women's employment by extending the operating hours of factories and stores. The reduction in household chores due to the use of home appliances has also increased employment opportunities such as harvesting crops. Moreover, 17 new contracts by female entrepreneurs were reported in the region after implementing the project[30], which confirms how the project has helped create opportunities for women.

By implementing this project, it was confirmed that the maximum output had increased, and the distribution system loss ratio had decreased in the target areas and the target had been mostly reached. Although a rigorous analysis could not be conducted due to insufficient available data, the hours of SAIDI are on a downward trend and a certain level of effectiveness is deemed to have been generated, which means a stable electricity supply is now possible. Due to the increase in electricity consumption, the amount of electricity sold by the target PBSs after implementing the project also far exceeded the target. Changes in customer awareness of the efficient use of electricity through REB/PBS and customer training and improvements in customer service through PBS were also confirmed. Furthermore, thanks to the stable electricity supply, the impact in terms of improving the living environment and quality of life of residents, such as expanding agricultural activities, increasing profits of shops and factories, opening up employment,

[27] Source: PCR
[28] Source: Questionnaire responses from the executing agency
[29] Source: Questionnaire responses from the executing agency and interview with PBS
[30] Source: Interview with Patuakhali PBS

revitalizing the local economy, utilizing home appliances and improving the learning and safety environment, were reported. In light of the above, this project has mostly achieved its objectives. Therefore, effectiveness and impacts of the project are high.

3.4 Sustainability (Rating: ②)

3.4.1 Institutional/Organizational Aspect of Operation and Maintenance

Since the time of the appraisal, the system and roles whereby REB invests in facilities, provides technical guidance to PBSs and PBSs implement operation and maintenance activities have remained unchanged. The PBSs have a management committee elected by residents to serve as the decision-making body, while a general manager appointed by the REB oversees the operational practices. The composition of each PBS is generally the same (see Figure 1). As an example, the personnel setup and number of staff to be filled for the Patuakhali PBS, the target of this project, are shown (see Table 8).

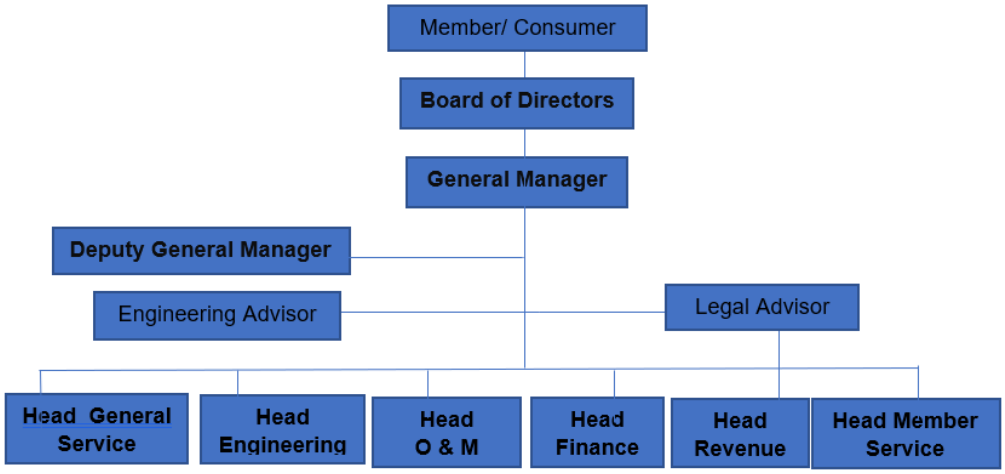


Figure 1 Organization Chart of PBS

Source: REB Website http://www.reb.gov.bd/site/organogram/d6b216cd-6348-4525-8c3e-4cf3ebabb9f2/- (Confirmed on 3rd of September, 2021)

Table 8 PBS Personnel Setup and Staffing Number (Example)

Post	Setup post	Presently assigned post Note1	Vacant post
Assistant general manager (Operation & maintenance/engineering)	12	9	3
Junior engineer/assistant engineer	24	22	2
Meter testing supervisor	12	7	5
Meter tester			
Lineman / line Crew	243	177	66

Source: Documents provided by REB
Note1: Number of personnel as of June 2021

According to the questionnaires to the REB, the responses cited no problems with the staffing and operation and maintenance system of PBS since REB deploys additional manpower also

in crisis time as per the requirement of PBS. On the other hand, it was reported by interviewees at PBS that the configured number of staff were not deployed, and the number of technicians, particularly those with the right experience and skills, tended to be insufficient. Even in the overall situation of all PBS under the jurisdiction of REB, the number of personnel assigned was 35,961, while the number of people stipulated was 43,833 as of 2020[31]. According to PBS staff, the lack of staffing sometimes made it difficult to respond quickly, which proved challenging for operation and maintenance.

