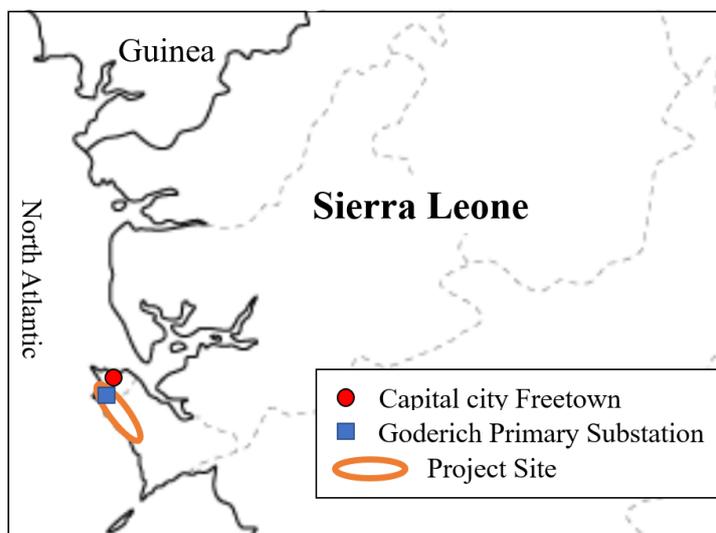


Country Name	Project for Urgent Improvement of Power Distribution System in Freetown
The Republic of Sierra Leone	Project for Urgent Improvement of Power Distribution System in Freetown (Phase 2)



Location of the project site



11 kV switchboard at Goderich primary substation

I. Project Outline

Background	<p>Since the end of the civil war in 2002, which lasted nearly 11 years, Sierra Leone's economy has been growing through post-war reconstruction. Along with that growth, the existing power supply system in the Western Area, where economic development and population concentration centered in the capital Freetown, became unable to meet the increasing power demand. Under these circumstances, the Government of Japan's grant aid project titled Project for Urgent Improvement of Electric Power Supply System in Freetown (Phases I and II) was implemented to strengthen the capacity of the power supply system in Freetown. However, while the power generation facilities were expanded, problems still persisted in the form of frequent power outages and high transmission and distribution losses due to inadequate power transmission and distribution infrastructure, making it difficult to efficiently distribute the generated power to consumers. Against this background, the Government of Sierra Leone requested that the Government of Japan implement the grant aid project titled Project for Urgent Improvement of Power Distribution System in Freetown (hereinafter referred to as "Phase 1") aimed at strengthening the power distribution network in the capital region of Freetown.</p> <p>During Phase 1, construction work was suspended for 23 months due to the outbreak of the Ebola virus disease (hereinafter referred to as "Ebola outbreak"). Subsequently, for the remaining Phase 1 construction period, as well as the need to replace equipment that had been procured in Phase 1 due to the suspension of construction work, the Project for Urgent Improvement of Power Distribution System in Freetown Phase 2 (hereinafter referred to as "Phase 2") was implemented.</p>
Objectives of the Project	<p>The objective of the project is to improve the existing power distribution system, that is deteriorated and unstable with high power distribution losses by constructing a 33/11 kV power distribution substation and 33 kV distribution lines, and repairing and extending the existing 11 kV distribution lines to facilitate safe, stable, and efficient power distribution in the capital region of Freetown, thereby contributing to the improvement of power supply reliability.</p>
Contents of the Project	<ol style="list-style-type: none"> 1. Project Site: Western Area including the capital Freetown 2. Japanese side <ol style="list-style-type: none"> (1) Procurement and installation of equipment at the existing Wilberforce Primary Substation (2) Construction of the Goderich Primary Substation (3) Procurement and installation of equipment at the Goderich Primary Substation (4) Construction of 33 kV distribution lines (5.8 km between the Goderich Primary Substation and the Wilberforce Primary Substation) (5) Rehabilitation and extension of 11 kV distribution lines (18.5 km between the Babadori River and Sussex) and rehabilitation (12 locations) and new construction (4 locations) of secondary substations (Juba, Goderich, and Sussex) (6) Procurement of related materials and equipment (spare parts, etc.) 3. Sierra Leone's side <ol style="list-style-type: none"> (1) Installation of 11 kV distribution lines (1.5 km) between the Peninsular Secondary Substation and the Goderich Village Secondary Substation (2) Construction work on the Goderich-2 Secondary Substation and the Goderich Village Secondary Substation using the equipment and materials procured by the project (3) Renovation and extension of the low voltage distribution system in the project target area using the equipment and materials procured by the project

Implementation Schedule	E/N Date	May 22, 2013 December 17, 2013 (First Amendment: Increase in the grant amount) ¹ March 16, 2017 (Second Amendment: Increase in the grant amount and extension of the period) ² March 21, 2018 (Third Amendment: Re-extension of the period) ³
	G/A Date	May 22, 2013 December 17, 2013 (First Amendment: Increase in the grant amount) ⁴ August 27, 2015 (Second Amendment: Extension of the period) ⁵ March 16, 2017 (Third Amendment: Increase in the grant amount and extension of the period) ⁶ March 23, 2018 (Fourth Amendment: Extension of the period) ⁷
	Completion Date	June 20, 2017 (Phase 1 and Phase 2) (Date of delivery and start of operation)
Project Cost	E/N Grant Limit, G/A Grant Limit: 1,692 million yen (Breakdown: [Phase 1] 1,552 million yen, [Phase 2] 140 million yen) Actual Grant Amount: 1,686 million yen (Breakdown: [Phase 1] 1,546 million yen, [Phase 2] 140 million yen)	
Executing Agency	At the Time of Ex-Ante Evaluation: National Power Authority (hereinafter referred to as “NPA”) At the Time of Ex-Post Evaluation: Electricity Distribution and Supply Authority (hereinafter referred to as “EDSA”)	
Contracted Agencies	Main Contractor and Equipment Procurement Agency: Nishizawa Limited. Main Consultant: Yachiyo Engineering Co., Ltd.	

