FY2024 Simplified Ex-Post Evaluation Report of Japanese Grant Aid Project

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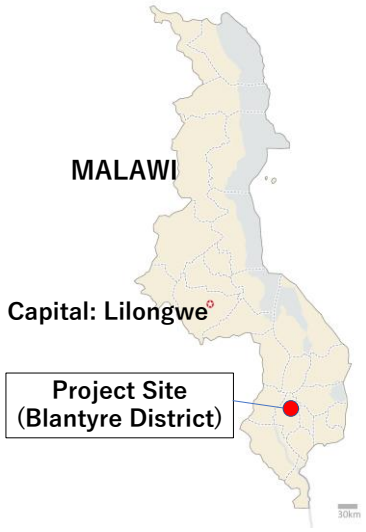
Duration of the Study: December 2024 – February 2026

Duration of the Field Study: 4 May 2025 – 15 May 2025

Country Name	The Project for Expansion of Tedzani Electricity Hydropower Station
Republic of Malawi	



Location of the Project Site
(Source: Prepared from the materials provided by JICA)

Generator Installed in This Project
(Source: Taken by the External Evaluator)

I. Project Outline

Background	In 2012, Malawi's peak electricity demand reached 347 MW, while actual electricity supply remained at only 288 MW. As a result of chronic nationwide power shortages, severe negative impacts were observed on citizens' daily lives and economic activities, particularly in the capital city of Lilongwe and the commercial city of Blantyre. Peak electricity demand in Malawi was projected to increase at an annual rate of more than 5% until 2020 and to reach 1,597 MW by 2030. Accordingly, enhancement of power supply capacity was recognised as an urgent challenge. However, while electricity demand continued to increase, the Government of Malawi faced serious fiscal constraints, and investment in infrastructure development and improvement for power generation as well as transmission and distribution had not progressed sufficiently.			
Objectives of the Project	The objective of the project is to promote the use of renewable energy, improve the reliability of electricity supply, and enhance the quality of electricity supplied by expanding the Tedzani Hydropower Station in Blantyre District, thereby contributing to the strengthening of Malawi's economic and industrial base.			
Contents of the Project	1. Project Site: Blantyre District 2. Japanese side: <Civil Works> Intake facilities (width: 32.2 m), waterways (height: 5.0 m, length: 586.2 m), forebay, penstocks (diameter: 4.0 m, length: 110.9 m), powerhouse, tailrace and outlet channels, access road to the powerhouse (length: 280.0 m), and related facilities <Procured Equipment> Power generation equipment (one turbine unit with an output of 19.3 MW, generator output of 22.5 MVA), overhead crane, main transformer, outdoor switchgear, cable facilities, transmission facilities (including two transmission towers), grounding facilities, and related equipment <Consulting Services> Detailed design, tender assistance, and construction supervision. No technical assistance (soft component) was included. 3. Malawian side: Implementation of necessary procedures (including acquisition of construction permits and approvals, customs clearance and tax exemption procedures, banking arrangements and issuance of payment authorisation documents), and preparation of the Environmental Management Plan and Environmental Monitoring Plan.			
Implementation Schedule	E/N Date	17 March 2014 (Detailed design) 18 March 2015 (Main works)	Disbursement Date	N/A
	G/A Date	17 March 2014 (Detailed design) 18 March 2015 (Main works)	Completion Date	7 May 2021
Project Cost	E/N Grant Limit / G/A Grant Limit (Detailed design): 101 million yen, Actual Grant Amount: 101 million yen			

	E/N Grant Limit / G/A Grant Limit (Main works): 5,822 million yen, Actual Grant Amount: 5,821 million yen
Executing Agency	At the time of planning: Electricity Supply Corporation of Malawi (ESCOM) At the time of ex-post evaluation: Electricity Generation Company (Malawi) Limited (EGENCO)
Contracted Agencies	Main Contractor: Mitsubishi Corporation Main Consultant: Tokyo Electric Power Services Co., Ltd.

II. Result of the Evaluation

Summary

This project aimed to expand the Tedzani Hydropower Station currently in operation in Blantyre District in southern Malawi in order to promote the use of renewable energy, improve the reliability and quality of electricity supply, and thereby contribute to strengthening the country's economic and industrial foundation. This project was consistent with Malawi's development policies and development needs at the time of planning, and no major issues were identified in the project design or approach. This project was also consistent with Japan's development cooperation policy in terms of supporting the development of Malawi's economic infrastructure. However, internal coherence and external coherence were not specifically confirmed. Therefore, the relevance and coherence of the project are high. With regard to project implementation, bidding failures occurred, resulting in a slight downsizing of the project scope compared with the original plan. Although the project cost remained within the planned amount in nominal terms, taking into account the reduced project outputs, the actual cost can be regarded as having slightly exceeded the plan in real terms. In addition, the project period significantly exceeded the original plan due to substantial delays prior to commencement of construction caused by bidding failures, as well as the impact of the COVID-19 pandemic. Accordingly, efficiency of this project is moderately low. As for project effects, regarding the quantitative effects of this project, while the target for maximum output was largely achieved, electricity generation and capacity utilisation rates fell significantly below the target values. This was largely attributable to constraints in the transmission and distribution network. As a whole, quantitative effects were not sufficiently realised. In addition, the qualitative effect of stabilising electricity supply was not fully achieved, and the impacts in terms of improvement of citizens' living conditions and strengthening of the industrial foundation were limited. Therefore, effectiveness and impacts are moderately low. With respect to sustainability, although further improvement is required in financial aspects, no major issues were identified in policy and system, organisational and institutional aspects, technical capacity, environmental and social considerations, risk management, or operation and maintenance. The sustainability of the project effects is therefore judged to be high.

