United Republic of Tanzania

FY2015 Ex-Post Evaluation of Japanese Grant Aid Project

"The Project for Rehabilitation of Substation and Transmission Line in Kilimanjaro Region"

External Evaluator: Keishi Miyazaki, OPMAC Corporation

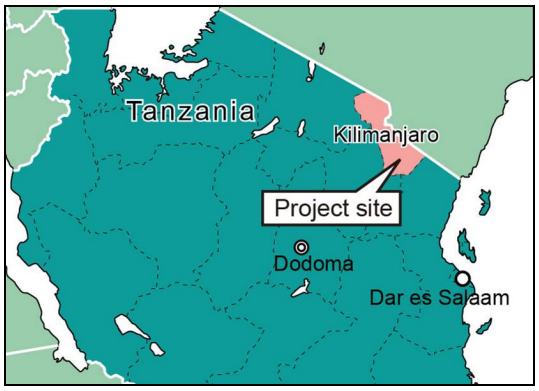
0. Summary

The objective of this project is to ensure a stable power supply to local residents in Kilimanjaro Region in the northeastern part of Tanzania by installing and upgrading substations, transmission, and distribution equipment, and thereby contributing to vitalizing social and economic activities in Kilimanjaro Region.

The project was consistent with the development plans of the Government of Tanzania and development needs of Kilimanjaro Region, both at the time of project planning and ex-post evaluation. Also, the project was also consistent with Japan's ODA policy towards Tanzania at the time of project planning. Therefore, the relevance of the project is high. Although the project cost was within the plan, the project period exceeded the plan. Therefore, the efficiency is fair. As for the project effects, anticipated targets for the "reduced time of power interruptions due to failures" and "stable electricity voltage" have been attained. The results of the beneficiary survey also confirmed that improvements were made in such areas as "stability of electricity voltage," "reduction in the frequency of blackout" and "reduction in the frequency of electrical accidents/faults" after project implementation. As for the "reduction in restricted power supply time," however, there was no data available to show the results and its achievement could not be verified. Some positive impacts were noted in the increase in the number of power consumers (customers), improvement in the living environment of local residents, operational stability of schools and hospitals, and improvement in productivity and service quality of local industries. Therefore, the effectiveness and impacts of the project are high. The sustainability of project is fair since some problems were observed in the financial position of the implementing agency, although no problem was identified in its institutional and technical aspects of the operation and maintenance of the facilities developed by the project.

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

1. Project Description



Project location

Makuyuni Substation newly installed by the project

1.1 Background

The economy in Tanzania had been growing faster than approximately 5% annually since 2000, and enhanced economic activities had led to an even more rapid growth in power demand of 8.6% annually. Nevertheless, during the period between 1992, when the Tanzania Electric Supply Company Limited (TANESCO) was privatized on a trial bases, and 2006, when the privatization efforts were suspended and TANESCO was reinstated as a public corporation, public assistance, including aid from donors, in the country's power sector stagnated. During this period, Tanzania was unable to invest in additional facilities commensurate with the growing demand for electricity or conduct adequate maintenance of existing facilities. Under this situation, power supply facilities in the country deteriorated, the equipment in existing substations was left chronically overloaded to meet the increasing demand for electricity, and power outages frequently occurred due to inadequate maintenance of distribution equipment, taking a heavy toll on socioeconomic activities in the country.

Kilimanjaro Region, where this project was implemented, is located in Northeast Tanzania. The region constituted an economic center with a population of 1.56 million and served as Tanzania's foremost tourist destination that received many visitors from all over the world. The region's electricity demand had grown rapidly together with its economic growth in recent years, and many of its substations were inevitably overloaded. As a result, power supply was frequently interrupted by load shedding and equipment failures.

1.2 Project Outline

The objective of this project is to ensure a stable power supply to local residents in Kilimanjaro Region in the northeastern part of Tanzania by installing and upgrading substations, transmission, and distribution equipment, and thereby contributing to vitalizing social and economic activities in Kilimanjaro Region.

E/N Grant Limit or GA Grant Amount /Actual Grant Amount	2,500 million yen / 2,092 million yen
Exchange of Notes Date (/ Grant Agreement Date)	March 2011 (/ March 2011)
Implementing Agency	Tanzania Electric Supply Company Limited (TANESCO)
Project Completion Date	February 2013
Main Contractors	Joint venture (Mitsubishi Corporation / Aichi Electric Co., Ltd. / Yurtec Co., Inc.)
Main Consultant	Yachiyo Engineering Co., Ltd.
Basic Design	February 2011
Related Projects	Technical Cooperation - The Project for Capacity Development of Efficient Distribution and Transmission Systems (2009-2016) Official Development Assistance Loan - Iringa-Shinyanga Backbone Transmission Investment Project (2010-present) (cofinanced with the African Development Bank) Other International Agencies and Donors The World Bank - Tanzania Energy Development and Access Expansion Project (TEDAP) (2010-present)

2. Outline of the Evaluation Study

2.1 External Evaluator

Keishi Miyazaki, OPMAC Corporation

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted as follows:

Duration of the Study: December 2015－January 2017

Duration of the Field Study: (First) April 3, 2016－April 16, 2016

(Second) June 23, 2016－July 1, 2016

2.3 Constraints during the Evaluation Study

At the time of project planning, “restricted power supply time,” “time of power interruptions due to failures” and “voltage drop” were selected as the operation and effect indicators to measure the quantitative effects of this project, and a target was set for each of these indicators

to be checked after three years of project completion (2016). Of the three indicators, data for "time of power interruptions due to failures" and "voltage drop" were collected, but those for "restricted power supply time" were not available. This is because the operation data which the implementing agency measured and recorded on the regular basis were limited to "planned outage hours" and "unplanned outage hours". Moreover, even the data collected were incomplete as they did not cover the full year (12 months) for the target year of 2016 (three years after the project completion). Therefore, it should be noted that the achievement of the project's operation and effect indicators was evaluated under these constraints.