II. Result of the Evaluation

<Summary>

The project was implemented to improve the existing power distribution system, that was deteriorated and unstable with high power distribution losses by constructing substations and rehabilitating and extending the power distribution facilities in the capital region of Freetown. The relevance of the project is high, as it is fully consistent with Sierra Leone’s development policies and needs, and Japan’s ODA policies at the time of ex-ante evaluation. Regarding the effectiveness of the project, improved supply restriction time and power quality were confirmed, but in terms of the impacts, improvement in power supply to some consumers was limited. Therefore, effectiveness and impacts of the project are fair. As for the project implementation, the outputs from the Japanese side were generally produced as planned, and the project cost and period were as planned. However, efficiency of the project is fair because some of the outputs from the Sierra Leone’s side have not been completed, and the status indicating whether the outputs are effectively produced by certain project inputs cannot be confirmed. Regarding sustainability, although there are no particular problems in terms of institutional, organizational, and technical aspects, some issues were identified in terms of the financial aspect and the current status of operation and maintenance. Therefore, sustainability of the project effects is fair.

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

Overall Rating⁸	C (Partially Satisfactory)	Relevance	③⁹	Effectiveness & Impacts	②	Efficiency	②	Sustainability	②
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<Notes/Constraints during the Evaluation Study>

- Since the project’s expected effects (effectiveness and impacts) were assumed to be achieved through the combination of Phases 1 and 2, achievement of Phases 1 and 2 is evaluated together in the ex-post evaluation.
- Due to the 2019 novel coronavirus pandemic (hereinafter referred to as “COVID-19 pandemic”), the external evaluator’s travel to conduct the field survey was canceled. For this reason, information was collected remotely through online meetings and other means. In addition, the external evaluator provided guidance and instructions remotely for a local consultant in advance, and the local consultant conducted the site visit and interviews to assess the project impacts under the supervision of the external evaluator.

1. Relevance

<Consistency with the Development Policy of Sierra Leone at the Time of Ex-Ante Evaluation>

In the *Sierra Leone Second Poverty Reduction Strategy Paper* (2008–2012) (hereafter referred to as “PRSP-II”), one of the four priorities for the medium-term strategy was to strengthen the power supply. Additionally, in the PRSP-II, the modernization of power transmission and the distribution network was positioned as one of the top priorities of the Government of Sierra Leone. Moreover, in the *Sierra Leone National Energy Strategic Plan* (2009), a target was set to increase household access to electricity nationwide from 7–8% in 2000, to 50% by 2020, and to 75% by 2025. Therefore, it can be said that the implementation of the project, which aimed to improve the power distribution system, was consistent with development policies of Sierra Leone at the time of ex-ante evaluation.

<Consistency with the Development Needs of Sierra Leone at the Time of Ex-Ante Evaluation>

Due to the deterioration and insufficient maintenance of the transmission and distribution facilities, transmission and distribution losses were estimated to be more than 30%, making it difficult to efficiently transmit and distribute power to consumers. As such, there was high demand for improving the transmission and distribution facilities and reducing transmission and distribution losses. In addition, due to the

¹ The grant limit was amended from 1,397 million yen to 1,552 million yen due to fluctuations in the exchange rate.

² The grant limit of 140 million yen was increased and the due date was extended from March 31, 2017, to March 31, 2018 to implement Phase 2.

³ The due date was re-extended from March 31, 2018 to March 31, 2019 due to a delay in issuing the Authorization to Pay, caused by a deficiency in the Completion Certificate prepared by the EDSA and delays in the necessary procedures within the EDSA, the Ministry of Energy, and the Ministry of Finance and Economic Development.

⁴ The grant limit was amended from 1,397 million yen to 1,552 million yen due to fluctuations in the exchange rate.

⁵ The due date was extended from March 31, 2016 to March 31, 2017 due to the Ebola outbreak.

⁶ The grant limit of 140 million yen was increased and the due date was re-extended from March 31, 2017 to March 31, 2018 to implement Phase 2.

⁷ The due date was re-extended from March 31, 2018 to March 31, 2019 due to the delay in issuing the Authorization to Pay.

⁸ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

⁹ ③: High, ②: Fair, ①: Low

deterioration and insufficient capacity of the transmission and distribution facilities, power outages were frequent, and power quality (voltage drop) became a major issue in the capital region of Freetown. Under these circumstances, the unstable power supply was hindering the operation and service provision of public and social welfare facilities such as hospitals and schools. Therefore, it can be said that the implementation of the project, which aimed to improve the power distribution system, was consistent with the development needs in Sierra Leone at the time of ex-ante evaluation.

<Consistency with Japan’s ODA Policy at the Time of Ex-Ante Evaluation>

In the *Japan’s ODA Charter* (2003), one of the four priority issues is “sustainable development,” and focus is placed on the “development of economic and social infrastructure.” The *ODA Medium-Term Policy* (2005) also identifies “sustainable growth” as one of the priority issues and pledges to provide assistance for the development of energy-related infrastructure. In addition, *Japan’s ODA Data by Country* (2012) names infrastructure development as a priority area, with particular assistance allocated to the power sector. Furthermore, the *Yokohama Action Plan* (2008), formulated at TICAD IV, highlighted electricity infrastructure and stated that cooperation regarding establishing a stable power supply would be reinforced. Therefore, it can be said that the project was consistent with Japan’s ODA policies at the time of ex-ante evaluation.

<Evaluation Result>

In light of the above, relevance of the project is high.

2. Effectiveness/Impacts

<Effectiveness>

In order to analyze achievement of the project objective, “to improve the existing power distribution system that is deteriorated and unstable with high power distribution losses,” three quantitative indicators set at the time of ex-ante evaluation are examined in this ex-post evaluation. With regard to Indicator (1) “supply restriction time,” the target value was 1 hour/day, whereas the actual value in 2020 (three years after completion of the project, which corresponds to the target year) was 0.67 hours/day, indicating that the indicator was achieved.