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

Overall Rating[1]	**C**	**Relevance & Coherence**	③[2]	**Effectiveness & Impacts**	②	**Efficiency**	②	**Sustainability**	③

1 Relevance/Coherence

<Relevance>

・Consistency with the Development Policy of Malawi at the Time of Ex-Ante Evaluation

At the time of the ex-ante evaluation, Malawi's national development plan was the Second Malawi Growth and Development Strategy (2011–2016), in which energy development was identified as one of the nine priority areas. The strategy emphasised the importance of an efficient energy system for the development of industry, mining and tourism, and stipulated that the Government of Malawi would improve electricity services and enhance economic productivity through expansion of power generation, transmission and distribution, as well as diversification of energy sources. In addition, in response to the deterioration of the domestic economic situation, the Economic Recovery Plan announced in September 2012 identified electricity shortages as having a negative impact on key industries. The plan therefore set out policy reforms to promote production expansion for export markets through investment in the energy sector and other priority areas, with preferential budget allocation to be made by 2015.

Therefore, this project was fully consistent with Malawi's national-level development policies at the time of ex-ante evaluation.

・Consistency with the Development Needs of Malawi at the Time of Ex-Ante Evaluation

As described in the Background section, Malawi's peak electricity demand in 2012 was 347 MW, while electricity supply remained at 288 MW. Electricity demand was projected to increase by more than 5% annually until 2020 and to reach 1,597 MW by 2030. Chronic nationwide power shortages resulted in frequent power outages, particularly in the capital city of Lilongwe and the commercial city of Blantyre, causing severe negative impacts on citizens' daily lives and economic activities.

As this project was implemented to address the issue of insufficient electricity supply, it adequately met Malawi's development needs at the time of ex-ante evaluation.

・Appropriateness of Project Design/Approach

As described in '2. Efficiency', the project scale was slightly reduced due to bidding failures; however, as a whole, no major

[1] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[2] ④: Very High ③: High, ②: Moderately low, ①: Low

issues were identified in the project design or approach.

In ex-post evaluations of similar past projects, insufficient knowledge and technical capacity of engineers in executing agencies were identified as lessons that could affect project sustainability. To address this kind of risk, this project planned to provide initial operation guidance and on-the-job training (OJT) on operation and maintenance for approximately two months at the time of equipment installation, in conjunction with the introduction of equipment with specifications different from existing facilities. These activities were implemented as planned during the commissioning period, and it was confirmed that they were beneficial for staff of the executing agency in operating and maintaining the facilities. Therefore, lessons learned from past projects were appropriately utilised.

<Coherence>

・Consistency with Japan's ODA Policy at the Time of Ex-Ante Evaluation

This project was consistent with Japan's assistance policy for Malawi at the time of ex-ante evaluation, which identified "development of infrastructure to foster industries such as agriculture and mining" as a priority area. This project constituted one component of the Economic Infrastructure Development Programme under Japan's rolling plan for Malawi and contributed to strengthening the foundation for economic growth.

Therefore, this project supported the development of Malawi's economic infrastructure and is considered to be highly consistent with Japan's development cooperation policy for Malawi at the time of ex-ante evaluation.

・Internal Coherence

During the planning and implementation period of the project, JICA deployed a Power Development Planning Advisor (2013–2016) to Malawi's Ministry responsible for the energy sector, providing technical cooperation covering the power sector as a whole. However, according to the executing agency, no specific coordination or linkage directly related to this project was undertaken, and no particular synergistic effects were observed. Therefore, internal coherence was not confirmed.

・External Coherence

At the time of ex-ante evaluation, the World Bank and the African Development Bank conducted feasibility studies related to hydropower development. According to the executing agency, these studies included hydrological assessments of the Shire River, where the Tedzani Hydropower Station is located, and contributed to improving the understanding of Malawian government officials, particularly with regard to data collection methodologies. However, no specific coordination, collaboration or tangible effects were observed between these studies and the present project. Accordingly, external coherence was not confirmed.

<Evaluation Result>

In light of the above, the relevance and coherence of the project are high[3].

2 Efficiency

・Project Outputs

The planned and actual outputs of this project are shown below.