In addition, at the time of ex-post evaluation, TANESCO's financial reports in FY2014 or later were not available since they had not been formally approved by its Board of Directors. Thus, in analyzing the financial sustainability of the project, financial standing of TANESCO in FY2014 or later was difficult to assess thoroughly based on the actual data.

3. Results of the Evaluation (Overall Rating: B[1])

3.1 Relevance (Rating: ③[2])

3.1.1 Relevance to the Development Plan of Tanzania

At the time of project planning, the Government of Tanzania emphasized "Strategy 1: Growth and Reduction of Income Poverty" as one of the three main pillars of its national development plan, known as *the National Strategy for Growth and Reduction of Poverty (NSGRP) (2005-2010).* Under this strategy, "provision of reliable and affordable energy to consumers" was listed as a target related to the energy sector. Furthermore, under the *"Power System Master Plan,"* which is the 25-year long-term power sector development plan from 2008 to 2033 (updated in 2009), nation-wide efforts were under way in the development of power sources and expanding transmission facilities and substations.

The country's *"National Five Year Development Plan[3]" (2011/12-2015/16)* at the time of ex-post evaluation lists five core priorities of "infrastructure," "agriculture," "industry," "human capital development and social services" and "tourism, trade and financial services." Under "infrastructure," upgrading and constructing new transmission and distribution lines, improving power supply/distribution to rural areas, enhancing the natural gas development projects, and fast-tracking bio-fuels development projects are stated as its strategic interventions. In addition, *"Power System Master Plan 2012 Update"* underlines the need to develop and reinforce transmission facilities and substations in order to achieve the target of 78% electrification rate (by 2035), while continuing with the further strengthening of power

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

[2] ③: High, ②: Fair, ①: Low

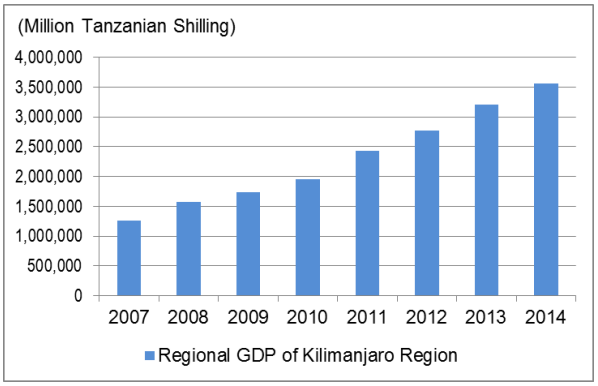
[3] The National Five Year Development Plans are considered as roadmaps towards the achievement of the country's long-term development plan, *"Tanzania Development Vision 2025."* The Government of Tanzania intends to formulate development plans every five years in order to attain the goals set by "Tanzania Development Vision 2025".

generation capacity in order to respond to the power shortage.

Based on the foregoing, the project is considered to be consistent with the development plans of Tanzania.

3.1.2 Relevance to the Development Needs of Tanzania

Kilimanjaro Region, where this project was implemented, constitutes an economic center with a population of 1.56 million and serves as Tanzania's leading tourist destination that receives many visitors from all over the world. At the time of project planning, the region's electricity demand was increasing rapidly together with its economic growth of recent years, and many of its substations were inevitably overloaded (Figure 1). As a result, power supply was frequently interrupted by load shedding and equipment failures.



Source: The National Bureau of Statistics, Tanzania

Figure 1: Regional GDP in Kilimanjaro Region

After the implementation of this project, some improvements have been made in the demand and supply situations of the region's power sector, as seen in such an indicator as the power demand-supply gap. However, restricted power supply and unstable electric voltage persisted at the time of ex-post evaluation, due to insufficient capacity of the backbone transmission lines, which transmit electricity from South Tanzania to North Tanzania, as well as the deterioration of certain existing distribution facilities in Kilimanjaro Region. Hence, there is still room for improvement in the region's power sector (Table 1)

Therefore, the project is relevant to the development needs of Tanzania.