As for Indicator (2) “power quality (voltage drop),” the data from 2017 to 2020 were not available because related data was not collected. With reference to the data for the period January to May 2021 only, which were available at the time of the ex-post evaluation, the average value was 4.7%. Although those data are from a very limited period, it shows a significant reduction from the baseline value of 20% and is lower than the target value of 10%.

Regarding Indicator (3) “power losses,”¹⁰ the data were not collected and therefore could not be analyzed. Since the *National Energy Efficiency Action Plan* (2015–2030) includes a target¹¹ to reduce power losses, the data on power losses should have been collected. According to the EDSA, power loss is considered to have been reduced to a certain extent through the improvement of some substations and distribution lines under the project, but the reduction of overall power losses in the EDSA remains a major challenge.

As shown in Figure 1, the power distribution facilities developed under the project are only a part of the distribution network that the EDSA operates, and the overall power losses of the network are caused by various factors, including the operating status of power stations, the aging of other distribution facilities such as transmission lines between power stations and substations, excessive extension of low-voltage distribution lines (those connecting secondary substations to consumers), and overloading of distribution lines due to insufficient distribution capacity caused by the increase in the number of consumers. It should be also noted that the actual values of the quantitative indicators (1) and (2) mentioned above do not necessarily represent the exclusive effect of the substation and distribution facilities developed under the project, as they are greatly affected by many factors external to the project, such as power generation transmission and, distribution capacity at the end connected to consumers.

In light of the above, although it was not possible to make an evaluation judgment on Indicator (3) “power losses” due to the unavailability of data, the target was achieved for Indicator (1) “supply restriction time,” and improvement was confirmed for Indicator (2) “power quality,” albeit with limited data.

Table 1. Quantitative indicators

Indicators	Baseline value	Target value	Actual value				
	2010	2018 * 3 years after completion	2017 Completion year	2018 1 year after completion	2019 2 years after completion	2020 3 years after completion	2021 4 years after completion
(1) Supply restriction time (including failure interruptions) (hours/day)	12	1	3.37	2.19	1.06	0.67	N/A
(2) Power quality (voltage drop) (%)	20 >	10	N/A	N/A	N/A	N/A	4.7 **
(3) Power losses (%)	30 >	20	N/A	N/A	N/A	N/A	N/A

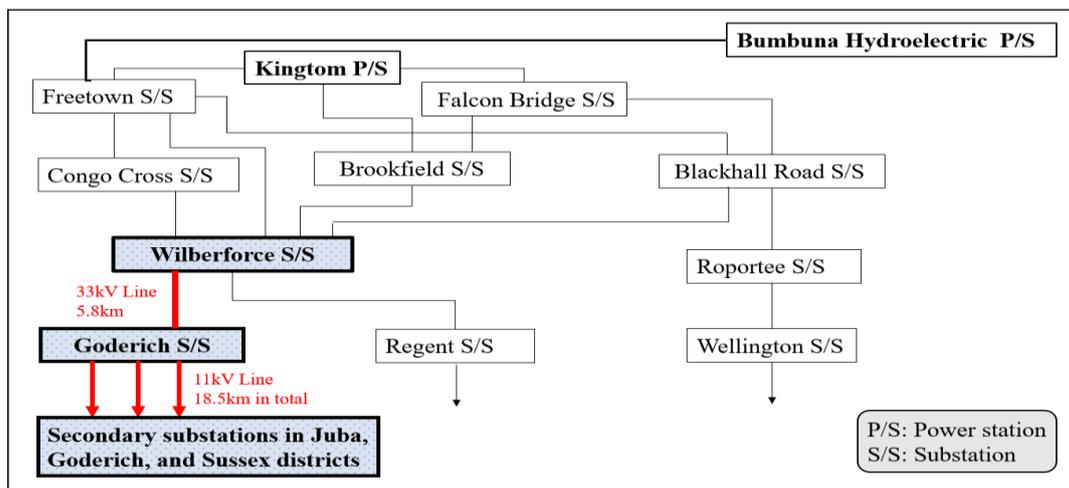
Source: Materials provided by the executing agency.

* At the time of ex-ante evaluation, the target year (three years after project completion) was set to 2018 because the project was assumed to be completed in 2015. However, the project was actually completed in 2017, so the target year was changed to 2020.

** Average value of data from January to May 2021 only.

¹⁰ Transmission and distribution losses, including technical and non-technical losses.

¹¹ Target to reduce 45% (including 39% of distribution loss) in 2013 to 15% (including 12% of distribution loss) by 2020 and 9% (including 7% of distribution loss) by 2030.



* Substations in blue (dots) boxes and distribution lines in red (bold lines) are the facilities and equipment targeted by the project.
Source: Created by the evaluator based on materials provided by the executing agency.

Figure 1. Freetown Distribution Network Diagram

<Impacts>

In order to confirm the project impacts, “to improve the existing power distribution system that is deteriorated and unstable with high power distribution losses,” the ex-post evaluation conducted interviews targeting two medical facilities (the Emergency Surgical Hospital and the Lakka Government Hospital), two educational facilities (the Milton Margai College of Education and Technology, and the Services Secondary School¹²), five commercial facilities (a grocery store, a construction materials store, two hotels, and a pharmacy), and ten residents.¹³

(1) Medical facilities

At the Emergency Surgical Hospital in Goderich district, according to the project’s *Preparatory Survey Report*, which was prepared at the time of planning, there were power outages for about 12 hours per day. In addition, due to the poor power quality (large voltage fluctuations), the hospital was reliant on its private generators during surgical operations. At the time of ex-post evaluation, it was reported that the power supply had been improved for a while after the completion of the project, but it became unstable one or two years prior to the time of ex-post evaluation. In addition, although voltage fluctuation has been improved, EDSA electricity is mainly used only for lighting and office equipment because of the frequent power outage, which could damage precision equipment. During surgical operations, the hospital still relies on its private generators.

