Republic of Ghana

FY2021 Ex-Post Evaluation Report of Grant Aid Project

"The Project of Reinforcement of Power Supply to Accra Central"

External Evaluator: Katsuyoshi Takakura

Foundation for Advanced Studies on International Development

## 0. Summary

The project was implemented with the objective, which is to supply stable electric power and reduce electric power transmission and distribution loss at capital city Accra, Ghana by constructing a core transmission and substation facility, thereby contributing to the stabilisation of residents' lives and industrial development.

The project is consistent with Ghana's development policy, development needs, and Japanese aid policy at the time of planning. Synergies with internal and external JICA projects have been identified based on prior coordination and planning. Hence, relevance and consistency are high. Although the project period was slightly longer than the plan, the project costs were within the planned amount, so efficiency is high. Regarding the quantitative effects of effectiveness, the effects of achieving capacity of transformers within Accra, reducing the annual planned outage hours, reducing the annual number of outages, increasing the transmission and distribution electricity supply, and reducing the distribution loss ratio were identified. However, no effects were observed for annual unplanned outage hours, transmission loss ratio, and transmission line overloading. Qualitative effects were only observed to be achieved in some facilities with regard to the stability of electricity supply, reduction in the number of power outages, and reduction in the duration of power outages. In addition, no negative impacts were observed as a result of the implementation of the project, but the expected impact set at the time of planning, namely 'stabilisation of residents' livelihoods and industrial development', was limited. Therefore, effectiveness and impacts of the project are moderately low. Although there are some minor technical problems in the operation and maintenance of the project, there are no problems in other areas such as the structure and financial aspects. Therefore, sustainability of the project effects is high. In light of the above, this project is evaluated to be satisfactory.

## 1. Project Description


Project Location (Source: Evaluator)

Accra Central BSP (Source: Evaluator)

1.1 Background

Ghana continued to grow steadily until COVID-19 started to have an influence, driven by private investment and infrastructure development due to the start of commercial oil production. In Ghana, the demand for electricity was increasing along with the economic growth. It is prognosticated that electricity demand will reach 4,161 MW in 2026. However, there was already a nationwide power shortage, especially in the Accra central area, and it was causing serious obstacles to economic activities. In addition, the development of power grids to meet the rapidly increasing demand for electricity had been delayed, and system losses for electricity transmission and distribution in Accra in 2013 were recorded at 30 MW.

The Government of Ghana formulated *VISION 2020* as a long-term comprehensive development guideline in 1995 and has positioned power sector development as one of the priorities. Furthermore, nationwide electrification was being pursued with the ultimate goal of supplying electricity to all citizens through the formulation of the *National Electrification Scheme (NES)* for 2020. Because of the effects of these political measures, the electrification rate in Ghana was 72% at the end of 2011, which was higher than the average of Sub-Saharan African countries (30.5%).

Therefore, it was expected that the implementation of this project would contribute to the increase in electric power supply and the improvement of the electric system loss rate.

1.2 Project Outline

The objective of this project is to supply stable electric power and reduce electric power transmission and distribution loss at capital city Accra, Ghana by constructing a core transmission and substation facility, thereby contributing to the stabilisation of residents' lives and industrial development.

<Grant Aid Project>

| | |
|---|---|
| Grant Limit/Actual Grant Amount | 4,357 million yen/4,197 million yen |
| Exchange of Notes Date /Grant Agreement Date | December 2015/December 2015 |
| Executing Agency[1] | Ghana Grid Company Limited (GRIDCo) |
| Project Completion | December 2018 |
| Target Area | Accra, Greater Accra Region |
| Main Consultant(s) | Joint Venture of Yachiyo Engineering Co., Ltd. |

[1] Cooperating agency is Electricity Company of Ghana (ECG).

| | |
|---|---|
| | and West Japan Engineering Consultants Inc. |
| Main Contractor(s) | Joint Venture of Mitsubishi Corporation, Hitachi Plant Construction, Ltd., and Yurtec Corporation |
| Basic Design/Preparatory Survey | December 2013-August 2015 |
| Related Projects | Technical Cooperation Project "The Project on Electrical Engineers Training for African Countries" (2010-2016) |

## 2. Outline of the Evaluation Study

2.1 External Evaluator

Katsuyoshi Takakura, Foundation for Advanced Studies on International Development

2.2 Duration of Evaluation Study

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

Duration of the Study: December 2021-March 2023

Duration of the Field Study: 23 May 2022-4 June 2022 and 11 September 2022-17 September 2022

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

3.1 Relevance/Coherence (Rating: ③[3])

3.1.1. Relevance (Rating: ③)

3.1.1.1 Consistency with the Development Plan of Ghana

At the time of planning, the Government of Ghana had formulated *Ghana Vision 2020* in 1995 as a long-term comprehensive development guideline, which identified power sector development as one of its priorities. Under *National Electrification Plan*, national electrification was being planned with the ultimate goal of supplying electricity to all citizens, and reducing transmission and distribution losses was identified as one of the key issues. In addition, *National Energy Strategic Plan 2006-2020* identified (i) stimulating economic activity and promoting economic growth through a stable energy supply, (ii) integrating, upgrading, and expanding existing energy facilities, and (iii) strengthening the organisation, human resources, and research and development capacity in the energy sector as the main planning objectives. The plan included the reinforcement and expansion of the electricity transmission and distribution network as one of its strategies.

[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory.
[3] ④: Very High, ③: High, ②: Moderately Low, ①: Low.

At the time of the ex-post evaluation, the importance of developing an electricity infrastructure, including generation, transmission, and distribution, is mentioned in *Ghana Long-Term National Development Plan 2018-2057* in order to build secure communities. *Medium-Term National Development Plan 2022-2025* also mentions the importance of developing an electricity infrastructure to provide electricity to the total population.

As the above demonstrated, this project is consistent with the development policy.

3.1.1.2 Consistency with the Development Needs of Ghana

At the time of planning, Ghana was growing steadily, driven by private investment and infrastructure development against the backdrop of the start of commercial oil production and other factors. Also, demand for electricity was increasing with economic growth. Nationwide electricity shortages, particularly in the Metropolitan areas and large cities, were becoming a problem and seriously hampering economic activities.

In the Accra Metropolitan Region, electricity demand reached 923.7 MW in FY2021[4], compared to 776 MW in 2018. Even at the time of the ex-post evaluation, electricity demand was high. The Accra Central Bulk Supply Point (BSP) was the main substation supplying electricity to Accra's central business district. Without this BSP, the supply of electricity to Accra's central business district would have been challenging[5].

Therefore, this project meets the development needs.

3.1.2 Coherence (Rating: ③)

3.1.2.1 Consistency with Japan's ODA Policy

At the time of planning, Japan's basic policy in aiding Ghana was to promote strong economic growth that would benefit the population at large. Economic infrastructure (electricity and transport) was identified as an area of focus[6]. Ghana's policy for addressing its development challenges was to increase power generation capacity, improve the electrification rate, electrify rural areas, and rehabilitate and enhance transmission and distribution facilities in order to promote the appropriate distribution of energy necessary for local communities and economic growth[7].