Table 1: Electricity Demand and Supply Status in Kilimanjaro Region

		2011	2012	2013	2014	2015
1	Peak Electricity Demand (MW)	35.87	38.50	33.83	35.85	38.00
2	Peak Electricity Supply (MW)	35.97	39.72	37.00	37.50	38.07
3	Demand/Supply Gap (MW)	0.10	1.22	3.17	1.65	0.07
4	Required Annual Electricity Energy (MWh)	172,369	188,659	107,650	82,431	110,820
5	Supplied Annual Electricity Energy (MWh)	204,809	192,509	109,847	84,113	110,820
6	Demand/Supply Gap (MWh)	32,440	3,850	2,197	1,682	0

Source: TANESCO

3.1.3 Relevance to Japan's ODA Policy

The "Country Assistance Program for Tanzania" (June 2008) of the Government of Japan regards infrastructure development (transport and traffic such as roads, energy, rural water supply and water resource management), which contributes to economic growth and poverty reduction, as one of the priority agenda. The project is aimed at supporting infrastructure development in Tanzania's energy sector, by upgrading and newly building transmission and distribution facilities in Kilimanjaro Region. Therefore, the project was consistent with Japan's ODA policy towards Tanzania at the time of project planning.

In light of the above, this project is deemed highly relevant to development plans and needs of Tanzania, as well as Japan's ODA policy. Therefore, its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The project aimed at: renewing two deteriorated substations (YMCA Substation and Lawate Substation), reinforcing two existing substations (Trade School Substation and Kiyungi Substation), constructing two new substations (KCMC Substation and Makuyuni Substation), and the procurement and installation of equipment and materials necessary for these substations, such as transformers and circuit breakers The project also installed a 66kV transmission line (34km in length) between Kiyungi and Makuyuni Substations and a 33kV distribution line (5km in length) between Trade School and KCMC Substations. All the outputs were delivered as planned.

For this project, the Tanzanian side was expected to: (1) level the land needed for the upgrading and new construction of substations, (2) install the 33kV transmission line beyond Makuyuni Substation, (3) execute connection works from the renewed or newly constructed substations to the existing 33kV and 11kV distribution lines, (4) procure and install SCADA[4] and communication systems, and (5) procure and install the optical grounding wire (OPGW) for the 66kV transmission line and its accessories. These outputs were also delivered as planned.

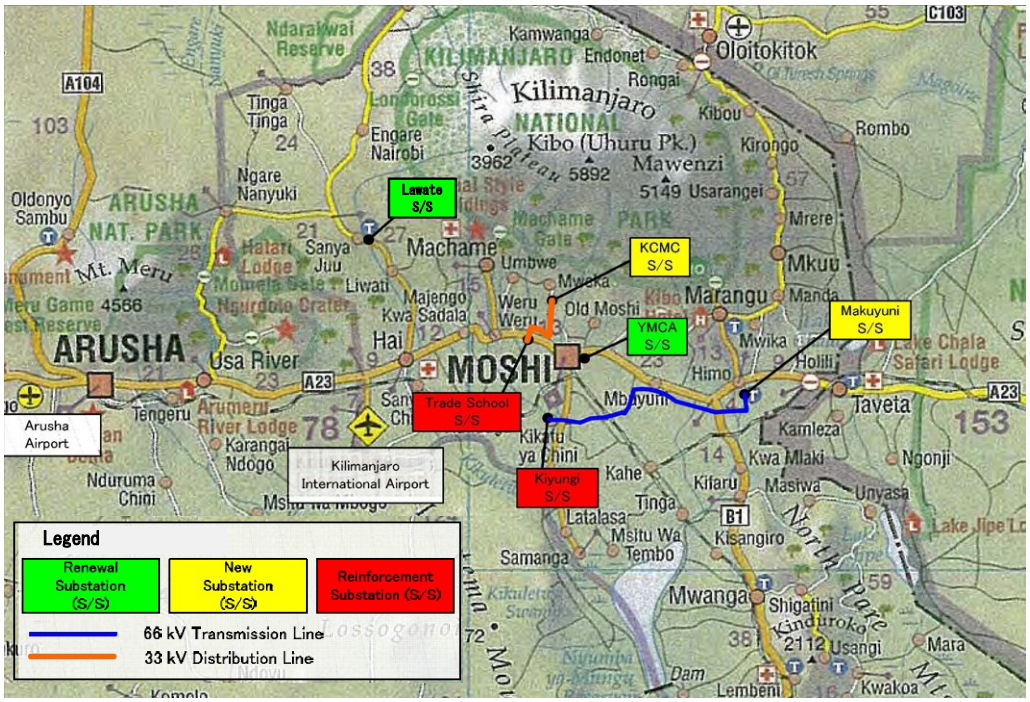
The summary of produced outputs of the project is provided in Table 2, and the project sites are marked in Figure 2.

[4] SCADA: Supervisory Control and Data Acquisition System

Table 2: Project Outputs (Plan/Actual)

Item	Plan	Actual
(1) Transformer	• 33/11kV Transformer (15/17 MVA×1 unit, 10 MVA×2 unit) • 66/33kV Transformer (10 MVA×2 units) • 132/66kV Transformer (20 MVA×1 unit)	As planned
(2) Circuit Breaker	• 33kV and 11kV circuit breaker (3 locations) • 66kV and 33kV circuit breaker (1 location) • 132kV and 66kV circuit breaker (1 location)	As planned
(3) Transmission and Distribution Lines	• 66kV transmission line 34km (Kiyungi - Makuyuni,) • 33kV distribution line 5km (Trade School – KCMC (Note 1))	As planned
(4) Target Substations	6 locations • YMCA (Note 2) Substation (Renewal) • Lawate Substation (Renewal) • KCMC (Note 1) Substation (New) • Trade School Substation (Reinforcement) • Makuyuni Substation (New) • Kiyungi Substation (Reinforcement)	As planned