As mentioned above, the roles between REB and PBS regarding operation and maintenance were clear and there was a system in place to ensure appropriate coordination, with REB providing necessary support to PBS as required. Conversely, the PBSs, which are in charge of operation and maintenance activities, pointed out the shortage in the number of technically qualified staff, which is a concern from the institutional /organization perspective.

3.4.2 Technical Aspect of Operation and Maintenance

Daily maintenance, such as inspection of distribution lines, is handled by the engineers of each PBS and all PBSs are capable of their own operation and maintenance. As for the operation and maintenance of newly installed facilities, trainings were conducted while implementing this project, including on-the-job training overseas and at substations. In particular, since the substations incorporated equipment and technologies that required new knowledge for REB and PBS staff, operation and maintenance training sessions were conducted for all installed substation staff, providing them with opportunities to learn about how to operate and maintain switchgear, power transformers, protection and control equipment, etc. Moreover, while installing facilities and equipment, manufacturers, contractors and consultants worked with REB and PBS staff at each substation, thereby fulfilling the function of on-the-job training. At the time of the ex-post evaluation, operation and maintenance activities are being continued without any problems by utilizing the technical skills learned through training sessions and OJT[32].

Moreover, REB has conducted training sessions for PBS staff on operation and maintenance of the distribution system to maintain their competence in this area. In case of any disruption to facilities or equipment, REB assists PBSs in resolving these problems.

As mentioned above, there are no concerns about the technical capabilities of PBS, since PBSs does not have issues on their technical capacity and appropriate support can be also obtained from REB.

[31] Source: REB, *Annual Report* 2019/2020

[32] Source: Questionnaire answer from the executing agency, interviews with PBS

3.4.3 Financial Aspect of Operation and Maintenance

(1) Financial Information of REB

The REB's profit and loss situation has been increasing for the past few years and has remained steady. The capital adequacy ratio in the balance sheet is also high at 75%. Although government capital has been invested in REB, the importance of rural electrification has been maintained as a government policy and will not affect the budget allocation in future.

Table 9 Financial Information of REB

(Unit: million taka)

	2016/17	2017/18	2018/19	2019/20
Total revenue	5,160	7,274	8,345	8,587
Interest loan to PBS	4,385	6,275	6,658	6,728
Other	775	998	1,687	1,859
Total operating expenses	1,375	1,572	1,786	1,941
Operating expenses	3,785	5,702	6,559	6,646
Interest expenses	832	817	1,015	1,023
Net margin	2,953	4,885	5,544	5,623

Source: Document provided by REB

(2) Financial information of PBS

According to the data provided by REB, all PBSs covered by the project have been in the red for the past three years. One of the reasons in considered to be the fact that the profit per kWh of the target PBSs is in the red (Table 10), which means it is not sufficiently profitable. According to the REB, the standard involves earning 45,000 taka on average from one kilometer of power distribution, but the current electricity tariffs do not sufficiently cover the cost of supply and at the time of ex-post evaluation, many PBSs have not been able to earn the standard income. In rural areas, which are the target areas of this project, most of the customers are the general households whose electricity price is set low (see Table 12), making it difficult to obtain sufficient profit from the system. However, REB explains that new export processing zones, factories, markets and small- and medium-sized enterprises (SMEs) have emerged in the vicinity of the PBS distribution system in recent years, which has sparked an increase in electricity sales with higher price unit and is expected to improve PBS revenues. Moreover, all PBS is considered as a single unit, thus REB can provide cross subsidy to cover deficit. REB explained that average profit of all PBSs in 2020/21 is turning in positive and it is expected to improve the situation in future. Since the REB's income is highly dependent on PBS interest payments, however, improving the balance of PBS is considered one of the future challenges for REB as well.

Table 10 Profitability of PBS: Profit per kWh

(Unit: taka)

	2017/18	2018/19	2019/20
Average of all PBSs	-0.07	0.02	-0.10
Average of the target PBSs of the project	-0.29	-0.16	-0.35

Source: Questionnaire answers from the executing agency

The following table shows the maintenance costs of the target PBSs. REB has allocating the operation and maintenance budget based on the yearly demand. REB stated that several PBSs are able to secure budget for the required operation and maintenance, but that some PBSs required a loan from REB. PBSs where the site visits were conducted also explained that they do not always ensure sufficient budget for operation and maintenance, but they have been dealing with operation and maintenance as far as possible.