3.1.2.2 Internal Coherence

Under the Project on Electrical Engineers Training for African Countries (2010-2016), a technical cooperation project implemented by JICA at the same time as this project, capacity strengthening training was provided for ECG technicians and engineers with the aim of improving

[4] Questionnaire responses to ECG.
[5] Questionnaire responses to GRIDCo and ECG.
[6] Country assistance policy for Ghana 2012.
[7] Rolling plan for Ghana 2014.

their capacity to operate and maintain electricity distribution facilities. The project contributed to the development of human resources and capacity strengthening of ECGs to construct, operate, and maintain the substation facilities developed under this project[8]. Because five ECG technicians and 14 ECG engineers who participated in the training were involved in the project, there was a synergistic effect in that the technicians and engineers who had improved their ability to operate and maintain power distribution facilities by attending the training contributed to the construction, operation, and maintenance of the substation facilities, which are the outputs of the project[9]. In the detailed planning survey report for the technical cooperation project, it was written as 'New grant aid is being considered for power distribution facilities and maintenance based on the above master plan for power distribution, and synergies are expected to be generated through collaboration with the project'. Hence, synergies with this project have been consciously promoted from the outset.

3.1.2.3 External Coherence

The Pokuase BSP[10] Project (2016-2022), implemented by Millennium Challenge Corporation (MCC), increased the capacity of the sub-transmission network in northern Accra and improved transmission line voltage levels[11]. The project's objective is to reduce technical transmission and distribution losses, thereby promoting economic growth and reducing poverty. The Pokuase BSP was developed to provide stable electricity supply by reducing transmission losses and increasing the capacity of the distribution network within Accra. The project has helped the Accra Central BSP achieve its goals of stable electricity supply and in reducing technical transmission and distribution losses[12]. From the above, it can be said that there was a synergistic effect with the objective of this project to reduce technical transmission and distribution losses in Accra. According to JICA's Financial Cooperation Operations Department, this project was being coordinated with related projects, such as donor support, from the time of the preparatory survey. At the ground-breaking ceremony, the positioning of this project, which is to meet future electricity demand in the Accra Metropolitan Region in collaboration with the Pokuase BSP, and the division of roles between the two BSPs were also explained, and this project was implemented in collaboration with the Pokuase BSP Project.

As mentioned above, in terms of relevance, the project is consistent with Ghana's development policy and development needs. With regard to coherence, the project is consistent with Japan's aid policy at the time of planning. Regarding cooperation with projects within JICA, synergies were confirmed because the technicians and engineers who participated in the technical

[8] Interview with the JICA Ghana Office.
[9] Questionnaire responses of ECG training centres.
[10] The Pokuase BSP was built to improve the electricity supply in the northern part of the Accra Metropolitan Region, whereas the Accra Central BSP was built to improve the electricity supply in the central area of Accra city.
[11] Interviews and questionnaire responses to ECG.
[12] Interviews to MCC, GRIDCo, and ECG.

cooperation project EETA, which aims to strengthen the capacity of ECG technicians and engineers, are engaged in the construction, operation, and maintenance of substation facilities, which is the output of this project. With regard to collaboration with projects outside JICA, synergies were identified with the MCC's 'Pokuase BSP Project' in each other's project objectives. It was confirmed that there were prior coordination and planning in both internal and external coherence.

Therefore, its relevance and coherence are high.

3.2 Efficiency (Rating: ③)

3.2.1 Project Outputs

The planned and actual outputs of this project are as shown in Table 1. Relating to the outputs, the Japanese side achieved almost as much as planned, although there were some changes in the specifications of facilities and equipment and the transmission line route. For facilities, there were minor changes in the control building, main transformer platform types, and GIS platform types. For equipment, there were changes to the transmission line route and pylon specifications. For the Ghanaian side, the securing of land and the clearing of the site and removal of obstacles were not achieved as planned.

**Table 1 Planned outputs and actual outputs**

| Planned outputs | Actual outputs |
|---|---|
| Civil engineering works, procurement equipment, etc. | |
| Facilities | |
| -Control building<br>-Main transformer platform<br>-GIS platform (for 170 kV Gas insulated switchgear)<br>-Platforms for 161 kV transmission pylons | -Control building<br>-Main transformer platform (Change from solid platform to pile platform)<br>-GIS platform (Change from solid platform to pile platform)<br>-Platforms for 161 kV transmission pylons |
| Equipment | |
| Accra Central BSP<br>-161/34.5 kV Transformer<br>-170 kV Gas insulated switchgear<br>-33 kV Gas insulated switchgear<br>-SCADA interface panel<br>-Control and protection panel | As planned. |
| 161 kV Power Cable<br>-161 kV Overhead cable<br>-161 kV Underground cable<br>-Pylon | As planned.<br>However, there were changes regarding the routes of 161 kV overhead cables and 161 kV underground cables and the specifications of the towers, etc. |
| Other Equipment<br>-Maintenance tools for procured equipment.<br>-Spare parts for procured equipment. | In addition to equipment at the time of planning, 'emergency spare parts for procured equipment' were added. |
| Consulting services | |

| | |
|---|---|
| Detailed design, bidding support, and construction supervision. | As planned. |
| Ghanaian side | |
| -Securing land for the project site (new BSP and 161 kV transmission line route).<br>-Clearing the project site and removing obstacles.<br>-Securing land for temporary storage of materials and equipment and fences/gates.<br>-Facility works: Construction of gates and fences, Access road works to the project site, Hypothetical reconnection works at the Graphic Road substation during the removal of the existing 33 kV switchboard, Connection works at the junction of the 161 kV transmission line, and Removal works of 33 kV sub-transmission lines. | -The transmission line route and pylon specifications were changed due to the inability to secure land around pylon N18.<br>-The construction period was extended by one month due to the discovery of buried cables at the project site.<br>-'Procurement of equipment to connect the SCADA connection panel to the existing SCADA communication network and connection work' was added. |

(Source: documents provided by JICA and preparatory survey report)

As shown in Table 2, there were specification changes, changes due to non-removal of obstructions, and changes due to the occurrence of claims, from Outline Design (O/D) and Detailed Design (D/D) with regard to the project's outputs.

Change 1) was a change in the specification of the pylon and related equipment due to the effect of the Brazilian state-supported junction viaduct construction project. At the time of this project's planning, GRIDCo was not aware of that project because it had not started. At the start of this project's construction, GRIDCo recognised the need to change the height of the pylon and the specifications of the platform due to the effect of the Brazilian project. So, GRIDCo decided to change them. The height of the pylons and the specifications of the platforms had to be changed in order for the transmission line to be able to pass over the junction viaduct, which was constructed by a Brazilian project. Technically, it was impossible to avoid.

Change 2) was a reasonable change because it was a platform change to guarantee the performance of the equipment. Change 3) was a change of the transmission line route and pylon specifications due to the lack of available construction space. It was also an inevitable change.

Pertaining to change 4), it was stated that the removal of the existing 33 kV distribution line was not completed before the start date of the 161 kV transmission line works (September 2017) due to a lack of coordination between GRIDCo and ECG. However, in reality, the two companies had adequate coordination and communication. The cause was the delay in obtaining permission from the Accra Municipal Authority for the cable route[13].

Change 5) was an extension of the construction period because of incomplete removal of existing structures, etc. Because a large number of buried cables were discovered on the ECG-owned project site land, it took a long time to remove the cables. It was impossible for GRIDCo,

[13] Questionnaires and interviews to ECG.

which was carrying out the removal work, to check the underground conditions at the time of planning, and it was difficult to find the presence of the cables in advance. The problem could not be avoided technically. Also, GRIDCo had checked with ECG at the time of planning.

Change 6) was an extension of the project's implementation period due to a claim from the landowner before the start of construction. However, the claim could not have been foreseen in advance, so the change and the extension of the period were inevitable.

As stated above, it can be concluded that the changes in 1) to 6) were unavoidable. Furthermore, the quality of the BSP and transmission and distribution line facilities did not deteriorate as a result of the extended project period. The facilities were constructed as originally planned. No other changes in this project were identified.