Table 1. Planned and Actual Outputs of This Project

Category	Facility / Equipment Name	Plan	Actual
Power generation	Type of Power Generation	Canal-type and run-of-river type	Canal-type and run-of-river type
	Maximum Design Discharge	70.0 m^3/s	58.5m^3/s
	Effective Head	37.0 m	37.0m
	Maximum Output	21,800 kW	19,143kW
Structure	Intake	13.8 m in height and 32.2 m in width	13.8 m in height and 32.2 m in width
	Headrace Channel	5.0 m in height, 5.0 m in width and 586.2 m in length	5.0 m in height, 4.4 m in width and 586.2 m in length
	Forebay Tank	17.2 m in height, 39.7 m in width and 87.5 m in length	17.2 m in height, 16.0 m in width and 87.5 m in length
	Penstock	4.0 m in diameter and 110.9 m in length	4.0 m in diameter and 110.9 m in length
	Powerhouse	40.7 m in height, 32.0 m in width and 27.0 m in length	38.5 m in height, 27.8 m in width and 18.8 m in length
	Tailrace Channel	11.2 m in width and 18.8 m in length	9.4 m in width and 17.5 m in length
	Access Road to Powerhouse	6.0 m in width and 280.0 m in length	6.0 m in width and 280.0 m in length
Procured equipment	Turbine	Output 23,000 kW	Output 19,300kW
	Inlet Valve	3,800 mm in diameter	3,740 mm in diameter
	Auxiliary Equipment	Cooling water supply facilities, etc.	Cooling water supply facilities, etc.
	Generator	Output 26,600 kVA	Output 22,521 kVA
	Main Control and Protection System	Main unit control panel, protection panel, etc.	Main unit control panel, protection panel, etc.

[3] Relevance: ③, Coherence: ②

	Generator Main Circuit Equipment	Generator main circuit and neutral grounding system	Generator main circuit and neutral grounding system
	Station Service Power Supply System	Station service transformers, etc.	Station service transformers, etc.
	Cable System	Power cables, control cables, etc.	Power cables, control cables, etc.
	Overhead Crane	Main hoist 1,200 kN	Main hoist 1,200 kN
	Main Transformer	Rated capacity 26 MVA	Rated capacity 23 MVA
	Outdoor Switchgear	Circuit breakers, disconnectors, current transformers, etc.	Circuit breakers, disconnectors, current transformers, etc.
	Transmission Facilities	Two transmission towers, etc.	Two transmission towers, etc.
	Earthing System	Installed equipment for the power plant and switchyard	Installed equipment for the power plant and switchyard

Note: Items where the planned and actual contents differ are underlined.
Source: Preparatory Survey Report and materials provided by JICA

As shown in Table 1, while there were no changes in the number of facilities constructed or equipment procured, reductions in scale were observed for several facilities and equipment items, including generation capacity. This was due to redesign following bidding failures as described in '2. Efficiency', which resulted in a downsized project scale.

With regard to the items borne by the Malawian side, all planned items—including administrative procedures (construction permits and approvals, customs and tax exemption procedures, banking arrangements and issuance of payment authorisations), environmental and social considerations (preparation of the Environmental Management Plan and Environmental Monitoring Plan), and restructuring and budgeting for operation and maintenance—were confirmed to have been implemented.

・Project Cost

The planned project cost comprised JPY 5,873 million on the Japanese side (JPY 101 million for detailed design and JPY 5,772 million for main works) and JPY 22 million on the Malawian side (bank charges, environmental monitoring, spare parts for generators, etc.), for a total of JPY 5,895 million. Subsequently, an additional cost of JPY 50 million was incorporated on the Japanese side due to the COVID-19 pandemic[4], bringing the final planned amount to JPY 5,923 million.

The actual project cost on the Japanese side amounted to JPY 5,922 million (JPY 101 million for detailed design and JPY 5,821 million for main works), which was within the planned amount (100%). However, although the nominal cost remained within the plan, bidding failures resulted in downsizing of project outputs. Taking into account the reduction in generation capacity of 12%, the actual cost corresponds to approximately 114% of the planned cost in real terms[5]. Therefore, the project cost is judged to have slightly exceeded the plan.

With respect to the project cost of the Malawian side, a dedicated budget line for this project was not established within the executing agency, and expenditures were not centrally managed. As a result, it was difficult to confirm the total amount. Accordingly, the assessment of project cost focuses solely on the Japanese side.

・Project Period

The planned project period was 55 months, from March 2014 to September 2018. However, the actual project period was extended from March 2014 to May 2021, totalling 87 months. Table 2 indicates the planned and actual periods.

Table 2. Planned and Actual Periods of This Project

Project Phase	Plan	Actual
Signing of Grant Agreement	March 2014	March 2014
From the signing of Grant Agreement to Detailed Design	1 month	1 month
Detailed Design Period (including the tender period)	14 months	April 2014 – July 2017 (40 months)
Main construction period	40 months	June 2018 – May 2021 (36 months)
Total	55 months	87 months

Source: Prepared based on the Preparatory Survey Report and materials provided by JICA

In this project, two tender failures occurred for the main construction works, and it took approximately two years and nine months before the commencement of the main works, which led to a significant extension of the project period. As a result, the project required 87 months to reach completion. Although delays in the construction schedule were partly caused by the COVID-19 pandemic, including delays in the transportation of turbines and generators, the construction works were not completely suspended; therefore, this period is included in the project period.

Based on the above, the actual project period was 158% of the planned duration, and it is judged that the project period substantially exceeded the original plan.

[4] Personnel costs incurred due to those concerned with the project being stranded as a result of the suspension of international flights to and from Malawi, insurance costs arising from the extension of the construction period, and expenses for infection-prevention equipment and supplies, etc.