At the Lakka Government Hospital in Lakka district, prior to the completion of the project, private generators had been used during power outages and when using examination equipment that required stable power. At the time of ex-post evaluation, voltage fluctuation was improved, but power outages have occurred frequently, especially in the past two years. In addition, solar power is utilized to store medicines and vaccines, and when the EDSA electricity is frequently cut off, the hospital has no choice but to use its own generators.

(2) Educational facilities

At the Milton Margai College of Education and Technology in Goderich district, according to the *Preparatory Survey Report*, there were power outages for about 12 hours per day, which interfered not only with lectures but also with office work due to the inability to use office equipment. Consequently, the college had to operate its own generators during the outages. At the time of ex-post evaluation, the frequency of power outages had been decreased and the duration of power outages also decreased, ranging from 30 minutes to 8 hours per day, indicating that the power supply has improved. In addition, voltage fluctuations were no longer observed, which means that the power quality has improved. However, the college is still facing issues such as difficulty in using laboratory equipment and delivering lectures at night during power outages.

At the Services Secondary School in Juba district, prior to the completion of the project, classes were held in the dark during power outages. At the time of ex-post evaluation, it was reported that the school experienced power outages for about an hour several times per day at least twice per week. During power outages, the classrooms become very dark, and especially in bad weather, the children’s visibility becomes very poor. In addition, since office equipment such as computers and printers are not usable during power outages, the school has to use its private generator for any urgent office work. Moreover, since fans and air conditioners cannot be used, the work environment becomes uncomfortable, especially during the hot season.

(3) Commercial facilities

At the grocery store in Battalion district, where an interview was conducted at the time of ex-post evaluation, it was reported that power outages lasting 3 to 6 hours occurred almost daily before the project’s completion. Moreover, unstable voltage fluctuations lasting 30 minutes to 1 hour also occurred frequently. As a result, the store was not able to sell cold drinking water to customers. After the project’s completion, the duration of power outages has been reduced to one-third, the frequency has been halved, and the power voltage has stabilized. In addition, drinking water sales have increased, and the store is now able to operate at night because of the availability of lighting.

At the construction materials store in Ogo Farm district, before the project’s completion, there was no power supply at all, and a store owner reported that he had to go to a printing store to print bills and other documents; furthermore, he could not charge his cell phone, which was necessary to respond to customer inquiries, and this was hindering his business. In addition, the store had been robbed at night when there was no light. After the project’s completion, it was reported that electrical appliances such as a printer and a fan can be used at

¹² Secondary education in Sierra Leone is between the ages of 13 and 18.

¹³ Gender of the targets: four males and six females. Average age: 36.2 years. Target districts: five persons in Goderich, one in Juba, one in Lakka, one in Hamilton, one in Battalion, and one in Ogo Farm.

the store, and the store owner has indicated feels safer because security lights are available at night.

At the hotel in Sussex district, there was no power supply before the project's completion, and the hotel had to use a private generator, which required high fuel and maintenance costs. At the time of ex-post evaluation, it was reported that although power outages occur about four times per month, the frequency of private generator use and thus the amount of the associated utility costs have been reduced, and the number of guards needed at night has also been reduced. In addition, when a power outage occurred, the hotel contacted the EDSA to address the situation, and the power was soon stabilized.

At the hotel in Lakka district, the power supply had improved since the project's completion. However, about two years before the time of ex-post evaluation, the power supply situation was worsening and the occurrence of power outages increased to about three times per week. It was reported that private generators have been used to run refrigerators, fans, and air conditioners, and the operating cost of the private generators has been increasing.

At the pharmacy in Goderich district, the power supply situation has deteriorated since around 2020, and power outages have become more frequent. In the past, there was no need to use a private generator, but now, the pharmacy uses it for 4 to 6 hours per day in order to prevent damage to electrical appliances.

(4) Residents

According to the results of interviews with ten residents, the average frequency of power outages was 5.1 times per week before the project's completion, while it was 3.9 times per week at the time of ex-post evaluation.¹⁴ Although the average frequency of power outages has decreased, a breakdown of the ten respondents shows that four of them reported that the frequency of power outages has increased, indicating that the power supply situation varies by household and area. Most of the respondents who reported that the power supply was getting worse said that it had become unstable, especially since about two years ago. Furthermore, eight out of ten respondents said that the power supply situation has further worsened with the COVID-19 pandemic.

Regarding the duration of private generator use, the average value has decreased from 4.6–6.4 hours/day to 3.4–5.3 hours/day, but a breakdown of the results shows that four out of ten respondents said that duration of private generator use has increased, indicating that the changes in the use of private generators vary by household and area. Residents in Ogoo Farm, Lakka, and parts of Goderich, where the population has been growing rapidly in recent years, reported that the power supply situation has been worsening. According to the households with improved power supply, they can now use air conditioners and sleep peacefully without worrying about mosquito bites. They have also seen reduced fuel costs for private generators, which has eased the burden on their household budgets. On the other hand, households that reported the worsening of power supply said that it was interfering with their children's attendance of online classes and studying at night. In addition, some households purchased new private generators due to the unstable power supply by the EDSA. Therefore, the situation of power supplied by the EDSA varies from household to household. Some households have reported that the situation has improved, while others confirmed that the power supply situation worsened sometime after the completion of the project.