**Table 2 Changes from O/D and D/D[14]**

| | |
|---|---|
| Specification changes | |
| 1) | Because of the Brazilian-supported intersection grade crossing (around the ECG's project office), the specifications (dimensions and quantities) of the pylons and platforms (N9 and N10) for the 161 kV transmission line works were changed. (April 2016) |
| 2) | Because the bidder's internal policy required that the building's immovable settlement be as '0 mm' as possible to guarantee the performance of the equipment, the platforms were changed from solid to piled platforms. (April 2017) |
| 3) | The 161 kV transmission line route between pylon N16 and the Accra Central BSP and the pylon specifications, etc., were changed due to the lack of space for construction work regarding pylon N18 and the 161 kV underground transmission cable, which is one of GRIDCo's responsibilities. Regarding pylon N18, the reason for the change was that it was not possible to secure a construction space due to the lack of agreement on the acquisition of the adjacent car factory. Concerning the construction of the 161 kV underground transmission cable, the reason was that it was difficult to obtain permits and approvals for the relocation of water pipes and other public buried objects, and construction space could not be secured. (May 2017) |
| Changes due to unremoved obstacles | |
| 4) | Because of the removal of the existing 33 kV distribution line, one of GRIDCo's responsibilities, was not completed before the start date of the 161 kV transmission line construction (September 2017), and the construction location of the 161 kV transmission line from pylon N1 to N12 was changed. After that it was confirmed during the warranty inspection that the removal of the existing 33 kV distribution line had been carried out. (October 2017) |
| 5) | Because of the removal of existing structures and other work at the Accra Central BSP, which GRIDCo was supposed to carry out, was not completed by the end of August 2016, the contract performance deadline was extended from 31 July 2018 to 31 October 2018. The additional costs of the contractor for the extended construction period were paid from the grant aid. When GRIDCo was in the process of removing the cables, a large number of buried cables were discovered on the project site. Hence, the removal work became more than expected. Because the project site was an existing BSP owned by ECG, GRIDCo could not find the cable. The removal of the cables took approximately 4.5 months. They were removed by mid-January 2017, when construction work started. (December 2018) |
| Changes due to the occurrence of a claim | |
| 6) | The 161kV underground cable route to be laid between pylon N19 and the Accra BSP required time for residents' safety and coordination with landowners, so the construction period was extended by one month. Additional costs for contractors due to the extended construction period were paid from the grant aid. On the day of starting construction work, there were urgent complaints to GRIDCo |

[14] 1) was a change from O/D; 2)-6) were changes from D/D.

| |
|---|
| from residents in the vicinity to apply safety measures to the construction work. The landowner also requested consultations before the start of construction. Hence, the start of construction was delayed by one month. (December 2018) |

(Source: documents provided by JICA and interviews to implementation consultant)

### 3.2.2 Project Inputs

#### 3.2.2.1 Project Cost

The actual amount was 4,197 million yen (96% of the plan), whereas the E/N limit amount was 4,357 million yen at the time of the plan. Project costs were within the plan. A breakdown of planned and actual amounts is shown in Table 3.

**Table 3 Planned and actual project cost**

(Unit: 1,000 yen)

| | Planned amount | Actual amount | | | |
|---|---|---|---|---|---|
| | | Domestic currency | Foreign currency (Japanese procurement) | Foreign currency (Third country procurement) | Total |
| Construction | 400,000 | 412,679 | 254,099 | 32,694 | 699,472 |
| Equipment | 3,797,000 | 0 | 2,983,337 | 361,472 | 3,344,809 |
| Design and Administration | 153,000 | 0 | 153,000 | 0 | 153,000 |
| Total | 4,350,000 | 412,679 | 3,390,436 | 394,166 | 4,197,281 |

(Source: documents provided by JICA and preparatory survey report)

As noted in '3.2.1 Project Outputs', there was a change due to unremoved obstacles and a change due to claims. These changes increased the costs.

Specifically, there was an increase in costs for the extension of the construction period (an increase of 7,772,000 yen from the contractor's contract amount) because of incomplete removal of existing structures (Table 2 Change 5), and there was an increase in costs (an increase of 7,144,000 yen from the contractor's contract amount) for the extension of the construction period due to complaints from residents living near the construction site (Table 2 Change 6). However, although the contract amount of the contractor was increased, the bidding price was lower than planned. As a result, the overall project cost on the Japanese side was lower than planned.

At the time of planning, the project cost of the project on the Ghanaian side was assumed to be 200 million yen, but at the time of the ex-post evaluation, the project costs were unknown because

most data on project costs did not exist[15].

3.2.2.2 Project Period

At the time of planning, the project period was planned to be 31 months (Aug 2015-Feb 2018), but the actual result was 37 months (Dec 2015-Dec 2018): 119% of the plan. It slightly exceeded the plan. Details are given in Table 4.

**Table 4 Project period plans and achievements**

| | Planned | Actual |
|---|---|---|
| Grant agreement signing | August 2015 | December 2015 |
| Design and bidding period | August 2015-January 2016 (5 months) | December 2015-May 2016 (6 months) |
| Construction period | January 2016-February 2018 (25.5 months) | September 2016-December 2018 (28 months) |
| Project completion | February 2018 | December 2018 |
| Total project period | August 2015-February 2018 (31 months) | December 2015-December 2018 (37 months) |

(Source: documents provided by JICA and preparatory survey report)

The project period exceeded the plan due to the extension of the construction period and the handling of complaints from residents. Specifically, the deadline for implementation was extended from 31 July 2018 to 31 October 2018 due to the extension of the construction period for the uncompletion of the removal work of existing structures, etc. (Table 2 Change 5). In addition, due to the handling of complaints from residents living near the construction site, it took three months to resolve disputes, and the construction period was delayed. The implementation deadline was therefore further extended from 31 October 2018 to 28 December 2018 (Table 2 Change 6)[16].

With regard to the outputs, on the Japanese side, there were changes in the type of platform, the 161 kV overhead transmission line and transmission line route, and the specification of the pylon. However, it has mostly achieved as much as planned. For the Ghanaian side, as the changes from the O/D and D/D, there were changes to the transmission line route and pylon specifications because the securing of land and removal of obstacles could not be achieved as planned. These were unavoidable changes, and the extension of the project period was reasonable. The handling of claims from the landowner before the start of construction could not have been predicted in advance, and it was unavoidable that the project had to be extended by three months to resolve the disputes. As the above demonstrates, the project period was slightly longer than planned, but

[15] Documents provided by JICA, questionnaires and interviews to GRIDCo and ECG.

[16] Details are discussed below in resettlement and land acquisition.

the project costs were within the planned amount. Therefore, the project's efficiency is high.

3.3 Effectiveness and Impacts[17] (Rating: ②)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

The status of achievement of the operation indicators measuring the project's objective 'stable electricity supply and reduction of transmission and distribution losses' is shown in Table 5. Operation indicator (a) Capacity of transformers in Accra (MVA) was achieved. The achievement of operation indicator (b) Transmission and distribution losses in Accra Metropolitan Area (MW) could not be measured.