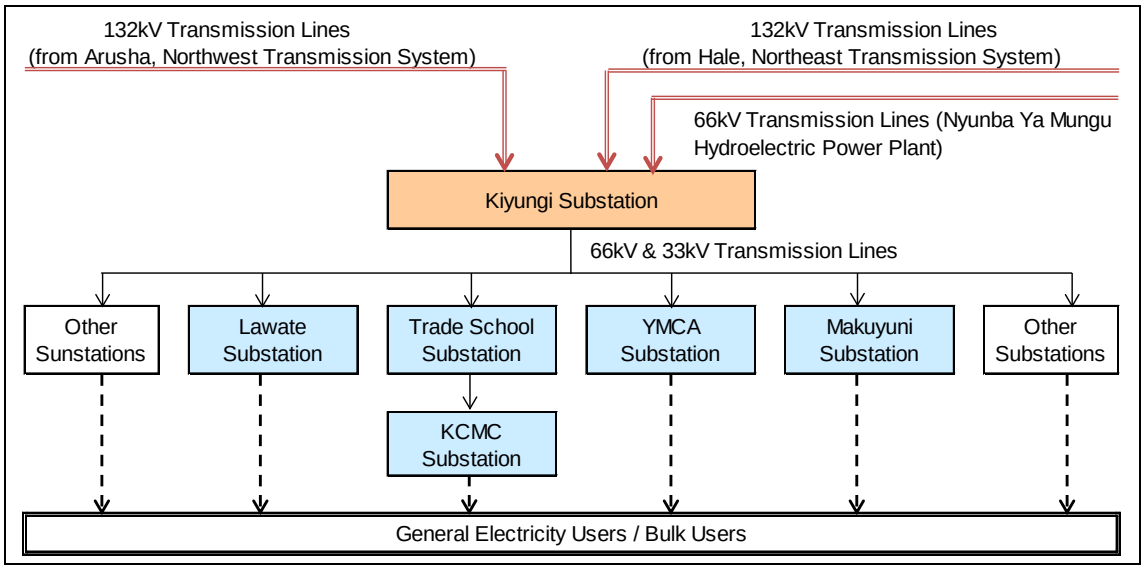
Source: The Preparatory Survey Report and documents provided by JICA.
Note 1: KCMC (Kilimanjaro Christian Medical Centre)
Note 2: YMCA (Young Men's Christian Association)



Source: Preparation Survey Report.

Figure 2: Project Site

Figure 3 describes the transmission and distribution networks in Kilimanjaro Region after project completion. Kiyungi Substation is a substation located between the transmission and distribution systems in Kilimanjaro Region. It receives power from the backbone transmission systems (Northwestern and Northeastern transmission systems) and the Nyunba Ya Mungu Hydroelectric Power Plant in the region, through the 132kV and 66kV transmission lines, and steps the voltage down to 33kV before transmitting electricity to other distribution substations (secondary substations) in Kilimanjaro Region.



Source: Prepared by the External Evaluator.

Figure 3: Transmission and Distribution Networks in Kilimanjaro Region

Photographs: Substations and 66kV transmission line developed by the Project

KCMC S/S (New)

YMCA S/S (Renewal)

Trade School S/S (Reinforcement)

Makuyuni S/S (New)

Lawate S/S (Renewal)

Kiyungi S/S (Reinforcement)

Inside Makuyuni S/S

66kV Transmission Line

Inside Kiyungi S/S

Note: S/S: Substation

3.2.2 Project Inputs

3.2.2.1 Project Cost

The planned project cost to be borne by the Japanese side was 2,500 million yen and the cost to be borne by the Tanzanian side was 212 million yen[5], with the total project cost of 2,712 million yen. The actual project cost borne by the Japanese side was 2,092 million yen and that by the Tanzanian side was 338 million yen[6] (6,276 million TZS), with the actual total project cost of 2,430 million yen remaining within the planned cost (89.6% of the planned project cost). The lower project cost than the estimated cost on the Japanese side was made possible by reduced costs of equipment as a result of competitive biddings. The reasons for the cost overrun on the Tanzanian side could not be clarified.

3.2.2.2 Project Period

The actual project period of 24 months (March 2011–February 2013) was slightly longer than the planned period of 22 months (April 2011–January 2013) (109% of the planned project period). The prolonged project period was caused by the delay in construction of an access road (temporary road), to be built by the Tanzanian side, in order to transport building equipment and materials for the steel tower, which was necessary for the installation of the 66kV transmission line between Kiyungi and Makuyuni Substations.

As seen above, although the project cost remained within the plan, the project period exceeded the target. Therefore, the efficiency of the project is fair.

3.3 Effectiveness[7] (Rating: ③)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

As the operation and effect indicators to measure the quantitative effects of this project, "restricted power supply time," "time of power interruptions due to failures" and "voltage drop" were selected at the time of project planning. For the purpose of ex-post evaluation, supplementary indicators, namely "electricity supply" and "maximum output," in the target substations were also added.