Table 11 Operation and Maintenance Cost for the Target PBSs (Average)

(Unit: taka)

	2017/18	2018/19	2019/20
Operation and maintenance cost	298,554,426	346,522,496	357,524,285

Source: Questionnaire answers from the executing agency

As shown in Table 12, the electricity price at the time of the ex-post evaluation was set low for residential customers as a policy measure and high for large-scale industries and offices, so it can be said that the poor were considered. Pricing like this has also caused PBS's low profitability and the need to consider raising electricity rates in future is highlighted.

Table 12 Electricity Price Table

	Taka/kWh		Taka/kWh
Residential 0-50 unit (lifeline)	3.75	Small industry: flat	8.53
0-75 unit	4.19	off peak	7.68
76-200 unit	5.72	peak	10.24
201-300 unit	6.00	Construction	12.00
301-400 unit	6.34	Public facilities	6.02
401－600 unit	9.94	Roadside lamp	7.7
601－unlimited	11.46	Office: flat	10.3
Irrigation	4.16	off peak	9.27
		peak	12.36

Source: Documents provided by the executing agency

3.4.4 Status of Operation and Maintenance

At several substations managed by PBSs, damage to some facilities and equipment was observed during the site visits as follows[33]. However, the functioning of the power distribution

[33] Source: Questionnaire answers from the executing agency and site visits

lines and substations was unaffected, and all are operating and fulfilling their functions without any problems. PBSs are repairing of them or working to identify the issues to be addressed as needed.

- Patuakhali PBS (Barisal division): 11 kV capacitor (equipment damaged by lightning), ACR (equipment damaged by lightning), insulators for 33 kV line (crack)
- Jessor PBS (Khulna division): ACR (equipment damage due to short circuit failure), insulators for 33 kV line (equipment damaged by lightning), two 11 kV transformers (high tension coil of transformer burned by overload), lightning arrester (burst by high voltage lightning), potential transformer (high tension coil of transformer burned by short circuit)
- Dinajpur PBS - 2 (Rangpur division): Insulators for 33kV line (crack), lightning arrester (burst by high voltage lightning)
- Joypurhat PBS (Rajshahi division): Insulators for 11kV and 33 kV line (crack), insulator for 11 kV transformer (crack), ACR (equipment damage due to short circuit failure)
- Rajshahi PBS (Rajshahi division): Insulators for 11kV and 33kV (crack), insulator for 11 kV transformer (crack)

The distribution lines of the PBS are maintained quarterly in each of the four areas. The substations are maintained in November and January every year and each PBS has a plan to maintain its distribution lines and substations. On completion of the project, the utilization status of the installed facilities and equipment is checked and monitored by the REB and is utilized under the responsibility of each PBS. Moreover, replacement of consumables and wear items are carried out according to the schedule prepared and managed by REB and distributed to PBS and there were no problems in obtaining them. The manual for maintenance is also being used at PBSs[34].

As mentioned above, although some of the equipment and materials newly installed or upgraded by the Project were damaged, the overall functions of the distribution lines and substations remain unaffected and they are being properly operated, maintained and fully utilized by REB and PBSs.

In light of the above, while no major problems have been observed in technical and current status of the operation and maintenance system, minor problems have been observed in terms of the institutional/Organizational aspect and financial aspect. Therefore, sustainability of the project effects is fair.

[34] Source: Questionnaire answer from the executing agency, interviews with PBS

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The project was implemented with aims to reduce power distribution loss and strengthen and stabilize the power supply systems, which make power supply efficient by constructing and rehabilitating the existing power distribution facilities, thereby contributing to the economic development and poverty reduction in the western and the southern part of Bangladesh and the greenhouse gas elimination.

The purpose of the project is in line with Bangladesh's development plan at the time of appraisal and ex-post evaluation, which has emphasized infrastructure development in the power sector, development needs to improve the demand-supply gap and distribution loss ratio and Japan's ODA policy, which has positioned the power sector as a priority area for assistance. Thus, its relevance is high. In implementing the project, although the project cost was within the plan, the project period exceeded the plan due to delays in consultant selection and bidding, as well as changes in the substation specifications and capacity. Therefore, efficiency of the project is fair. Implementing the project boosted the maximum output and power sales volume, reduced the extent of power outages and improved the distribution loss ratio, with targets mostly attained in all these areas. Moreover, thanks to various training, a change in the level of awareness of customers towards the need to use electricity efficiently and improvement of customer service by the PBS was also apparent. The project also had an impact in terms of revitalizing the local economy and boosting the living environment and living standards of local residents, hence its effectiveness and impacts are high. In operation and maintenance terms, despite no problems in the technical aspect and the status of operation and maintenance, minor issues remain in the institutional/organizational and financial aspects. Therefore, sustainability of the project effects is fair.