[5] An initial project cost of JPY 5,923 million was planned for a facility with a generation capacity of 21,800 kW; however, the actual installed capacity became 19,143 kW. Accordingly, the project cost required to achieve a capacity of 21,800 kW would have been JPY 6,743 million (5,922 × 21,800 / 19,143). This corresponds to 114% of the planned cost.

<Evaluation Result>

In light of the above, the project cost slightly exceeded the plan, and the project period significantly exceeded the plan. Therefore, the efficiency of the project is moderately low.

3 Effectiveness/Impacts[6]

<Effectiveness>

・Quantitative Effects

In this project, maximum output, electricity generation, and the capacity factor were set as indicators of quantitative effects. The baseline values, target values, and actual values of these indicators are shown in Table 3. Table 4 presents, as reference data, trends in electricity generation by power source in Malawi from FY2011 to FY2024.

Table 3. Quantitative Effects of This Project

Indicators	Baseline	Target	Actual		
	2012	2021 3 Years after Completion	2022	2023	2024
Maximum Output (kW)	92,700	(Original) 114,500 (Revised) 124,500	121,843	121,843	121,843
Electricity generation (GWh/year)	620.8	782.8	768.6	688.4	652.2
Capacity factor (%)	76	78	72.5	64.9	61.3

Note: The baseline values represent the combined figures for Units I, II and III of the Tedzani Hydropower Station. The target and actual values represent the total figures including Unit IV developed under this project[7]. The target value for maximum output includes an additional 10,000 kW, reflecting the increase in the maximum output of Tedzani Unit III implemented after the planning of this project. All figures are based on calendar-year data (January–December) and therefore differ from the "fiscal year" data shown in Table 4.

Source: Ex-ante Evaluation Form, Preparatory Survey Report, and materials provided by the executing agency

(Reference) Table 4. Trends in Electricity Generation in Malawi

(Unit: GWh)

FY		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Hydropower generation	Nkula	823.0	738.6	775.3	667.9	671.6	587.6	543.2	590.5	623.4	683.3	581.3	901.4	734.5	762.4
	Tedzani	669.9	656.2	619.3	641.2	544.6	482.9	458.4	456.8	459.7	575.9	488.4	777.7	615.4	638.2
	(of which Tedzani IV)	-	-	-	-	-	-	-	-	-	(6.7)	(80.8)	(94.8)	(53.0)	(59.1)
	Kapichira	408.0	426.7	491.6	644.2	734.8	703.1	654.1	680.5	579.5	774.2	432.6	-	715.3	726.4
	Others	18.5	19.0	21.3	21.2	25.1	27.3	32.8	34.9	33.3	24.7	16.1	27.5	25.7	27.0
	Total	1,919.3	1,840.5	1,907.5	1974.5	1976.1	1,800.9	1,688.5	1,762.7	1,695.9	2,058.1	1,518.4	1,706.6	2,090.9	2,154.0
Total thermal power generation		-	-	-	-	0.6	11.0	7.5	16.5	40.7	28.3	29.0	38.5	7.0	14.2
Total solar power generation		-	-	-	-	-	-	-	-	-	0.7	0.9	1.2	1.2	1.0
Total electricity generation		1,919.3	1,840.5	1,907.5	1,974.5	1,976.7	1,811.9	1,696.1	1,779.2	1,736.6	2,087.1	1,548.4	1,746.3	2,099.1	2,169.3

Note: For fiscal years up to FY2020, the fiscal year runs from July to June of the following year. FY2021 covers a nine-month period from July to March of the following year, while from FY2022 onwards the fiscal year runs from April to March of the following year. Unlike Table 3, Table 4 presents electricity generation data based on these fiscal years.

Source: Prepared based on materials provided by the executing agency

In conducting the evaluation, as the facilities and equipment installed under this project commenced operation in 2021 due to project delays, data since the start of operation were collected on an annual basis, and the degree of achievement was analysed by comparing the actual values in 2024, three years after completion of this project, with the target values.

Under this project, the maximum output of the Tedzani Hydropower Station was originally planned to increase by 21,800 kW, from 92,700 kW to 114,500 kW. However, due to a reduction in the scale of this project, the actual increase amounted to 19,143 kW, resulting in a total capacity of 111,843 kW. In addition, in the latter half of the 2010s, the existing Unit III of the Tedzani Hydropower Station (two generators) was upgraded from 52,000 kW to 62,000 kW. As a result, at the time of ex-post evaluation, the maximum output of the Tedzani Hydropower Station stands at 121,843 kW. Nevertheless, since the 10,000 kW upgrade of Unit III had not been planned at the time of formulation of this project and was therefore not included in the target value, the

[6] When providing the sub-rating, Effectiveness and Impacts are to be considered together.

[7] Prior to the implementation of this project, the Tedzani Hydropower Station was equipped with Units I, II, and III. The generating unit added under this project is referred to as Unit IV. Units I to III each comprise two generators, while Unit IV is equipped with a single generator.

target capacity of 114,500 kW can be redefined as 124,500 kW by adding this increment. Compared with this adjusted target value, the achievement rate of this project can be considered to be 98%.