According to the EDSA, the Western Area has been experiencing economic development and population concentration, and the development of the power distribution facilities has not been able to meet the increasing power demand. Especially in areas with high concentrations of residents such as Ogoo Farm, Lakka, and Goderich districts, the overloading of the power distribution network is considered to be a factor in the deteriorating power supply situation. Although the increase in the power demand was within expectations,¹⁵ it can be said that the improvement of power distribution facilities under the project alone was not sufficient to meet the power demand. Moreover, according to the EDSA, the COVID-19 pandemic may have contributed to the worsening of the power supply situation because the power distribution facilities could not be repaired and maintained promptly due to the lockdown and curfew measures. However, since the power supply situation was unstable even before the COVID-19 pandemic, it cannot be attributed solely to the external factor. As Figure 1 shows, the power distribution facilities developed under the project are part of the power distribution network operated by the EDSA; therefore, the power supply situation in the target area can be affected by other power distribution facilities. Hence, the EDSA mentioned that the most critical issue is to strengthen the entire power distribution network, including the facilities targeted by the project, in order to meet the growing demand.¹⁶ In terms of power generation capacity, while the peak power demand was 85 MW in 2020, it has been covered by hydropower facilities (50 MW in the rainy season and 10 MW in the dry season), heavy oil power generation facilities (24 MW), biomass power generation facilities owned by the private sector (30 MW), and a power ship also owned by the private sector (20 MW in rainy season and 60 MW in dry season).^{17,18} In addition, in order to further expand the power supply capacity, the importation of electricity from the West African Power Pool (WAPP)¹⁹ and a further increase in hydropower generation capacity have been promoted with the support of the World Bank, the African Development Bank, and others.

In light of the above, it was found that the status of power supply to consumers varies from area to area. While stabilization and improved reliability of power supply was confirmed in some areas, the reliability of power supply in other areas is poor, and it can be said that the contribution to impacts by repairing and extending power distribution facilities through this project alone could be only partially confirmed.

<Other Impacts>

(1) Impacts on the natural environment

The *Environmental Impact Assessment Report*²⁰ was approved by the Environmental Protection Agency of Sierra Leone in August

¹⁴ The power outage frequency obtained from the ten interviewees is the respondents' subjective perception, and the average power outage frequency may differ from the actual number of power outages.

¹⁵ The peak demand observed in 2020 was 85 MW (source: World Bank). According to the master plan developed in 2009, the peak power demand in 2020 was forecasted to be 97 MW, so it can be said that the increase in demand in 2020 was within expectations.

¹⁶ With regard to the distribution network, the Energy Sector Utility Reform Project (2014–2022), supported by the World Bank, has been providing assistance for the improvement of the upstream distribution network including the rehabilitation and construction of substations (33/11 kV) and distribution lines (33 kV) as well as assistance with reducing power losses.

¹⁷ June 2020 to June 2022. From July 2022 to June 2025, it will increase by another 5 MW totaling 65 MW in the dry season and 25 MW in the rainy season.

¹⁸ The actual available power generation capacity is likely to be smaller due to the low utilization rate of power generation facilities caused by the shortage of fuel and the maintenance cost of heavy oil power generation facilities, as well as due to the shortage of biomass.

¹⁹ It is a specialized institution of the Economic Community of West African States (ECOWAS), which is a cooperative framework for sharing electricity among West African states.

²⁰ The project was categorized as "Category B" in accordance with the *Guidelines for Environmental and Social Considerations of the Japan International Cooperation*

2011, before the project started. At the time of ex-post evaluation, the monitoring reports were not available, as they were not filed with the EDSA. However, according to the Ministry of Energy and the EDSA, environmental monitoring during project implementation was properly conducted, and no negative impacts on the natural environment were observed.

(2) Land acquisition and resettlement

At the time of ex-ante evaluation, two illegal houses and one abandoned house were identified in the area of the Goderich Substation. The payment of compensation following a simple resettlement action plan was a precondition for starting the project. At the time of ex-post evaluation, it was confirmed that the two illegal houses and the single abandoned house were removed.

(3) Impacts on women's empowerment

For the operation and maintenance of facilities and equipment including secondary substations and transmission lines installed under the project, six women out of 183 were employed, four of whom are in senior positions and two of whom are engineers (one subsequently left). According to the EDSA, although the number of female engineers is limited and recruitment is not easy, the EDSA actively promotes recruitment from the perspective of gender equality and women's empowerment.

(4) Synergies with other JICA project

As part of the activities associated with the JICA technical cooperation project titled Project for Capacity Development for Maintaining Power Supply Facilities (2011–2019), a pilot project was implemented, and a new power distribution system was introduced to reduce power losses by expanding the 11 kV distribution network to the vicinity of the consumers, while utilizing the power distribution facilities procured and installed under the project. The system was subsequently expanded with the support of the World Bank. According to the EDSA, the installation of the system has reduced power losses and contributed to power stability and improved customer services. Therefore, it can be said that the implementation of the project and the JICA technical cooperation project have produced synergies.

<Evaluation Result>

Regarding effectiveness, the target value was achieved for Indicator (1) “supply restriction time.” As for Indicator (2) “power quality,” although the data were very limited, the status of improvement was confirmed. As for Indicator (3) “power losses,” it was not possible to confirm the achievement of the target due to the lack of data. Regarding the impacts, although power supply has improved in some areas, the power supply situation has worsened, and power supply reliability has not improved in other areas, so achievement of the desired impacts is judged to be limited. Therefore, effectiveness and impacts of the project are fair.

3. Efficiency

<Project Outputs>

As for the outputs for which the Japanese side was responsible, although minor design changes occurred, the planned outputs were generally produced as planned. The minor design changes are listed below (total reduction of approximately 2.2 million yen).