**Table 5 Achievement of operation indicators**

| Operation indicators | Baseline value (2013) | Target value[18] (2021: 3 years after completion) | Reference value (2021) | Actual value | | |
|---|---|---|---|---|---|---|
| | | | | 2018 | 2020 | 2021 |
| (a) Capacity of transformers in Accra (MVA) | 726 | 1,608 | 1,233[19] | 1,299 | 1,233[20] | 1,813 |
| (b) Transmission and distribution losses in Accra Metropolitan Area (MW[21]) | 30 | 49 | 70 | N/A | N/A | N/A |

(Source: prepared by the evaluator based on Ex-ante Evaluation Sheet, preparatory survey report, and questionnaires and interviews to GRIDCo, ECG, implementation consultant, and MCC)

Relating to operational indicator (a) Capacity of transformers in Accra, this project's increased capacity of transformers was only 375 MVA (three 125 MVA transformers) of the target value in 2021 of 1,608 MVA, as shown in Table 5. To measure the effectiveness of the project, the installation of three 125 MVA transformers in the Accra Central BSP was visually confirmed. The transformers and the main transmission lines were also confirmed to be in operation by a monitoring panel in the control building of the BSP. As a result, it can be said that this project's target value for the capacity of transformers, namely 375 MVA (three 125 MVA transformers) has been achieved. In addition, as shown in Table 6, the capacity of transformers increased by 205 MVA from the time of planning in the Pokuase substation construction project, which was

[17] When providing the sub-rating, Effectiveness and Impacts are to be considered together.
[18] The target values are the theoretical values from Table 6 added to the 2013 baseline values. The implementation consultant used theoretical values using analysis software, and the actual values were not measured (1,608 MVA=726 MVA+375 MVA+375 MVA+132 MVA).
[19] Target value of 1,608 MVA minus theoretical value of 375 MVA (three 125 MVA) due to implementation of the project. Estimated value due to non-implementation of this project.
[20] The reason for the drop in the capacity of transformers in Accra in 2020 to 1,233 MVA is due to the temporary relocation of one transformer (66 MVA) from the Achimota BSP to the BSP in Kumasi.
[21] In the Ex-ante Evaluation Sheet, it was MVA, but after checking, MW was correct, so which has been corrected.

supported by other donors (MCC). Thereby, the capacity of transformers in Accra in 2021 was 1,813 MVA. Therefore, the target value for indicator (a) was exceeded.

**Table 6 Details of capacity of transformers in Accra (MVA)**

| Plan at the time of this project's planning | | |
|---|---|---|
| Name of BSP | Capacity of transformers | Year of installation |
| Accra central BSP Construction (This project) | 375 MVA (125 MVA×3) | 2018 |
| Pokuase BSP Construction | 375 MVA (125 MVA×3) | 2020 |
| A3 BSP Reinforcement of facility | 132 MVA (66 MVA×2) | 2014 |
| Actual at time of ex-post evaluation | | |
| Accra central BSP Construction (This project) | 375 MVA (125 MVA×3) | 2018 |
| Pokuase BSP Construction | 580 MVA (145 MVA×4) | 2021 |
| A3 BSP Reinforcement of facility | 132 MVA (66 MVA×2) | 2014 |

(Source: prepared by the evaluator based on Ex-ante Evaluation Sheet, preparatory survey report, and questionnaires and interviews to GRIDCo, ECG, MCC, and implementation consultant)

Then, this section describes operation indicator (b) Transmission and distribution losses in Accra Metropolitan Area (MW), for which it was not possible to measure achievement. As mentioned above, in the Pokuase substation construction project, which was supported by another donor (MCC), the capacity of transformers increased by 205 MVA from the time of planning this project. Therefore, the capacity of transformers capacity in Accra in 2021 was 1,813 MVA. As a result, the actual target value of the indicator for transmission and distribution losses in the Accra Metropolitan Area was larger than the value calculated by the implementation consultant using the analysis software at the time of planning, so project effectiveness could not be measured using the target value of the indicator for transmission and distribution losses in the Accra Metropolitan Area set at the time of planning. In addition, the revised target value for the indicator needed to be calculated using specialised analysis software. Hence, it was difficult to revise the target values.

As reference information, capacity of transformers, compared with the target value (2021), is given using Table 7. Regarding transmission losses, actual measurements could not be obtained because GRIDCo replied that there are no meters on the transmission line between the Akosombo hydroelectric power station and the Aboaze thermal power station. Hence, it was not possible to measure transmission losses between these two power stations. With regard to the actual measured distribution losses, the data for 2020 was 15 MW. It achieved the target because it was lower than the originally set target of 17 MW for 2021.

**Table 7 Details of transmission and distribution losses in Accra Metropolitan Area (MW)**

| Indicators | Baseline value | Target value | Reference value | Actual value | | |
|---|---|---|---|---|---|---|
| | 2013 | 2021 | 2021 | 2018 | 2020 | 2021 |
| (b) Transmission and distribution losses in Accra Metropolitan Area (MW[22]) | 30 | 49 | 70 | N/A | N/A | N/A |
| (b1) Transmission losses in Accra Metropolitan Area (MW) | 20 | 32 | 32 | N/A | N/A | N/A |
| (b2) Distribution losses in Accra Metropolitan Area (MW) | 10 | 17 | 37 | 13 (2017) | 15 | N/A |

(Source: prepared by the evaluator based on Ex-ante Evaluation Sheet, preparatory survey report, and questionnaires and interviews to GRIDCo, ECG, MCC, and implementation consultant)

Therefore, reference and additional reference indicators were set and reflected in the ratings because the pre-set operation indicators are not sufficient to measure the project effects.

Reference indicators were set for annual outage hours (planned and unplanned), annual number of outages, transmission and distribution loss ratio, and transmission and distribution electricity supply. The results for the reference indicators are shown in Table 8. Regarding (c) annual outage hours, the annual planned outage hours decreased significantly by 95% compared to 2013, whereas the annual unplanned outage hours increased by 42%. The increase in unplanned outage hours was attributed to system disturbances, but there was no clear evidence of a system disturbance[23]. (d) Number of annual power outages increased by 37% in 2018 compared to 2013 but decreased by 11% in 2021 compared to 2013. Relating to (e) transmission loss ratio, there was a slight increase of 10%, whereas there was a 56% decrease between 2013 and 2020 for the distribution loss ratio. (f) Amount of electricity supply increased by approximately 40% for both transmission and distribution. As a result of the above, the reference indicators were only partially achieved.

[22] Transmission and distribution losses in Accra Metropolitan Area are the sum of transmission losses (b1) and distribution losses (b2). The transmission losses represent the transmission losses between the Akosombo hydroelectric power station and the Aboaze thermal power station, whereas the distribution losses represent the losses on the 33kV sub-transmission lines and transformers in the Accra Metropolitan Region.

[23] According to the ECG, there is no evidence for this because system shutdowns due to unauthorised system access (called galamsey in Ghana) are frequent. Galamsey means illegal mining but is also used to refer to illegal activities that disrupt the system (e.g., stealing power illegally from the power grid).

**Table 8 Result of reference indicators[24]**

| Indicators | 2013 | 2018 | 2020 | 2021 |
|---|---|---|---|---|
| (c) Annual planned outage hours (hour) | 13,373 | 1,080 | 521 | 652 |
| (c) Annual unplanned outage hours (hour) | 3,733 | 3,883 | 6,052 | 6,420 |
| (d) Number of annual power outages | 7,176 | 11,462 | 8,080 | 6,420 |
| (e) Transmission loss ratio (%)[25] | 4.49 | 4.43 | 4.5 | 5.01 |
| (e) Distribution loss ratio (%) | 3.95 (2012) | 1.81 (2017) | 1.74 | N/A |
| (f) Amount of electricity supply: transmission (GWh) | 12,927 | 15,960 | 19,717 | 21,466 |
| (f) Amount of electricity supply: distribution (MWh) | 3,430,502 | 4,603,694 | 5,149,528 | 5,879,026 |

(Source: prepared by the evaluator based on questionnaires and interviews to GRIDCo and ECG)

The presence or absence of overloads on transformers, as well as on transmission and distribution lines, was set as an additional reference indicator because external experts have commented that it is important to check for overloads on transformers, as well as on transmission and distribution lines, to confirm the effectiveness of the electricity distribution facilities plan. If this project was not implemented, transformer overloads could occur at the Achimota, Malang, and A3 BSP[26] in 2018, disrupting the supply of electricity to the Accra Metropolitan Area[27]. Between the end of the project and 2021, there were no overloads on transformers and transmission lines, etc. However, an overload[28] occurred on the transmission line between Achimota BSP, Accra Central BSP, and Malang BSP in 2022. This overload had a negative impact on the electricity supply in Accra[29]. According to GRIDCo, the causes of overload were as follows: 1) Existing (old) transmission lines had limited capacity between Achimota BSP-Accra Central BSP-Mallam BSP[30]; and 2) the power load drawn from the Accra Central BSP exceeded the capacity of the existing transmission line. Therefore, it was concluded that indicators on the presence or absence of overloads were not achieved.