(1) Restricted Power Supply Time and Time of Power Interruptions due to Failures

As for the time of power interruptions due to failures, the project target of 190 hours/month was set to be achieved in 2016. The actual time of power interruptions was 122.2 hours/month in 2013, 46 hours/month in 2014, and 49.3 hours/month in 2015. It is

[5] The responsibilities of the Tanzanian side include: (1) building of a temporary road necessary for the construction of the 66kV transmission line; and (2) installation of the 33kV distribution line (beyond Makuyuni Substation).
[6] 1 Tanzanian Shilling (TZS) = 0.054 Japanese yen (Average exchange rate during 2011-2013). Source: International Financial Statistics, IMF.
[7] Sub-rating for Effectiveness is also provided in consideration of Impacts.

therefore concluded that the target has already been achieved. The main reasons for the failures that caused power interruptions include damaged utility poles, damaged power lines caused by fallen trees, and equipment malfunctions (Table 3). According to the staff of TANESCO, significant reductions in the time of power interruptions can be attributed to the decrease in equipment malfunctions. This, in turn, is presumably brought about by the upgrading and new installation of substations, transmission and distribution facilities and equipment under this project, as well as TANESCO's continuous efforts to replace deteriorated distribution lines.

The restricted power supply time is defined as "the power outage period arising from the shortage in power supply, excluding repair outage hours (maintenance outage hours), which is the time of temporary outage conducted for the purpose of work, maintenance and inspection of transmission and distribution systems." However, because the implementing agency does not measure and record this indicator, the achievement of this indicator could not be verified. On the other hand, at the time of ex-post evaluation, TANESCO was routinely measuring and recording two indicators, namely "planned outage hours" and "unplanned outage hours." The former includes the outage time due to the shortage of power supply as well as repair outage hours (maintenance outage hours), and hence, differs from the restricted supply time by definition. On the other hand, unplanned outage hours is synonymous with the time of power interruptions due to failures.

For reference, planned outage hours after project completion in 2013 were: 199.6 hours/month in 2013, 57.1 hours/month in 2014, and 332.4 hours/month in 2015. The planned outage hours showed a temporary but significant decline between 2013 and 2014, but increased markedly in 2015 (see Table 4). According to the staff of TANESCO, the recent increase in planned outage hours is due to the load shedding conducted on the overloaded 220kV/132kV backbone transmission line as well as the impact of ongoing expansion works on this line. 60% of Tanzania's electric power is generated at the thermal power plants in or near Dar es Salaam. North Tanzania, including Kilimanjaro, Arusha and Tanga Regions, depends heavily on the power generated in Dar es Salaam in the south and transmitted through the two 220kV/132kV backbone transmission lines, i.e. the Northwestern Transmission System (Dar es Salaam–Iringa–Dodoma–Singida– Babati -Kisongo) and the Northeastern Transmission System (Dar es Salaam- Hale-Same-Moshi) (see Figure 4). However, a part (Iringa-Dodoma) of the 220kV backbone transmission line in the Northwestern Transmission System has been experiencing capacity constraints, making the power supply from the south to the north unstable. Moreover, because the 400kV transmission lines are currently being installed between Iringa and Shinyanga (total length approximately 667km), partly under Japan's ODA loan "Iringa-Shinyanga Backbone

Transmission Investment Project,"[8] the power transmission is obliged to be temporarily suspended due to its construction works. This situation also contributed to the significant increase in planned outage hours, especially repair outage hours (maintenance outage hours), in 2015.

The expansion of the transmission line between Iringa and Shinyanga was expected to be completed in September 2016, and with the resultant increase in transmission capacity of the Northwestern Transmission System, the power supply to Kilimanjaro Region is expected to become more stable after the completion of expansion works.

Table 3: Restricted Power Supply Time and Power Interruption Time

Unit: Hour(s)/Month

Indicator	Baseline	Target	Actual			
	2010	2016	2013	2014	2015	2016 (Note 1)
	Plan	3 Years After Completion	Project Completion Year	1 Year After Project Completion	2 Years After Project Completion	3 Years After Project Completion
Restricted Power Supply Time (Note 2)	159	32	N.A.	N.A.	N.A.	N.A.
Power Interruption Time (Note 3)	272	190	122.2	46.0	49.3	39.5