With regard to electricity generation, Tropical Storm Ana, which struck Malawi in January 2022, caused damage to the intake structure of the Kapichira Hydropower Station, rendering it unable to generate electricity for a period of 15 months. As a result, the Tedzani Hydropower Station was required to compensate for the shortfall, and its electricity generation in that year reached almost the target level. However, in 2023, following the resumption of power generation at the Kapichira Hydropower Station, electricity generation at the Tedzani Hydropower Station declined significantly. In 2024, electricity generation fell further—by 5.3% compared with the 2023 level—due to the failure of one generator of Unit III at the Tedzani Hydropower Station, as well as the temporary closure of the intake facilities to avoid adverse impacts on generation equipment caused by rising water levels and excessive inflows from Lake Malawi, the source of the Shire River on which the Tedzani Hydropower Station is located. A similar trend was observed in the capacity factor, which has never exceeded the baseline value set at the time of planning of this project.

Hydropower accounts for more than 97% of Malawi's total electricity generation in recent years, and the output of the Tedzani Hydropower Station is adjusted in coordination with the generation levels at major hydropower stations such as Nkula and Kapichira. The Tedzani Hydropower Station has generally been able to supply the required amount of electricity to the transmission network without major difficulties, and no power generation issues attributable to the facilities and equipment installed under this project have been observed. At the national level, although greater electricity supply is required, the limited capacity of the transmission and distribution network and the implementation of planned power outages have constrained the unilateral expansion of generation capacity. Meanwhile, the Tedzani IV Unit developed under this project increased Malawi's overall generation capacity by several percentage points (Malawi's total generation capacity in 2021, when this project was completed, was approximately 488 MW, and the Tedzani IV Unit with 19.1 MW accounts for about 3.9%). It also played a complementary role in supplying the required electricity by operating at a high level during the period from 2022 to 2023, when the Kapichira Hydropower Station was completely out of operation due to cyclone damage.

However, this project was not implemented with the objective of serving as a backup power source in the event of an emergency shutdown of any power station, and no indicators were established for such a purpose. Rather, this project was implemented to mitigate the anticipated shortage of electricity supply while taking into account the planned development of the transmission and distribution network. Consequently, none of the quantitative indicators set under this project have been achieved. In particular, the achievement levels for electricity generation and capacity factor are low, and it cannot be concluded that the effects originally envisaged at the time of planning of the entire project have been sufficiently realised.

・Qualitative Effects

Under this project, it was envisaged as a qualitative effect that the stability of electricity supply to the capital city of Lilongwe and the commercial city of Blantyre would be improved through an increase in generation capacity. In the ex-post evaluation, recent data on the frequency and duration of power outages per household in Malawi were reviewed, as shown in Table 5. (Lilongwe is located in the Central Supply Area, while Blantyre is located in the Southern Supply Area.)

Table 5. Trends in the Frequency and Duration of Power Outages

Supply Area	Outage Frequency (times)		Outage duration (minutes)	
	FY2023/24	FY2024/25	FY2023/24	FY2024/25
Northern	13.0	20.5	50.7	123.0
Central	22.3	16.5	77.9	97.0
Southern	18.2	23.0	44.1	99.0

Note: The frequency of power outages represents the System Average Interruption Frequency Index (SAIFI), defined as the average number of power interruptions per customer per year. The duration of power outages represents the System Average Interruption Duration Index (SAIDI), defined as the average duration of power interruptions per customer per year. The above data show the annual number and duration of outage events, including unplanned outages and planned outages lasting five minutes or longer. Momentary interruptions lasting less than five minutes are not included.

Source: Data provided by Electricity Supply Corporation of Malawi

Although the power outage situation in Malawi varies by fiscal year, power outages lasting several minutes or longer continue to occur nationwide several times per month. According to the executing agency, the implementation of this project has increased the amount of electricity generated in Malawi, enabling additional electricity to be supplied. However, as electricity demand at times exceeds supply, it is sometimes necessary to apply average power distribution measures (load shedding). In addition, challenges in the distribution network—particularly the frequent failure of transformers at secondary substations—also contribute to insufficient electricity distribution.

In 2025, the Government of Malawi announced the *National Energy Compact for Malawi*, which aims to develop the transmission and distribution network; however, as of the time of the ex-post evaluation, its implementation had not yet commenced. Given the significant challenges in the distribution network, it can be said that stable electricity supply has not been adequately ensured, irrespective of the amount of electricity generated. While electricity generation and supply to the transmission network are expected to increase in the future, at the time of ex-post evaluation, sufficient electricity supply has

not been achieved due to issues outside the generation segment, namely constraints in the transmission and distribution network[8].

<Impacts>

・Intended Impacts

Under this project, it was envisaged that improvements in citizens' living conditions and the strengthening of the industrial base would be promoted through a stable supply of electricity.

As described under "Effectiveness", the increase in generation capacity by 19.143 MW achieved through this project enhanced the overall stability of power generation, enabling a more stable supply of electricity to the transmission network. In addition, when the Kapichira Hydropower Station was damaged by the tropical storm in 2022 and became unable to generate electricity for a period of 15 months, the stable operation of Unit IV of the Tedzani Hydropower Station, introduced under this project, helped mitigate the negative impacts of electricity shortages. In this sense, a stable supply of electricity from the power station level has largely been achieved. However, as noted in the section on the quantitative effects of "Effectiveness", challenges remain in the distribution network, and stable electricity supply to end users has not been ensured. Planned power outages continue to occur, and due to issues in the transmission and distribution network that fall outside the scope of this project, it is difficult to conclude that sufficient impact has been generated.