The quantitative effects of effectiveness are summarised below. With regard to the quantitative effectiveness (operation indicators), (a) Capacity of transformers in Accra has been achieved. Regarding (b) Transmission and distribution losses in the Accra Metropolitan Area, it was determined that project effectiveness cannot be measured by this indicator because the target value of this indicator needs to be revised. As reference information, the actual value of transmission losses could not be obtained. Distribution losses were achieved, albeit for reference

[24] The figures from (c) to (f) are for the Accra Metropolitan Area as a whole.
[25] Transmission loss ratios are for the entire Accra Metropolitan Region and cannot be calculated for each BSP area alone.
[26] There are five BSPs in Accra: Achimota, Malang, A3, Pokuase, and Accra Central.
[27] Preparatory survey report.
[28] 'Overload' refers to the phenomenon of a larger power (load) being applied than the power allowance. In this case, the overload was determined as the point at which the transmission line reached its maximum capacity of 170 MW and tripped.
[29] Questionnaire and interviews with ECG.
[30] These transmission lines were subsequently upgraded from 170 MW to 488 MW.

information. Concerning the reference indicators, decreases were observed in (c) Annual planned outage hours, and (d) Number of annual outages. (f) An increase in electricity supply was confirmed for both transmission and distribution. (e) Distribution loss ratio also decreased. On the other hand, (c) Annual unplanned outage hours increased significantly, probably due to system disturbances, and (e) transmission loss ratio increased slightly. With regard to the additional reference indicator of overloading, no effect was identified because transmission line overloading was identified in 2022 and affected electricity supply within Accra.

3.3.1.2 Qualitative Effects (Other Effects)

Regarding qualitative effects, it was planned to check the 'increase in electricity supply' and 'stability of electricity supply' from each of the facilities listed in Table 9 below in order to identify improvements in electricity supply. However, regarding the increase in electricity supply, data could not be obtained from each of the facilities interviewed. An increase in electricity supply in the Accra Metropolitan Area was confirmed as described above.

For 'stability of electricity supply', eight facilities were interviewed, as shown in Table 9[31]. It seems that the effects on 'security of electricity supply' were only partially achieved. Regarding 1) Stability of electricity supply, three institutions-the University of Ghana, Japan Motors, and Ridge Hospital-indicated that electricity supply was stable compared to before the project was implemented. Regarding the Noguchi Memorial Institute of Medical Research (NMIMR) and Graphic Communications, they stated there had been no significant change compared to before. Regarding 2) Number of outages and 3) Outage hours, only two institutions-University of Ghana and Japan Motors-stated there had been a decrease. Ghana Institute Journalism and Graphic Communications replied that there had been no decrease. NMIMR and Ridge Hospital replied that they didn't know.

Because no facility had data on the number of outages and outage hours from before the project implementation to the time of the ex-post evaluation, the qualitative responses of the persons in charge were compiled.

[31] When the evaluation policy was prepared, it was planned to check with commercial facilities (Accra Mall), higher education institutions (University of Ghana), and medical facilities (NMIMR), but information provided by the JICA Ghana Office and ECG revealed that they were not direct beneficiaries of the Accra Central BSP. (These facilities are not direct beneficiaries as they are not in the area under the jurisdiction of Accra Central BSP but in the area under the jurisdiction of other BSPs. However, the BSPs in the Accra Metropolitan Region are closely linked to each other and therefore indirect beneficiaries of the Accra Central BSP.) Therefore, by the recommendation of the JICA Ghana Office, Japan Motors, Ghana Institute Journalism, Graphic Communications, and Accra Brewery were added to the list of interviewees. The Ridge Hospital, a medical institution, was also added to the list during the secondary survey.

**Table 9 Result of interviews with each facility on stability of electricity supply**

| Facility name | 1) Stability of electricity supply | 2) Decrease in number of outages | 3) Decrease in outage hours |
|---|---|---|---|
| Accra Mall | Y/N | Y/N | Y/N |
| University of Ghana | Y | Y | Y |
| NMIMR | N | N/A | N/A |
| Additional interviewees. | | | |
| Japan Motors | Y | Y | Y |
| Ghana Institute Journalism | Y/N | N | N |
| Graphic Communications | N | N | N |
| Accra Brewery | Y/N | Y/N | Y/N |
| Ridge Hospital | Y | N/A | N/A |
| Total | Y 3, Y/N 3, N 2 | Y 2, Y/N 2, N 2 | Y 2, Y/N 2, N 2 |

(Source: prepared by the evaluator based on questionnaires and interviews with eight facilities)
Note: Y for Yes, N for No; Y/N for Yes and No, see footnote[32], for N/A, the answer was that they didn't know. The sample size was 9 and responses were obtained from 8 facilities[33].

The qualitative effects of the effectiveness of the project are summarised as follows. It seems that effectiveness is only observed to be achieved in some facilities pertaining to the stability of electricity supply, decrease in the number of outages, and reduction in outage hours. As a result of the above, the project has achieved the expected project effects to some extent, but some of the effects have not been achieved.

### 3.3.2 Impacts

#### 3.3.2.1 Intended Impacts

With regard to impact, quantitative effects were not established as an indicator at the time of planning. For qualitative effects, stabilisation of residents' life and industrial development were

[32] The Ghana Institute Journalism responded that the electricity supply was a little more stable than before and that the frequency of generator use had decreased but that the number of power outages had not improved. Regarding the duration of power outages, the questionnaire indicated that the duration of power outages had not improved. In the interviews, the respondents answered that the duration of each power outage had decreased but that the number of power outages had not improved in their experience and were more frequent, so it concluded the answer was yes and no.
Accra Mall responded that the duration of generator use and power outages had not changed much compared to previous years but that they felt a little better than before. Because the details of the answers in the questionnaire were not clear, they were rechecked. As a result, it was found that the supply of electricity has stabilised a little, but there are still power surges and the switch to the use of generators to prevent undesirable effects for air-conditioning and other equipment. Therefore, all answers were marked as yes and no.
Accra Brewery said that the power supply was a little more stable than in the past, and the number and duration of power outages had decreased a little, but this year the power outages were severe and the power supply was not stable. Thus, all answers were marked as yes and no. According to GRIDCo, "the causes of outages were that GRIDCo had taken out a section of the grid (161 kV Achimota-Mallam transmission line) for reconstruction work, and voltage stability was improved". However, unfortunately, supporting evidence for this information could not be obtained.
[33] No response was received from Junction Mall.

set. The qualitative effects on the stabilisation of residents' life were examined as follows: impact on higher education institutions, impact on medical facilities, and impact on the neighbourhood.

1) Impact on higher education institutions

Impacts on higher education institutions were identified. At the University of Ghana, a decrease in the frequency of generator use was observed, with a corresponding decrease in energy costs. Concerning improved convenience in campus life, stable electricity supply improved student life by allowing students to stay on campus late into the evening to study. In particular, many students are able to go to the Baam library late into the evening to study. There was no particular change in the number of cancelled or alternative classes because the university has generators in all lecture facilities. These generators are used in outages, so there was no class cancellation as a result of outages.