- (1) Cancellation of the renovation of two secondary substations²¹ (decrease of approximately 2.2 million yen)
- (2) Extension of the 11 kV distribution line (increase of approximately 0.3 million yen)
- (3) Addition of equipment at secondary substations (increase of approximately 0.5 million yen)
- (4) Other minor changes (decrease of approximately 0.8 million yen)

With regard to the outputs for which the Sierra Leone's side was responsible, the renovation of two secondary substations (Goderich-2 Secondary Substation and the Goderich Village Secondary Substation) had not been completed when the defect inspection was carried out in 2019. In addition, the substation equipment (distribution transformers and low-voltage switchboards) procured under the project had not been installed and was still stored in the warehouse at the time of the defect inspection. At the time of ex-post evaluation, the renovation and installation of the equipment for the Goderich-2 Secondary Substation had been completed, but the renovation of the Goderich Village Secondary Substation was not yet completed. In addition, the location of the substation equipment procured to be installed at the Goderich Village Secondary Substation was unknown at the time of the ex-post evaluation, and the EDSA is in the process of identifying its location. According to EDSA, the renovation of the Goderich Village Secondary Substation is considered as a priority matter and will be completed by the end of November 2021.

Regarding the secondary substations, a total of 20 secondary substations (18 on the Japanese side and 2 on the Sierra Leone's side) were initially planned to be constructed or renovated, but work on the two on the Japanese side was canceled because they were renovated by other donors during project implementation. Furthermore, one secondary substation (Goderich Village) on the Sierra Leone's side had not yet been renovated at the time of ex-post evaluation, so a total of 17 secondary substations were constructed or renovated.

<Project Cost>

The project cost on the Japanese side was initially estimated to be 1,552 million yen²² (Phase 1). However, due to the Ebola outbreak, additional expenses for evacuation, standby, and project resumption, as well as for the restoration of equipment and the replacement of parts, arose due to the suspension of construction work, which resulted in the implementation of an additional project (Phase 2), which costed 140 million yen. Since the Ebola outbreak is an external factor, the ex-post evaluation considers the cost of Phase 2 to be included in the planned amount (1,692 million yen in total). The actual amount on the Japanese side was 1,546 million yen for Phase 1 and 140 million yen for Phase 2, totaling 1,686 million yen. Therefore, while the planned project cost was 1,692 million yen, the actual project cost was 1,686 million yen (100% of the planned amount), and it can be said that the project cost was within the planned amount, even considering the output reduction of 2.2 million yen. The project cost on the Sierra Leone's side was estimated to be 13 million yen at the time of ex-ante evaluation, but the actual amount could not be confirmed, so the evaluation judgment was made based on the Japanese side only.

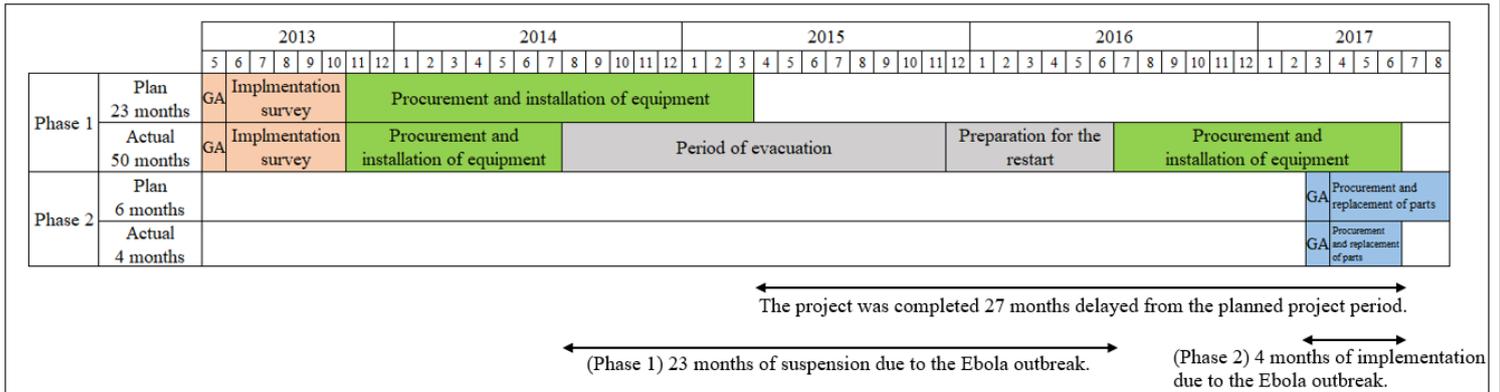
<Project Period>

Agency (2004).

²¹ The reason for the cancellation of the renovation was because they were renovated by other donors during the suspension of construction due to the Ebola outbreak.

²² Due to rapid appreciation of the yen, an exchange of notes was made to change the grant limit from 1,397 million yen to 1,552 million yen (an increase of 155 million yen) in 2013.

At the time of ex-ante evaluation, the project period was expected to be 23 months, from May 2013 (G/A signature) to March 2015 (month of delivery of the procured equipment). However, the Ebola outbreak caused a 23-month delay (August 2014 to June 2016) due to the suspension of construction work and preparations to restart the construction work. In addition, Phase 2 (4 months) was implemented due to the need for the procurement and replacement of parts caused by the suspension of construction work, and consequently, the project was completed in June 2017. The actual project period was 50 months against the planned 23 months, resulting in a delay of 27 months, but the extension period of 27 months due to the Ebola outbreak is not taken into account in the evaluation because it is an external factor. Therefore, the project period is judged to be as planned (100% of the planned period).



Source: Created by the evaluator based on materials provided by JICA.

Figure 2. Project Period

<Evaluation Result>

In light of the above, the outputs from the Japanese side were generally produced as planned, and the project cost and period were also as planned. However, the renovation of the Goderich Village Secondary Substation, which is a component of the outputs for which the Sierra Leone's side was responsible, have not been completed. The Goderich Village Secondary Substation is still in operation without completion of the renovation, and its impact on the project's effectiveness is not significant. However, since the location of the procured substation equipment cannot be verified, the status (output) indicating whether the input has been effectively utilized cannot be confirmed. Therefore, efficiency of the project is fair.