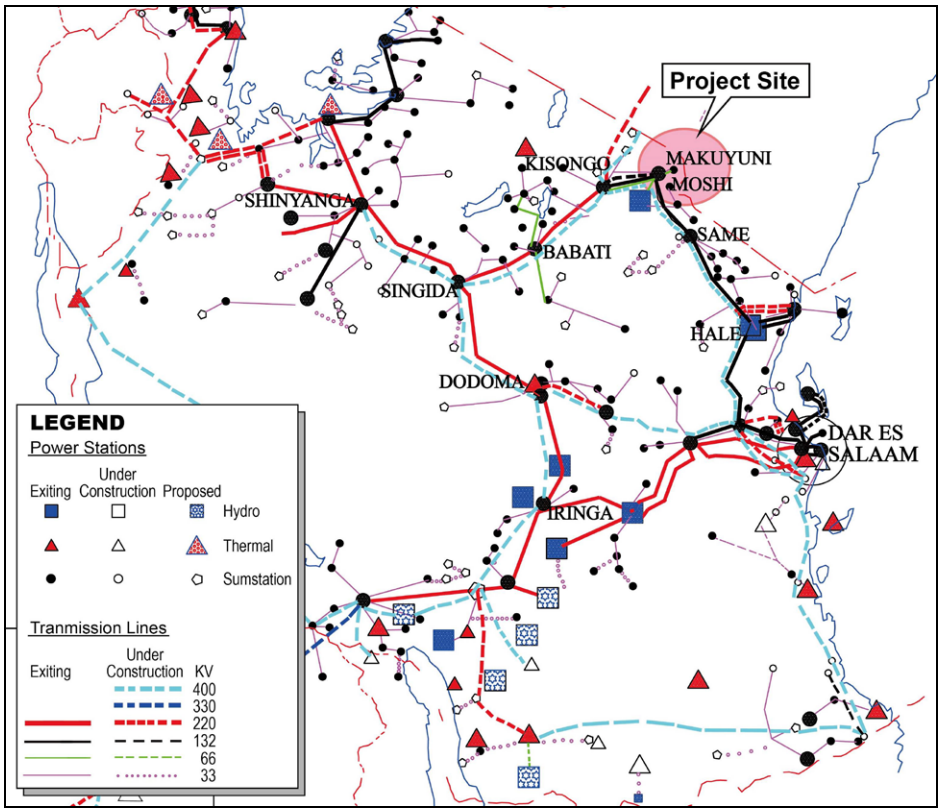
Source: Ex-ante Evaluation Summary Sheet (JICA) and TANESCO.
Note 1: The 2016 data is for 6 months from January to June.
Note 2: The power outage period arising from the shortage in power supply, excluding repair outage hours (maintenance outage hours), which is the time of temporary outage conducted for the purpose of work, maintenance and inspection of transmission and distribution systems.
Note 3: The power outage period arising from mechanical failures and accidents of transmission and distribution facilities.
Note 4: The actual figures of power interruption time in 2013-2016 are transcribed from the actual data of unplanned outage hours per month in 2013-2016 in Table 4.

Table 4: Planned and Unplanned Outage Hours in Kilimanjaro Region

	2013	2014	2015	2016 (Note 1)
(1) Planned Outage Hours (Note 2) (Hour)				
33kV Distribution Line	1,792	632	1,399	328
11kV Distribution Line	603	53	2,590	728
Total	2,395	685	3,989	1,056
Planned Outage Hours per Month (Hour/Month)	**199.6**	**57.1**	**332.4**	**176.0**
(1) Unplanned Outage Hours (Note 3) (Hour)				
33kV Distribution Line	1,026	409	276	92
11kV Distribution Line	440	143	315	145
Total	1,466	552	591	237
Unplanned Outage Hours per Month (Hour/Month)	**122.2**	**46.0**	**49.3**	**39.5**

Source: TANESCO.
Note 1: The 2016 data is for 6 months from January to June.
Note 2: The planned outage hours mean a temporary suspension of electricity supply based on the purpose, schedule, and target areas, which is determined by the power company beforehand. The planned outage hours in this table include a rolling blackout for avoiding a large-scale blackout when it is anticipated that the electricity demand will exceed the supply capacity as well as a temporary suspension of electricity supply for the purpose of work, maintenance and inspection of transmission and distribution systems.
Note 3: An outage hours arising from breakdowns and accidents of transmission and distribution facilities, which are not planned by the power company.
Note 4: The above planned and unplanned outage hours are total figures covering each distribution line and feeder in Kilimanjaro Region.

[8] Of the total total length of approximately 667km between Iringa and Shinyanga, Japan's ODA finances the transmission lines between Dodoma and Singida (Total length approximately 217km).



Source: TANESCO

Figure 4: Backbone Transmission Grid in Tanzania

(2) Voltage Drop

Regarding voltage drops, targets were established at two locations – KCMC Hospital which receives electricity from KCMC Substation (new) and the Rombo district which receives from Makuyuni Substation (new). At KCMC Hospital, although voltage drop once increased in 2015, the actual results in 2016 (January–February) were 0%. Similarly, the voltage drop at Rombo District improved to 3.75% in 2016. Considering that 2015 was an exceptional year, targets for this indicator are expected to be mostly achieved in 2016.

Table 5: Voltage Drop

Target Area	Baseline	Target	Actual			
	2010	2016	2013	2014	2015	2016 (Note 1)
	Plan	3 Years After Project Completion	Project Completion Year	1 Year After Project Completion	2 Years After Project Completion	3 Years After Project Completion
KCMC Hospital (11kv)	18% drop	No drop	0.0% (11kV=> 11kV)	1.8% (11kV=> 10.8kV)	4.5% (11kV=> 10.5kV)	0.0% (11kV=> 11kV)
Rombo (0.4kv)	16% drop	5% drop	7.5% (0.4kV=> 0.370kV)	4.5% (0.4kV=> 0.382kV)	7.75% (0.4kV=> 0.369kV)	3.75% (0.4kV=> 0.385kV)

Source: Ex-ante Evaluation Summary Sheet (JICA) and TANESCO.
Note 1: The 2016 data is for 2 months from January to February.