2) Impact on medical facilities[34]

With regard to the impact on medical facilities, only a partial improvement in the convenience of medical facilities due to the stability of electricity supply was confirmed. Regarding the stability of electricity supply, the NMIMR responded that there had been no significant changes from before, so the development of impacts, such as the progress of medical research, could not be confirmed. The Ridge Hospital responded that the electricity supply had stabilised and that medical care had become more convenient. The frequency of use of generators at the NMIMR[35]and Ridge Hospital was unknown.

3) Impact on the neighbourhood

The impacts on the neighbourhood are shown in Table 10 below. The development of the impact on livelihood improvement due to the stability of electricity supply was confirmed. With regard to the details of livelihood improvement, 87.5% of households stated that the stability of electricity supply had improved since before the project was implemented. Regarding the outage hours and frequency of outages, about 80% of households stated that they had decreased. When asked whether electricity stability had contributed to improved livelihoods, 75% of households said it had. In terms of how it contributed to improved livelihoods, the largest proportion of households said that it improved their work efficiency, as shown in Table 11. The next most common answers given by households were improved learning environment for children at home, more efficient household chores, more leisure time, improved security through the use of electricity at night, and the opening of new shops.

As described above, regarding the impact on the stabilisation of residents' lives, the impact on

[34] Questionnaires and interviews to NMIMR, Ridge Hospital.
[35] The number of uses cannot be counted, as the generator starts automatically when the voltage drops and rises.

higher education institutions was confirmed as a decrease in the frequency of generator use with the reduction in energy costs and the impact of improved convenience in campus life. With regard to the impact on medical facilities, it was partially confirmed that the stability of electricity supply improved the convenience of medical facilities. The impact on neighbouring residents was also confirmed in terms of the impact of improved livelihoods due to the stability of electricity supply.

**Table 10 Impact on the neighbourhood[36]**

| Question | Answer | | |
|---|---|---|---|
| | Yes | No | Unknown |
| Stability of electricity supply | 35 | 5 | 0 |
| Decrease in the number of outages | 31 | 8 | 1 |
| Decrease in the outage hours | 32 | 7 | 1 |
| Contribution to improved livelihoods through stability of electricity supply | 30 | 7 | 3 |

(Source: prepared by the evaluator based on questionnaires and interviews with neighbourhood residents)

**Table 11 Detailed contribution for the improvement of livelihoods**

| Contribution to improved livelihoods through stability of electricity supply | Number of responses | Percentage |
|---|---|---|
| Improved efficiency of work | 17 | 42.5% |
| Improved learning environment at home | 14 | 35.0% |
| Improved efficiency of household chores | 12 | 30.0% |
| Improved leisure time | 10 | 25.0% |
| Improved public safety by using electricity at night | 8 | 20.0% |
| Opening new shops | 5 | 12.5% |
| Promotion of women's participation in society | 0 | 0.0% |
| Others | 0 | 0.0% |

(Source: prepared by the evaluator based on questionnaires and interviews with neighbourhood residents)

The qualitative effects on industrial development were examined relating to commercial facilities, impact on enterprises, and economic activity in the centre of Accra.

[36] Results of interviews with 40 households living near the Accra Central BSP, conducted between 31 May and 6 June 2022. 23 male and 17 female residents were interviewed. All interviewed residents have been living in the area since before the project was completed. As a list of residents did not exist, the interviews were conducted by visiting every three houses around the BSP and using a random sampling method.

1) Impacts on commercial facilities and enterprises

With regard to the impact on commercial facilities and businesses, the impact was limited in terms of a reduction in the frequency of generator use. Only two facilities-Japan Motors and Ghana Institute Journalism-indicated a decrease in the frequency of generator use. Three facilities-Accra Mall, Graphic Communications, and Accra Brewery-stated that there had been no decrease.

2) Increased economic activity in central Accra

It was difficult to ascertain whether economic activity in the centre of Accra had increased. To check whether economic activity has increased, the evaluator asked Accra Mall whether the ease of shopping and doing business in the commercial facilities had improved, but the impact of the project could not be confirmed due to the significant impact of COVID-19. Regarding the improvement in production and consumption, it was also determined that COVID-19 had a significant negative impact on agricultural production activities and a negative impact on food distribution[37], making it difficult to confirm the impact of the project.

As mentioned above, regarding the impact on industrial development, the expression of the impact on the frequency of generator use was only observed in less than half of the commercial facilities and companies interviewed. With reference to the increase in economic activity, it was difficult to determine.

3.3.2.2 Other Positive and Negative Impacts

Regarding 'other positive and negative impacts', no negative impacts were identified by the project, as described below. With regard to positive impacts, only the expression of the impact of technology transfer through implementation of the project was observed.

1) Impacts on the Natural Environment[38]

According to the literature review and the results of interviews with GRIDCo, ECGs, and people living near the Accra Central Substation during the ex-post evaluation, as well as field visits from the time of planning to the time of the ex-post evaluation, no negative impacts on the natural environment were identified as a result of this project. Because this project does not correspond to a large-scale power transmission and distribution sector as based on the JICA Guidelines for the Confirmation of Environmental and Social Consideration (April 2010), the undesirable effects on the environment were judged to be insignificant. In addition, because this project did not correspond to the sensitive characteristics and sensitive areas based on the

[37] Questionnaire and interviews with Accra Mall.

[38] Questionnaire and interviews with GRIDCo, ECG, and implementation consultants, Environmental Assessment (EIA), and environmental monitoring reports.

guidelines, this project was classified as Category B[39].

Negative impacts related to water pollution, soil pollution, or air pollution were not identified during construction and when starting operation. Regarding noise and vibration during construction, there were no complaints from neighbours during and after the implementation of the project. For mitigation of a noise and vibration, the construction work was finished early in the evening to avoid disturbing the neighbouring residents. For noise mitigation measures after construction, the transformer is placed in a metal box to reduce noise.

Regarding environmental and social considerations, GRIDCo's Engineering Department was responsible for checking complaints about environmental issues as the project head. The Land and Environment Department was responsible for monitoring and reporting on environmental issues. Because approximately USD 62,000 was allocated for monitoring costs, USD 30,000 for preparation of the EIA, and USD 20,000 for training of the environmental maintenance team, sufficient money had been allocated to address environmental issues.

2) Resettlement and Land Acquisition[40]

No negative impact expression on resettlement and land acquisition by this project was identified. The results on resettlement and land acquisition are shown in Table 12. At the time of planning (2015)[41], this project involved the acquisition of approximately 0.405 ha of land and the involuntary resettlement of 177 people from 35 households, and land acquisition was planned to be carried out in accordance with Ghanaian national procedures and JICA Guidelines (151 people from 23 households were planned at the time of the preparatory survey)[42]. As a result, the number of resettled households and the number of people resettled were significantly reduced to one person from one household.

Explanations for the significant reduction in the number of households and persons relocated are as follows. As part of the Accra Metropolitan Assembly's decongestion exercise, which is unrelated to the project, a majority of households were properly relocated before the project's land acquisition and resettlement process was initiated[43]. Therefore, compensation to illegal land occupiers, which was expected at the time of planning, did not occur. Compensation was only incurred for the expropriation of land for the construction of pylon N19 due to the rerouting of the 161kV transmission line. Hence, the number of households relocated and the number of people relocated were significantly lower than anticipated at the time of planning.