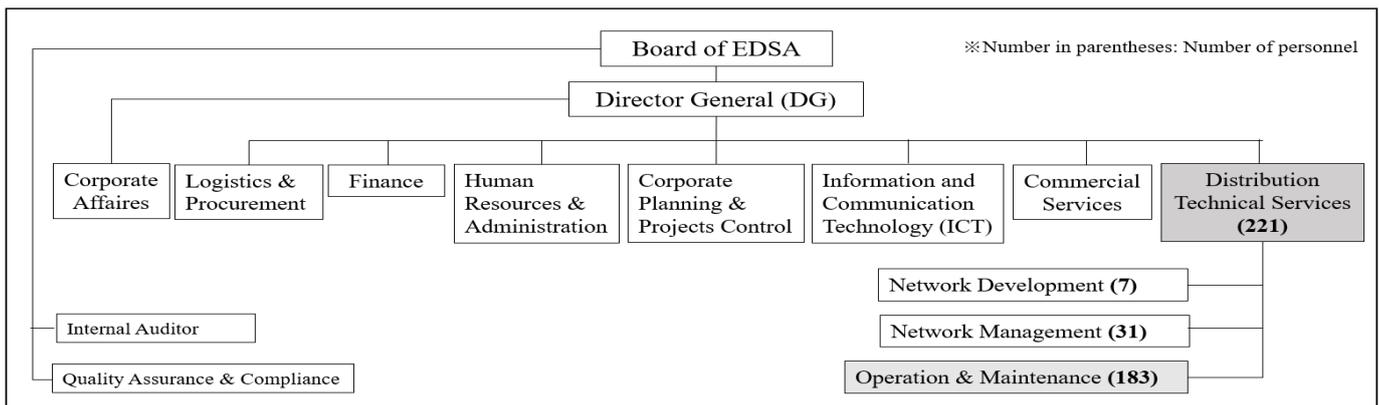
4. Sustainability

<Institutional and Organizational Aspect>

At the time of ex-ante evaluation, the executing agency of the project was the National Power Authority (NPA), but it was divided into the Electricity Generation and Transmission Company (EGTC) and the EDSA in 2015 based on the *National Electricity Act of 2011* (as amended in 2018). The EGTC is responsible for the generation and transmission of electricity, while the EDSA, the project's executing agency, is responsible for the distribution, supply, and sale of electricity. The lead ministry of the project was the Ministry of Energy and Water Resources at the time of ex-ante evaluation, but after two reorganizations, the lead ministry is the Ministry of Energy at the time of ex-post evaluation. The Ministry of Energy is responsible for energy-related policy formulation, project planning and implementation, and has supervisory functions over agencies related to the energy sector, including the EGTC and the EDSA.

As shown in Figure 3, the operation and maintenance of the power distribution facilities procured under the project are performed by the Operation & Maintenance Division in the Department of Distribution Technical Services. The Operation & Maintenance Division has 183 staff members, of which 101 are assigned to the Freetown section. According to the EDSA, the power distribution facilities operated by the EDSA are deteriorating year after year and the frequency of parts replacement and repair is increasing, which results in an increasing demand for personnel. Accordingly, the EDSA is proceeding with procedures to secure more human resources in consultation with the Human Resources and Administration Department. On the other hand, as far as the operation and maintenance of the power distribution facilities procured under the project are concerned, it can be said that sufficient personnel have been assigned since the minimum number of personnel required was assumed to be five at the time of the project's preparatory survey.

Therefore, the institutional and organizational structure of the EDSA are considered to be well established to maintain the effects of the project.



Source: Created by the evaluator based on materials provided by the executing agency.

Figure 3. Organizational Chart of EDSA

<Technical Aspect>

At the time of ex-ante evaluation, the power distribution facilities were operated and maintained without any problems, and the executing agency was identified as having sufficient experience and technical capacity. In addition, JICA's technical cooperation project titled Project for Capacity Development for Maintaining Power Supply Facilities (2011–2019), which was implemented in parallel with this project, was expected to improve the capacity of the operation and maintenance of the power distribution facilities, and to generate synergy effects with this project.

At the time of ex-post evaluation, according to the EDSA, there were no technical issues related to the operation and maintenance of the distribution facilities. The capacity of EDSA staff for the operation and maintenance has been strengthened through the use of the *Maintenance Procedure Manual* developed in 2018 and various training programs conducted under JICA's technical cooperation project and with the support of other development partners. In 2019, training on Operation and Maintenance of Substations and Substation Equipment, Power Distribution Network Maintenance and Repairs, and Energy Loss Management in Electric Utility Distribution Systems was conducted under the West Africa Power Pool program. In 2020, the U.S. Millennium Challenge Coordinating Unit²³ (MCCU) and other development partners conducted Training on Monitoring and Evaluation and Data Management as well as Training on G.I.S Mapping, Data Management, and Quality Assurance and Quality Control. In addition, the Energy Sector Utility Reform Project (2014–2022) supported by the World Bank has been implemented to improve the operational and management capacity of the EDSA and the technical capacity of its workforce.

Therefore, the EDSA is considered to have the capacity to properly operate and maintain the power distribution facilities installed under the project.

<Financial Aspect>

At the time of ex-ante evaluation, the NPA, the former executing agency, was experiencing stagnant sales and financial difficulties, and its deficit had been covered by government subsidies. One of the reasons for the stagnation in sales was that many large consumers in the industrial, manufacturing, and tourism sectors were using their own power generation facilities to meet their power demands, as the NPA was not able to provide satisfactory power services due to frequent power outages and voltage drops. In addition, due to the aging and inadequate capacity of the power transmission and distribution facilities, power losses were very high and the collection rate for billed amounts was very low, which also caused an increase in operating losses.

The EDSA's financial status remained challenging at the time of ex-post evaluation, as the financial balance for 2017–2019 shows a persistent deficit. The EDSA plans to reduce further power losses and improve its financial status by upgrading the power distribution facilities under the Energy Sector Utility Reform Project supported by the World Bank. In 2020, electricity sales decreased due to the lockdown during the COVID-19 pandemic. In addition, some consumers whose economic activities were restricted due to the COVID-19 pandemic had difficulties paying their electricity bills, which further worsened the EDSA's bill collection rate. In this context, the EDSA received financial assistance in the amount of 128 million leones (COVID-19 Relief Grant) from the World Bank to cover the 2020 deficit.