Interviews conducted with the Blantyre Water Board, the largest electricity consumer in southern Malawi where the Tedzani Hydropower Station is located, indicated that intake facilities located close to the power station receive priority electricity supply and benefit from relatively stable power supply. However, for example, the distribution network serving water treatment and distribution facilities within Blantyre City is unstable, and power outages occur frequently. Furthermore, interviews with hotels in Blantyre and Lilongwe also revealed that electricity supply to users remains unstable, with little noticeable improvement. Based on these findings, it is considered difficult to conclude that this project has generated impacts in terms of improvements in citizens' living conditions or the strengthening of the industrial base.

・Other Positive and Negative Impacts

1) Impacts on the Environment

This project was classified as Category B, as it does not fall under large-scale hydropower, dams or reservoirs as defined in the JICA Guidelines for Environmental and Social Considerations (issued in April 2010). It was therefore determined that the project would not cause significant adverse environmental impacts, nor does it correspond to projects with sensitive characteristics or those located in environmentally or socially sensitive areas as specified in the Guidelines.

At the time of planning of this project, as the project was to be implemented within the premises of the executing agency, a full-scale Environmental Impact Assessment was not conducted. Based on the results of the Initial Environmental Examination, the environmental impacts were assessed as not significant. This project was implemented in accordance with the Environmental Management Plan prepared at that time. No special conditions were imposed for implementation, and during the construction period, appropriate measures were taken for dust control, water quality management, and noise and vibration control. Regular monitoring was conducted using environmental, health and safety checklists. No noise affecting nearby residents was reported. According to the executing agency, no air, water or soil pollution has occurred since the completion of this project, and water quality testing has been conducted on a regular basis. No environmental issues were reported, and no particular concerns were observed during the site inspection conducted as part of the ex-post evaluation.

Therefore, it is considered that this project has not caused any negative environmental impacts.

2) Resettlement and Land Acquisition

This project was implemented within the premises of the Tedzani Hydropower Station operated by the executing agency, and therefore involved neither resettlement of residents nor land acquisition.

3) Gender Equality, Marginalised People, Social Systems and Norms, People's Well-being and Human Rights

In implementing this project, a mechanism was established—through the manager responsible for gender and inclusion within the executing agency—to address issues related to working conditions of project personnel as well as grievances concerning gender and human rights. According to the executing agency, no grievance cases were reported during the project period. In addition, no individuals were identified whose equitable participation in society was hindered. Some employment opportunities were also created for residents of villages surrounding the power station during the project period, and those employed were able to enhance their knowledge and skills in areas such as bricklaying techniques and environmental management.

Therefore, no particular issues related to gender or human rights were identified in relation to the implementation of this project. Furthermore, as this project involved the development of power generation facilities and equipment, it can be regarded as a project that benefited all users in an equitable manner.

<Evaluation Result>

[8] The National Energy Compact for Malawi, announced in 2025, sets a target of increasing the electricity access rate to 70%. To achieve this target, the Compact mainly plans the following transmission and distribution network developments:

- Construction and expansion of transmission and distribution lines: Installation of 1,940 km of new transmission lines and 22,417 km of new distribution lines
- Upgrading of substations: Capacity enhancement of existing substations and construction of new substations
- Strengthening regional interconnections: Enhancement of power interconnections with Mozambique, Zambia and Tanzania, and integration into the Southern African Power Pool and the Eastern African Power Pool

Based on the above, the quantitative effects have not been sufficiently realised, and the stabilisation of electricity supply (a qualitative effect), as well as improvements in citizens' living conditions and the strengthening of the industrial base (impacts), have been limited. Therefore, the effectiveness and impacts of this project are moderately low.

4 Sustainability

・Policy and System

At the time of ex-post evaluation, Malawi's national development framework was the *Third Malawi Growth and Development Strategy (2017–2022)*, under which energy development continued to be positioned as a priority sector, as in the previous national plans. In the energy sector, the *Malawi Renewable Energy Strategy* formulated in 2017 set out a direction to promote the utilisation of renewable energy, while the *National Energy Policy* formulated in 2018 emphasised the need to strengthen power generation capacity. Furthermore, in 2025, the *National Energy Compact* was launched, setting out the following five strategic pillars:

- Power generation and supply
- Regional power interconnections
- Expansion of last-mile connections
- Financing and private sector participation
- Institutional reform and the strengthening of public utilities

Under this strategy, the Government of Malawi has set targets to be achieved by 2030, including an increase in the electricity access rate to 70%, raising annual electricity generation to 5,166 GWh, adding generation capacity (of which 714 MW is to be introduced by the private sector), extending transmission lines by 1,940 km, and extending distribution lines by 22,417 km.

As described above, national plans and sector policies and strategies place particular emphasis on strengthening power generation capacity, especially through the promotion of renewable energy. In addition, there has been no change in the policy direction whereby the executing agency continues to be the organisation responsible for the majority of power generation in Malawi. Therefore, as a whole, the sustainability of this project from the policy and system perspectives is high.