This section describes the handling of claims relating to the land acquisition for the construction

[39] The Ex-ante Evaluation Sheet.
[40] Questionnaire and interviews with GRIDCo and documents from Land Commission, Land Valuation Division, and Adabraka Official Town yearbook of assembly.
[41] As it is a slum, the land is illegally occupied, and the number of households had increased when one year had passed since the preparatory survey in 2014 (Implementation consultant interviews).
[42] The Ex-ante Evaluation Sheet.
[43] GRIDCo was not aware in advance of the Accra Metropolitan Assembly's plans for decongestion exercises. The Accra Metropolitan Assembly occasionally conducts decongestion exercises to reduce congestion in the city.

of pylon N19. At the time of planning, no specific disagreement with this project was raised by the affected residents. However, during the implementation of the project, a dispute arose when residents in the surrounding area complained about the safety of the 161 kV underground cable route to be laid between pylon N19 and the Accra Central BSP. The dispute with the landowners around pylon N19 was that the church requested for compensation regarding additional land for which they did not have documented proof of ownership. The compensation for that land was subsequently dismissed by the court as the church failed to provide evidence of ownership as required by law. It took three months to resolve the dispute. Otherwise, there were no other specific disputes or complaints during the land acquisition.

Compensation due to resettlement and land acquisition was carried out in accordance with JICA Guidelines, and compensation payments were made prior to the start of construction. Compensation was paid to four persons, including one resettled household and two organisations (a church and a company). Monitoring on land acquisition was carried out on a quarterly basis, but there were no reports on monitoring results.

**Table 12 Result for resettlement and land acquisition**

| Year | Cost (GHC) | Number of resettlement households | Number of resettlement people | Total area of land acquisition (ha) |
|---|---|---|---|---|
| 2014 | 1,385,788 | 23 | 151 | 0.405 |
| 2015[44] | 2,546,000 | 35 | 177 | 0.405 |
| 2021 | 466,350 | 1 | 1 | 0.405 |

(Source: Questionnaires and interviews with GRIDCo)

3) Gender equality

Gender-related manifestations of impact were limited. Because many women participated in selling ice blocks, making dresses, working in bakeries, food processing treatment, etc., it seems that the security of electricity supply have had a positive impact on the livelihoods of many women[45]. However, as shown in the results of interviews with neighbourhood residents in Table 11, the expression of impact on the promotion of women's participation in economic and social activities could not be confirmed[46].

4) Marginalized People

The manifestation of impact on marginalised people was also limited. Before the implementation of the project, many low-income communities had experienced multiple power outages, affecting their health, income, and general livelihoods. However, the improved electricity

[44] Interviews to implementation consultant. See footnote 41 for details.
[45] Questionnaire and interviews with ECG.
[46] Forty neighbours, including 17 women, were interviewed.

supply in the project area seems to have contributed to some extent to improving the livelihoods of the low-income community members[47].

5) Social Systems and Norms, Human Well-being and Human Rights

As mentioned above in Table 11, this project has contributed to some extent to improving the lives of the population in terms of increased efficiency in work and household chores and improved learning environments at home.

6) Unintended Positive/Negative Impacts

About the others, the impact manifestation of technology transfer due to the implementation of the project was observed. The regular quality and safety compliant meetings were held under the project to ensure quality and zero accidents during construction, so no accidents occurred during the implementation of this project[48]. In addition, the contractors involved in this project are still working at other GRIDCo projects and are ensuring that safety-compliant meetings and protocols are adopted. As mentioned above, the implementation of Japanese-style safety and construction quality management in the project led to safe construction and high-quality management. Since then, the contractor has continued to implement safety management in other projects.

As mentioned above, no negative impact manifestations were observed as a result of the implementation of this project.

The summary of effectiveness and impact is as follows. With regard to the quantitative effects of effectiveness, effects were found for the achievement of capacity of transformers in Accra, reduction in annual planned outage hours, reduction in the number of annual outages, increase in transmission and distribution electricity supply, and reduction in distribution loss ratio. However, some effects were not identified for annual unplanned outage hours, transmission loss ratio, and transmission line overloads. Qualitative effects were only observed to be achieved in some facilities in terms of stability of electricity supply, reduction in the number of outages, and reduction in the outage hours. In addition, although no negative impacts were observed as a result of the implementation of the project, the expected impacts, which are stabilisation of residents' livelihoods and industrial development, were limited. This project has achieved its objectives only to a certain extent.

Therefore, effectiveness and impacts of the project are moderately low.

### 3.4 Sustainability (Rating: ③)

#### 3.4.1 Policy and System

Concerning sustainability in terms of policy and institutional aspects, *Ghana Long-Term*

[47] Questionnaire and interviews with ECG.
[48] These meetings took place every morning, including with Japanese construction companies.

*National Development Plan 2018-2057* mentioned the importance of developing an electricity infrastructure, including power generation, transmission, and distribution, in order to build secure communities. Therefore, the project is consistent with Ghana's national development policy, and there is a high prospect that the effects generated by the project will be sustained in the future.

3.4.2 Institutional/Organisational Aspect[49]

Regarding sustainability in terms of institutional and organisational aspect, the operational structure of the electricity system in Ghana is shown in Table 13. Compared to the planning period, GRIDCo is now able to operate for the 330 kV and 225 kV voltage classes.

In 'Java-Bali Transmission Line/Substation Development Project (1992, grant aid)' in Indonesia, it was pointed out that the lesson learned was that the expansion of electricity supply facilities capacity beyond medium pressure after the project implementation was insufficient to meet the potential demand. Although the implementation consultant did not have any specific knowledge of similar projects, they made highly accurate electricity demand assumptions, including potential demand[50]. GRIDCo is now able to manage the construction of high-voltage substations above 161 kV in Accra and other regions of Ghana, as shown in Table 13. It can therefore be said that the lessons learned from previous evaluations of similar projects have been applied to this project.

**Table 13 Operational structure of the electricity system in Ghana**

| Sector | Operator | Voltage class (at planning) | Voltage class (at ex-post evaluation) |
|---|---|---|---|
| Generation | VRA[51] | - | - |
| Transmission | GRIDCo | 161 kV, 69 kV | 330 kV, 225 kV, 161 kV, 69 kV |
| Distribution | ECG<br>NEDCo[52] | 33 kV, 11 kV and low voltage<br>34.5 kV, 11.5 kV and low voltage | 33 kV, 11 kV and low voltage<br>34.5 kV, 11.5 kV and low voltage |

(Source: prepared by the evaluator based on preparatory survey report, questionnaires and interviews with GRIDCo, ECG)

With regard to the organisation at the time of project implementation, the project team consisted of one project manager, two engineers, two field technicians, and two design managers[53]. Regular project meetings were held between GRIDCo and ECG engineers, and there was a resident location. Regarding the management structure after the project has ended, engineers and technicians from GRDICo and ECG are stationed at Accra Central BSP and cooperate in the management of the facilities.

[49] Questionnaire and interviews with GRIDCo and ECG; field survey of Accra Central substation by visual inspection and interviews.
[50] Questionnaire and interviews with GRIDCo and implementation consultants.
[51] Volta River Authority.
[52] Northern electricity distribution company.
[53] For engineers, field technicians, and design managers, they were from GRIDCo and ECG for transmission and distribution, respectively.

### 3.4.3 Technical Aspect[54]

About technical sustainability, with some exceptions, both GRIDCo and ECG have sufficient technology for operation and maintenance.

For the Accra Central BSP facilities, the areas around each facility and equipment, including the 161 kV transmission lines, were well maintained. The 161 kV gas insulated switchgear, which is unfamiliar in Africa, was also properly maintained at the time of the ex-post evaluation. Therefore, both companies have sufficient skills to carry out operation and maintenance on the equipment at Accra Central BSP.