(3) Electricity Supply (Supplementary Indicator)

The electricity supply, an indicator which was to check whether power supplied by each substation is adequate to meet the demand or not, was lower in 2015 than in 2014 at all substations (Table 6). The main reason for the declines is the increase in planned outage hours in 2015, and figures are expected to rise in 2016 or later at all substations.

Table 6: Electricity Supply (Supplementary Indicator)

Unit: kWh

Substation	Receiving/Sending Voltage Rated Capacity (Note 1)	Actual			
		2013	2014	2015	2016 (Note 2)
		Project Completion Year	1 Year After Project Completion	2 Years After Project Completion	3 Years After Project Completion
KCMC (New)	33kV/11kV 10MVA	N.A.	6,663,025	5,682,520	907,312
Makuyuni (New)	66kV/33kV 20MVA	N.A.	35,700,243	30,446,730	5,912,846
YMCA (Renewal)	33kV/11kV 17MVA	N.A.	51,669,880	44,066,344	7,860,227
Lawate (Renewal) (Note 3)	33kV/11kV 10MVA	N.A.	N.A.	N.A.	N.A.
Trade School (Reinforcement)	33kV Outgoing bay (Note 4)	N.A.	N.A.	28,412,629	4,536,566
Kiyungi (Reinforcement)	132kV/66kV 20MVA	N.A.	142,890,663	110,820,449	19,361,025

Source: TANESCO.
Note 1: The rated capacity is for the transformers installed by the project.
Note 2: The 2016 data is for 2 months from January to February.
Note 3: As no demand meter was installed in Lawate Substation, the actual figures are not available.
Note 4: Trade School Substation sends electricity only to KCMC Substation without voltage transformation.
Note 5: No baseline in 2010 and target in 2016 were set for this indicator.

(4) Maximum Output (Supplementary Indicator)

The maximum output of a substation is determined by the number of power consumers in the coverage area and their power demand, and therefore, varies from substation to substation. Judging from the actual data collected in 2014 and 2015, substations are generally equipped with the supply capacity to meet the maximum output in their respective coverage areas. While Makuyuni Substation (new) and YMCA Substation (renewal) saw increases in the number of power consumers as well as the peak output, their rated capacities are adequate to meet the additional power demand as a result of this project. The service coverage area of KCMC Substation (new) is expected to see more developments in the near future, and its power demand will likely to rise as well. Therefore, although KCMC Substation's maximum output in 2015 was only 1.74MVA as against its rated capacity of 10MVA, it is expected to grow in the future. At the same time, it should be noted that the maximum output of Kiyungi Substation (reinforcement) already exceeded its rated capacity of 20MVA after project completion, and further strengthening of its capacity is thus

necessary[9] (Table 7).

Table 7: Maximum Output (Supplementary Indicator)

Unit: MVA

Substation	Receiving/Sending Voltage Rated Capacity (Note 1)	Actual			
		2013	2014	2015	2016 (Note 2)
		Project Completion Year	1 Year After Project Completion	2 Years After Project Completion	3 Years After Project Completion
KCMC (New)	33kV/11kV 10MVA	N.A.	1.65	1.74	1.40
Makuyuni (New)	66kV/33kV 20MVA	N.A.	8.63	8.91	9.63
YMCA (Renewal)	33kV/11kV 17MVA	N.A.	8.97	8.60	10.24
Lawate (Renewal) (Note 3)	33kV/11kV 10MVA	N.A.	N.A.	NA	NA
Trade School (Reinforcement)	33kV Outgoing bay (Note 4)	N.A.	6.60	6.96	5.58
Kiyungi (Reinforcement)	132kV/66kV 20MVA	N.A.	25.02	21.46	20.69

Source: TANESCO.
Note 1: The rated capacity is for the transformers installed by the project.
Note 2: The 2016 data is for 2 months from January to February.
Note 3: As no demand meter was installed in Lawate Substation, the actual figures are not available.
Note 4: Trade School Substation sends electricity only to KCMC Substation without voltage transformation.
Note 5: No baseline in 2010 and target in 2016 were set for this indicator.

3.3.2 Qualitative Effects (Other effects)

(1) Stable Power Supply

This project is considered to have contributed to the stabilization of power supply in Kilimanjaro Region. In particular, it has been confirmed that the power outage hours have declined significantly and voltage has become much more stable at Rombo District, which receives power from the newly-constructed Makuyuni Substation. Similarly, Himo and Marangu Districts, both of which receive power from Makuyuni Substation, have also experienced improvements in power supply stability. Before the project, Rombo District used to receive electricity from Kiyungi Substation, through Boma-Mbuzi Substation. The transmission line used was a single-circuit line without a circuit breaker that can isolate faulty points, stretching over a long distance. As a result, power interruptions often occurred due to accidents and failures. After Makuyuni Substation was newly constructed and the 66kV transmission line was installed between Kiyungi and Makuyuni Substations under this project, however, power supply to Rombo, Himo and Marangu Districts became more stable.

[9] As mentioned in 3.2.1 Project Outputs, the expansion of Kiyungi Substation (receiving voltage/sending voltage: 132kV/66kV, rated capacity: 20MVA) and the installation of the 66kV transmission line were conducted with an aim to transmit power to the newly-built Makuyuni Substation. The rated capacity of the entire Kiyungi Substation by receiving voltage/sending voltage is: 35MVA (132kV/66kV) which includes additional 20 MVA expanded under the project, 20MVA (132kV/33kV) and 20 MVA (66kV/33kV).