・Institutional/Organisational Aspect

The organisation responsible for the operation and maintenance of the Tedzani Hydropower Station is the Electricity Generation Company (Malawi) Limited (hereinafter referred to as "EGENCO"). EGENCO was established in September 2016 through the separation of the power generation division from the Electricity Supply Corporation of Malawi (hereinafter referred to as "ESCOM")[9].

The Tedzani Hydropower Station is staffed by a total of 124 personnel, comprising 66 staff in the administrative division (including cleaners and security guards) and 58 staff in the technical division. The technical division is further divided into operation and maintenance sections and is composed mainly of engineers with many years of experience. With the commissioning of Tedzani Unit IV constructed under this project, an additional eight operation staff and two maintenance staff were recruited. According to EGENCO, the necessary personnel for operation and maintenance have been secured, and the organisation is not facing any staff shortages. In practice, no problems in operation or maintenance attributable to staff shortages or lack of experience have been observed, and the sustainability of the organisational and institutional aspects is therefore judged to be high as a whole.

・Technical Aspect

Under this project, as equipment with specifications new to EGENCO was to be introduced, it was planned to provide initial operation guidance as well as on-the-job training (OJT) at site on operation and maintenance methods. This guidance was duly implemented, and according to EGENCO, technical staff were able to deepen their understanding of the newly introduced equipment. Thereafter, by making use of the manuals provided under this project, EGENCO has been able to independently carry out operation and maintenance in practice, indicating that the technical standard is considered to be adequate.

EGENCO has the Training Department, which implements internal training programmes annually based on staff needs. Technical staff are required to attend at least one training programme per year (normally of one week's duration), demonstrating that EGENCO makes organisational efforts to enhance the technical capacity of its staff. With regard to external training, the Kafue Gorge Regional Training Centre, an affiliate of the Southern African Development Community (SADC), provides specialised training in hydropower and related engineering fields, and EGENCO dispatches staff to regional training programmes at this centre on an annual basis.

As described above, as a result of the initial operation guidance and OJT provided under this project, technical staff are able to operate and maintain the generators with a sufficient level of understanding, and no major technical issues have been observed. Efforts to enhance capacity through training are also being undertaken, and the sustainability from the technical aspect can therefore be said to be high.

・Financial Aspect

As coordination within the Government regarding the treatment of assets following EGENCO's separation from ESCOM has been ongoing, EGENCO's financial statements for FY2021/22 onwards have not yet been formally audited. Therefore, the financial status for FY2018/19 to FY2020/21, which has been publicly disclosed, is presented in Table 6.

[9] Until then, ESCOM had been Malawi's only corporate entity capable of carrying out the entire range of activities in the power sector in an integrated manner, including the planning and construction of power facilities, power generation, transmission and sub-transmission, distribution, operation and maintenance, and tariff collection.

Table 6. Financial Status of EGENCO

(Unit: million Malawian kwacha)

FY	2017/18	2018/19	2019/20	2020/21
Electricity sales revenue	43,080	56,650	63,170	67,252
Other income	1,636	7,695	2,012	2,358
Electricity sales expenses	-17,345	-29,107	-33,728	-35,640
Administrative expenses	-11,809	-13,075	-21,325	-55,855
Profit before tax	15,562	22,163	10,129	-21,885
Net profit	11,035	15,222	-33,267	-14,330

Note: In FY2019/20, the recognition of deferred tax assets, and in FY2020/21, the recognition of uncollectible receivables, resulted in a final net loss.

Source: Compiled from EGENCO financial statements (respective fiscal years)

EGENCO's financial position includes years in which deficits were recorded due to the recognition of uncollectible receivables and the implementation of tax-related accounting treatments. These factors constitute a significant constraint on securing funds for expanding generation capacity. However, when the analysis is limited to revenues and expenditures related to electricity sales, EGENCO has consistently maintained a surplus, and no major issues are observed. Nevertheless, as reflected in the recognition of uncollectible receivables in FY2020/21, the steady collection of tariffs is important for improving the financial situation. Furthermore, discussions with EGENCO during the ex-post evaluation site survey indicated that budgets for the operation and maintenance of the Tedzani Hydropower Station are generally secured each year, and no situations have arisen in which operation and maintenance could not be carried out due to budgetary constraints[10].

Therefore, as a whole, while there are some issues in EGENCO's overall financial condition, no significant problems are observed in the balance of revenues and expenditures related to electricity sales. It is therefore considered that financial sustainability has been secured to a certain extent.

・Environmental and Social Aspect

As described above under "Impacts 1) Impacts on the Environment," the ex-post evaluation confirmed that no negative environmental impacts have occurred, and EGENCO also considers that no adverse environmental or social impacts are expected to arise in the future.

Following project completion, no environmental monitoring other than water quality testing has been conducted; however, according to EGENCO, no particular negative impacts have been observed. Accordingly, no major issues are considered to exist.

・Preventative Measures to Risks

In 2022, when a tropical storm struck, the Shire River, where the Tedzani Hydropower Station is located, overflowed, and the project facilities suffered erosion damage. Similar events may occur again in the future. In addition, it was reported that the intake gates cannot always be fully closed due to sediment deposits on the riverbed, and that, should a malfunction occur, it could have a significant impact on power generation.