Both companies have manuals in place and use them effectively, and they regularly maintain their equipment, including each facility of the Accra Central BSP. Maintenance reports are recorded and filed as part of the annual report. In addition, both GRIDCo and ECG regularly conduct complementary technical and safety management training. They also receive the same training provided by external organisations and have the opportunity to share the knowledge gained.

On the other hand, GRDICo is concerned about the lack of engineers who can repair and maintain the 161 kV cable in the future when repairs are required. With regard to the maintenance of the high-voltage underground cable, Accra Central BSP is the first BSP that GRIDCo is responsible for[55]. Hence, GRIDCo intends to build capacity to repair 161kV cables in the future.

As described above, GRIDCo and ECG have sufficient technology to operate and maintain the equipment of the Accra Central BSP, with the exception of the 161kV cable, and have implemented appropriate operation and maintenance management.

### 3.4.4 Financial Aspect[56]

The financial sustainability of the project was examined. GRIDCo has allocated approximately 46,000 GHC for maintenance fees in 2018 (20,000 GHC in 2012), which is a steady increase in maintenance costs. ECG has also allocated approximately 266,000 GHC for maintenance and repairs in 2020[57]. As for GRIDCo's net income, it was 182,280 GHC in 2020 (64,490 GHC in 2012), which is approximately three times higher. Therefore, GRIDCo and ECG seem to be able to adequately operate and maintain their operations at present and in the future.

### 3.4.5 Environmental and Social Aspect

As discussed in '3.3.2.2 Other Positive and Negative Impacts 1) Impacts on the Natural

[54] Questionnaire and interviews with GRIDCo, ECG, and implementation consultants; field survey of Accra Central substation by visual inspection and interviews.

[55] ECG (cooperating agency) operates an extensive underground network and as such they have a cable repair group that is responsible for mending cable failures in their network.

[56] GRIDCo annual report 2018 and GRIDCo annual report draft 2020.

[57] ECG Financial Statement 2020. The data at the time of planning could not be confirmed.

Environment, no significant impacts on the natural environment were found.

Also, no negative environmental and social impacts were identified from the time of planning to the time of the ex-post evaluation, according to the literature review, the results of interviews with GRIDCo and people living near the Accra Central BSP, and the results of field visits during the ex-post evaluation. Therefore, it is considered unlikely that negative impacts on natural environmental and social aspects will occur in the future.

3.4.6 Preventative Measures to Risks

In terms of addressing risks, the risks related to external factors that were assumed at the time of planning did not develop. In the Accra Metropolitan Area, the electricity demand has been increasing year by year, but this area did not face an increase in electricity demand exceeding the planning assumptions. Also, there was also no negative impact on safety due to the lack of OJT for the operation and management of the 161 kV gas insulated switchgear.

3.4.7 Status of Operation and Maintenance

As described in '3.4.3 Technology', the operation and maintenance of the equipment were adequate and equipment was in good working order.

The effects of sustainability were summarised. No major problems in terms of structure, technology, and finance have been encountered at GRIDCo (executing agency) and ECG (the cooperating agency). From the above, slight issues have been observed in the operation and maintenance of the project; however, there are good aspects for improvement/resolution. Therefore, sustainability of the project effects is high.

## 4. Conclusion, Lessons Learned, and Recommendations

4.1 Conclusion

The project was implemented with the objective, which is to supply stable electric power and reduce electric power transmission and distribution loss at capital city Accra, Ghana by constructing a core transmission and substation facility, thereby contributing to the stabilisation of residents' lives and industrial development.

The project is consistent with Ghana's development policy, development needs, and Japanese aid policy at the time of planning. Synergies with internal and external JICA projects have been identified based on prior coordination and planning. Hence, relevance and consistency are high. Although the project period was slightly longer than the plan, the project costs were within the planned amount, so efficiency is high. Regarding the quantitative effects of effectiveness, the effects of achieving capacity of transformers within Accra, reducing the annual planned outage hours, reducing the annual number of outages, increasing the transmission and distribution

electricity supply, and reducing the distribution loss ratio were identified. However, no effects were observed for annual unplanned outage hours, transmission loss ratio, and transmission line overloading. Qualitative effects were only observed to be achieved in some facilities with regard to the stability of electricity supply, reduction in the number of power outages, and reduction in the duration of power outages. In addition, no negative impacts were observed as a result of the implementation of the project, but the expected impact set at the time of planning, namely 'stabilisation of residents' livelihoods and industrial development', was limited. Therefore, effectiveness and impacts of the project are moderately low. Although there are some minor technical problems in the operation and maintenance of the project, there are no problems in other areas such as the structure and financial aspects. Therefore, sustainability of the project effects is high.

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

## 4.2 Recommendations

### 4.2.1 Recommendations to the Executing Agency

It is recommended that GRIDCo continues to share information with other BSPs so that the experience gained from this project can be used to strengthen the operational capacity of BSPs across Ghana. In particular, it is desirable that Japanese-style safety management practices are applied in future projects implemented by GRIDCo and in other projects, not being limited within the projects currently implemented by GRIDCo.

### 4.2.2 Recommendations to JICA

Because GRIDCo is concerned that there are no technicians who can maintain the 161 kV cable, it is recommended that JICA provides training on cable maintenance to help build the capacity to repair the cable in the future.

## 4.3 Lessons Learned

Setting effective indicators to measure project effectiveness

As discussed in '3.3.1.1 Quantitative Effects (Operation and Effect Indicators)', in this project, indicators that cannot properly measure the project effects, i.e., that include the effects of other projects (external factors), were set. Specifically, in the project, the capacity of transformers (MVA) in Accra is an indicator that includes the effects of other projects and is not an appropriate indicator to confirm the effects of this project. The capacity of transformers for the Accra Central BSP should have been set as an indicator. As described above, appropriate indicators for effectiveness should be set based on the characteristics of the project, and in order to properly measure project effectiveness, it should be avoided to set indicators that include the effects of other projects (external factors).

In addition, with regard to the indicator for transmission and distribution losses (MW), the effectiveness of the project could not be confirmed because the indicator for transmission losses was set for a section of wire where actual measurements could not be taken due to the lack of meters. Therefore, when measuring project effects in similar projects, the indicators should be set for sections where actual measurements can be confirmed by meters.

Records to confirm project effectiveness

As discussed in '3.2.2.1 Project Cost', the data about inputs on the Ghanaian side were not available in the project. GRIDCo also did not record monitoring results on resettlement and land acquisition. Therefore, when implementing similar projects, executing and cooperating agencies should keep records of input items on the part of the implementing country. In addition, for projects with resettlement and land acquisition, executing agencies should record the monitoring results on resettlement and land acquisition in the form of reports or other. With regard to the above two data, the importance of keeping records and data should be carefully explained to the executing and cooperating agencies at the time of planning by the implementer of the preparatory survey and JICA. Furthermore, during implementing the project, the implementation consultants and JICA should have the opportunity to check regularly whether the executing and cooperating agencies are properly recording and keeping the data.

## 5. Non-Score Criteria

### 5.1 Performance

#### 5.1.1 Objective Perspective

1) Support of implementation consultant and JICA[58]

The support to executing agency was checked, and it was confirmed that the implementation consultant provided adequate support to GRIDCo during the implementation of the project, in terms of project maintenance through the organisation of regular progress meetings and problem-solving with the contractor. It was confirmed that the JICA Ghana Office provided adequate support to the implementation consultant for problems such as delays in the acquisition of land for the installation of transmission lines, which was a GRIDCo's responsibility.

### 5.2 Additionality

There is nothing in particular.

[58] Questionnaire and interviews with GRIDCo and implementation consultants.