In light of the above, this project is evaluated to be satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

・ <u>Addressing the staff shortages for operation and maintenance</u>

Staff shortages for operation and maintenance activities were reported by some PBSs. In particular, the shortage of skilled and experienced staff was highlighted, which may hinder the prompt implementation of operation and maintenance activities. Although the REB states that there is no shortage of staff in REB, PBS on the whole tends to be understaffed. Therefore, it is desirable that PBS and REB promptly identify the shortage of personnel engaged in operation and maintenance and consider assigning personnel as necessary.

・ Examining the recommendations to improve the financial status of PBS

PBS has been running a deficit every year. In fact, PBS states that the operation and maintenance budget is insufficient and if it does not improve in future, there is concerns that it will hinder the implementation of proper operation and maintenance activities. Currently, REB's financial situation is strong, but most of its income comes from payments from PBS. Therefore, the financial condition of PBS may also affect REB in future. REB expects PBS's deficit to improve along with the increase in power sales. Conversely, although the amount of electricity sold has increased significantly, PBS's balance of payments remains in the red, so it is desirable for REB to provide support for financial improvement by reconfirming the trends in rate setting and capital investment to see if PBS's financial situation will improve due to increased electricity sales.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

・Maintain operation and maintenance capacity of the staff through trainings during and after project implementation.

In this project, a substation requiring new knowledge and experience for REB and PBS staff in the operation and maintenance activities was constructed. Therefore, in this project, training sessions on operation and maintenance activities were provided to the staff of the executing agency as well as operation and maintenance institutions, both locally and overseas and they also collaborated in the actual field work as OJT. Accordingly, the project has helped improve the technical capacity of staff overseeing operation and maintenance on completion of the project and appropriate operation and maintenance activities have been implemented on an ongoing basis at the time of the ex-post evaluation. When installing facilities and equipment requiring new knowledge and experience for the executing agency as well as operating and maintenance institutions like this project, setting up a workplace with manufacturers, contractors and consultants as OJT would be a good opportunity to learn about the design, structure and operation and maintenance activities of the site, which will help ensure appropriate operation and maintenance.

・Implement a unique approach with a view to changing the understanding of electricity suppliers and users in rural areas

This project was implemented to supply efficient power within rural areas. Moreover, to support the development of facilities to ensure a stable power supply, the project also conducted awareness activities to enhance their understanding among local residents about the efficient use

of electricity and energy conservation. Trainings were also provided for REB/PBS staff to strengthen their capacity to conduct these awareness activities, and for PBS, which is entrusted with the operation of the power distribution services, to improve customer service. Through these activities and training sessions, the effects of PBS in improving customer service and changing residents' awareness of the efficient use of electricity were confirmed. In projects such as electricity supply, where support for users is expected to help ensure the sustainable effects, in addition to the development of facilities and equipment, it can be effective to involve service providers and users when designing the project.

(end)

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs		
1) Upgradation and construction of medium- and low-voltage lines		
33kV Line upgradation	1,184 km	882 km
11kV Line upgradation	1,579 km	1,975 km
33kV Line construction	885 km	852 km
11kV Line construction	1,536 km	1,135 km
Total extension	5,184 km	4,844 km
2) Construction and augmentation of substations		
Construction	50 units	As planned
Augmentation	30 units	As planned
3) Foreign and local trainings		
Foreign trainings	46 persons	48 persons
Local trainings	183 persons	As planned
4) Consulting service		
DSM consultant	210 man-months	477 man-months
SDCS consultant	510 man-months	688 man-months
2. Project Period	March 2010 – December 2014 (58 months)	March 2010 – June 2016 (76 months)
3. Project Cost		
Amount Paid in Foreign Currency	5,857 million yen	8,728 million yen
Amount Paid in Local Currency	12,579 million yen (9,458 million taka)	4,414 million yen (3,421 million taka)
Total	18,436 million yen	17,184 million yen
ODA Loan Portion	13,241 million yen	8,728 million yen
Exchange Rate	1taka = 1.33 yen (As of November 2009)	1taka = 1.29 yen (Average between March 2010 and June 2016)
4. Final Disbursement	March 2018	

(end)