To address these risks, EGENCO has constructed a block wall around the switchyard (located adjacent to the powerhouse building) into which floodwater flowed during the flooding event, thereby completing countermeasures against similar situations. With regard to the intake gate opening and closing mechanism, EGENCO has also commenced design work for its modification. Therefore, measures are being taken to address potential future risks, and it can be concluded that appropriate responses are being implemented.

・Current Status of Operation and Maintenance

A site survey was conducted to assess the operation and maintenance status of the facilities and equipment developed under this project. As a result, it was confirmed that erosion protection concrete slabs surrounding the headrace channel had been damaged by a tropical storm in 2022. While no defects were identified in the headrace channel itself, repairs to the damaged concrete slabs had not yet commenced at the time of the ex-post evaluation site survey. In addition, damage to the soil cover on the slope from the forebay to the powerhouse was observed and remained unaddressed. As these issues do not affect power generation, they are not considered to constitute major problems.

With regard to operation and maintenance, EGENCO has established a preventive maintenance schedule for the power station, under which generators are shut down every four months to carry out maintenance works. Necessary spare parts have been secured, and all power generation facilities and equipment were operating without problems at the time of the site survey. It was also confirmed that large-scale repairs, such as equipment replacement, or responses to major troubles are outsourced to manufacturers or other external parties, while all other works are carried out by EGENCO's technical staff.

Therefore, it was confirmed that the power generation facilities and equipment developed under this project have been appropriately operated and maintained in accordance with the preventive maintenance schedule and have been operating smoothly up to the time of the ex-post evaluation. Routine operation and maintenance works can be handled internally by

[10] With regard to securing budgets for preventive maintenance, the Tedzani Hydropower Station does not follow a practice of repairing power generation–related equipment only after failures occur. Instead, budgets are secured in advance, and regular inspections are conducted regardless of whether any malfunctions have occurred.

EGENCO, and as a whole, the operation and maintenance status is considered to be satisfactory.

<Evaluation Result>
Based on the above, while further improvements are required with regard to the financial situation, it is not considered to be at a critical level, and no issues were observed in other aspects, including policy and system, organisational and institutional aspects, technical aspects, environmental and social considerations, responses to risks, and the status of operation and maintenance. Therefore, the sustainability of the project effects is high.

III. Recommendations & Lessons Learned

・Recommendations to Executing Agency
The operating level of the generator introduced under this project has been adjusted in accordance with the overall electricity supply situation in Malawi and has not necessarily been operated at the level envisaged at the planning stage. Going forward, at the Tedzani Hydropower Station, as other generators continue to age and the likelihood of unexpected failures increases, and as regular inspections may require longer periods than anticipated, it will be important to keep the relatively new generator introduced under this project in good condition at all times so that the output can be increased when necessary. To this end, it is important to properly repair the project facilities, including the erosion protection concrete slabs around the headrace channel and the soil cover on the slope from the forebay, and to take preventive measures to the greatest extent possible in preparation for large-scale disasters, in order to ensure a stable electricity supply for Malawi as a whole.
In addition, although it falls outside the scope of this project, the condition of the transmission and distribution network has had a significant negative impact on the manifestation of the project's effects. While the generator introduced under this project has the capacity to supply a greater amount of electricity, they have not been able to fully demonstrate their supply capacity due to constraints related to grid stability capacity and the operational status of the transmission and distribution network. Although EGENCO's ability to address these issues is limited, it is desirable that, as improvements to stabilise the transmission and distribution network progress, the entire generation system be maintained in good condition so that the required electricity can be supplied without difficulty.

・Recommendations to JICA
None.

・Lessons Learned
<u>Need for Careful Examination of Project Costs at the Planning Stage</u>
Under this project, the bidding process failed twice, resulting in a significant delay to the implementation schedule. A major contributing factor was a divergence in perceptions regarding pricing between the project consultant who prepared the design and cost estimate and the contractors who actually submitted bids for the main works. As this project was Japan's first ODA project related to hydropower plant development in Malawi, it is considered that differences in assumptions between the project consultant and bidders—such as approaches to procuring equipment and materials and the way transport costs within the African continent were accounted for—may have contributed to this situation.
Although there was a substantial gap between the engineer's estimate and the initial bid prices, it was difficult to increase the estimated price. Consequently, the project scope had to be reduced to address the gap, which not only led to a considerable extension of the project period but also had a non-negligible impact on the project effects, including generation capacity and electricity output. When planning similar projects in the future, it is important that JICA staff, project consultants, and other relevant stakeholders take into account the location of the target site and, from the project formulation stage, carefully examine and scrutinise costs from all angles—not only the prices of equipment and materials but also additional logistics costs such as transportation and customs clearance required when procurement is undertaken in landlocked countries—in order to estimate project costs appropriately. This is considered important for ensuring the generation of project effects and avoiding implementation delays.

IV. Non-Score Criteria

・Performance
・Objective Perspective
None.

・Additionality
None.

Photo 1. Intake of Tedzani Hydropower Plant Unit IV
(Source: Taken by the External Evaluator)

Photo 2. Tedzani Hydropower Plant Unit IV Powerhouse
(Source: Taken by the External Evaluator)

(end)