Table 2. Financial Balance of the EDSA, 2017–2019 (Unit: 1,000 leones)²⁴

	2017	2018	2019
Revenue (A)	303,293,181	367,326,458	445,938,827
Direct Cost (B)	305,541,794	455,907,842	588,088,974
Gross Margin (C) = (A) – (B)	(2,248,613)	(88,581,384)	(142,150,147)
Other Income (D)	22,676,528	58,367,846	113,705,016
Employee Benefit Provision (E)	(2,207,218)	7,093,468	8,808,546
Administrative expenses (F)	60,992,782	67,428,852	85,584,511
Results from operating activities (G) = (C) + (D) – (E) – (F)	(38,357,649)	(104,735,858)	(122,838,188)
Finance income (H)	289,920	179,404	118,733
Finance cost (I)	1,033,860	5,654,490	49,967,710
Net profit / loss for the year (G) + (H) – (I)	(39,101,589)	(110,210,944)	(172,687,165)

Source: Materials provided by the executing agency.

In addition, as shown in Table 3, focusing on the “repair and maintenance costs” among the administrative expenses in the EDSA's financial balance, although the trend has been increasing since 2017, according to the EDSA, the demand for repair and replacement of parts for aging facilities and equipment has been increasing annually, and the EDSA has not successfully secured a sufficient budget for proper operation and maintenance.

Therefore, it is considered that there are some concerns about the financial aspect.

Table 3. Breakdown of Administrative Expenses (2017–2020) (Unit: 1,000 leones)

		2017	2018	2019	2020
Administrative expenses	Repairs and maintenance costs	410,872	882,704	768,725	877,663
	Other administrative costs	60,581,910	66,546,148	84,815,786	90,287,328
Total		60,992,782	67,428,852	85,584,511	91,164,991

Source: Materials provided by the executing agency.

<Current Status of Operation and Maintenance>

Regarding the operation and maintenance status at the time of ex-post evaluation, no serious problems were identified, including daily inspection and maintenance. However, according to the EDSA, some expensive spare parts that are not available locally are difficult to

²³ The unit established in the Millennium Challenge Corporation, which is a bilateral aid agency of the U.S. government.

²⁴ 1,000 leones = approximately 13.7 yen (the average rate based on data from the International Monetary Fund for the years 2017–2019)

replace in a timely manner, which hinders the proper operation and maintenance of the power distribution facilities. In addition to the lockdown and curfew measures due to the COVID-19 pandemic, the stagnation of the supply chain has delayed the procurement of spare parts, making timely maintenance and repair difficult.

Furthermore, in recent years, there has been an increase in incidents involving the destruction or theft of power distribution equipment, which has been a major blow to stable power supply. The Ministry of Energy and the EDSA intend to take legal action against those who destroy or steal power assets, and actively conduct community awareness campaigns.

<Evaluation Result>

In light of the above, no concerns were found in terms of institutional, organizational, and technical aspects, but some concerns have been observed in terms of the financial aspect and the current status of operation and maintenance. Therefore, the sustainability of the project effects is fair.

III. Recommendations & Lessons Learned

Recommendations to Executing Agency:

1. Establish a system for collecting and analyzing data on power losses

Data related to power losses, which is one of the project indicators, was not collected and analyzed. Power losses are an important issue, as it has been targeted for reduction in the *National Energy Efficiency Action Plan*. It is also an important indicator for planning the development of the power distribution network and for improving the EDSA's financial situation. Therefore, the EDSA is required to establish a system to collect and analyze data on power losses on a regular basis.

2. Renovation of the Goderich Village Secondary Substation and investigation into the location of the procured substation equipment

The renovation of the Goderich Village Secondary Substation, an output from the Sierra Leone's side, has not yet been completed. In addition, the location of the substation equipment that was expected to be installed at the Goderich Village Secondary Substation has not been identified because the serial number of the equipment cannot be specified. The EDSA is required to complete the rehabilitation of the secondary substation promptly and to locate the procured substation equipment and report it to JICA.

Recommendations to JICA: Monitoring and follow-up on the renovation of the Goderich Village Secondary Substation and the investigation into the location of the procured substation equipment

As indicated in "Recommendations to the Executing Agency" above, the renovation of the Goderich Village Secondary Substation has not been completed and the location of the procured substation equipment has not been identified. Monitoring the renovation of the secondary substation and the confirmation of the equipment's location are required. In addition, it is necessary to provide support for confirming the location of the substation equipment through consultants, such as identifying the serial number associated with the substation equipment that was stored in the warehouse at the time of the defect inspection.

Lessons Learned for JICA: Consideration of assistance in establishing a system for data collection and analysis

Although "power losses" was set as one of the indicators to verify the project's effectiveness, the executing agency did not have a monitoring system in place to collect and analyze the relevant data. Since the reduction of power losses is a key issue for the stable management of the executing agency, it is essential to collect and analyze relevant data on a regular basis. Monitoring power losses will be feasible by procuring and installing statistical meters and data management software in the substations constructed under the project. Furthermore, it is desirable to consider technology transfer for data management and analysis in the soft component (capacity building) of grant aid projects. Therefore, at the time of project planning, it is important to identify whether a system is in place at the executing agency to properly collect and analyze important data, and if necessary, it is also crucial to consider providing assistance in procuring related equipment and incorporating training on data management into the soft component.



Transformer at the Goderich Primary Substation installed under the project



Administration building at the Goderich Primary Substation constructed under the project



Distribution transformer at the secondary substation of Milton Margai College of Education and Technology renovated under the project



Distribution transformer at the secondary substation of the Emergency Surgical Hospital renovated under the project