In the beneficiary survey[10] (total effective samples of 100, comprising 79 general households and 21 business entities), 87% of beneficiaries responded that "stability of electricity voltage improved," 88% responded that "frequency of blackout decreased," and 93% responded that "frequency of electrical accidents/faults decreased" in comparison with the pre- and post-project implementation. Moreover, 74% of respondents expressed their satisfaction with electricity supply services (very satisfied: 7% and satisfied 67%) (Table 8).

Table 8: Beneficiary Survey Results (Project Effects)

Stability of Electricity Voltage

	Number of Respondents	%
Improved	87	87
Same	0	0
Worsened	13	13
Do not know	0	0
Total	100	100

Frequency of Blackout

	Number of Respondents	%
Decreased	88	88
Same	2	2
Increased	10	10
Do not know	0	0
Total	100	100

Frequency of Electrical Accidents/Faults (Note 1)

	Number of Respondents	%
Decreased	93	93
Same	0	0
Increased	4	4
Do not know	3	3
Total	100	100

Note 1: The electrical accidents/faults include power fire, power leakage, electrical shock, collapse of electric poles, and contact accident of trees to electric wires.

Satisfaction with Electricity Supply Services (Note 2)

	Number of Respondents	%
Very satisfied	7	7
Satisfied	67	67
Not really satisfied	26	26
Dissatisfied	0	0
Total	100	100

Note 2: The satisfaction with electricity supply services refers an overall satisfaction for electricity supply services based on perception of users on the status of electricity voltage, blackout, and electrical accidents/faults.

Source: The beneficiary survey results.

The key informant interviews[11] conducted with 12 power consumers (one bank, two manufactures, two hotels, two hospitals and five schools) also pointed out that the project brought about certain positive effects such as the improvement in voltage stability, decrease in power outage hours and decrease in frequency of accidents/faults (Details on the 12 power consumers interviewed are provided in Table 11). Before the project was implemented, consumers used to experience prolonged blackouts. In some areas, power supply completely stopped for days. Such conditions improved after the project was implemented. However, respondents' views on project effects differ according to the type and scale of their business.

[10] This beneficiary survey was conducted, using a non-random sampling method. Of six substations developed by the project, four substations (KCMC, Makuyuni, YMCA, Lawate) that distribute electricity directly to consumers were targeted. Taking into account such criteria as the population distribution, distinction between general households and business entities, and status of electricity supply infrastructure development, 11 survey sites were first selected and then samples were selected at each survey site. The number of samples at each of the 4 substations are: KCMC 28, Makuyuni 33, YMCA 20 and Lawate 19. Of 79 general household respondents, 40 were male and 39 were female. Of 21 business entity respondents, 14 were male and 7 were female. The sectors in which the business entities are engaged were: shops, restaurants, welding, wood processing and guesthouses.

[11] A key informant interview is an inquiry conducted with an important informant through a meeting.

For example, banks, hotels and schools tend to recognize well the effects of this project. On the other hand, manufacturers, who consume a large amount of electricity, can be more directly and seriously affected by the negative impacts of blackouts and unstable power supply on their productivity and production costs. Therefore, they also recognize that the stability of power supply improved to some degrees after the project, but consider that it is still inadequate as their level of demand for stable power supply is very high. In addition, hospitals, which utilize a number of electric medical appliances and regard stable power supply as essential for providing quality medical services, also pointed out that there remain further concerns despite certain improvements in power supply after the project.

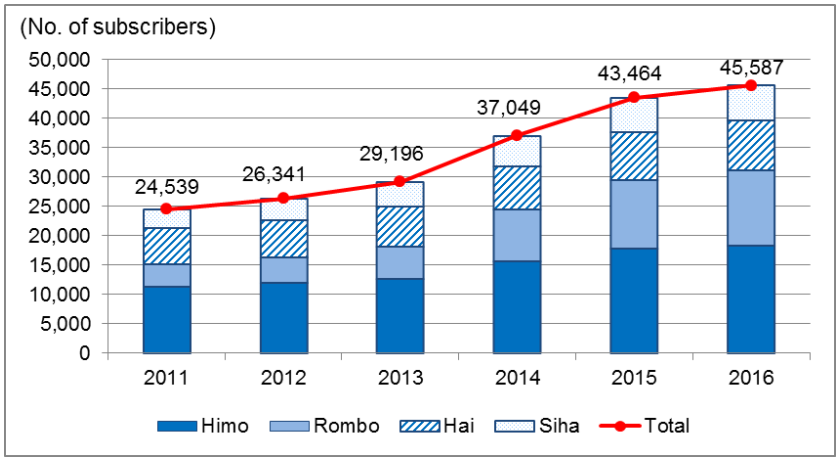
3.4 Impacts

3.4.1 Intended Impacts

(1) Increase in Number of Power Consumers (Number of Customers)

The number of power consumers (number of customers) that receive electricity directly from the substations developed by the project increased by approximately 1.8 times, from 24,539 consumers before the project in 2011 to 45,587 consumers after the project in 2016 (Figure 5). 21,048 consumers that were added during the five years were all new subscribers. Additionally, 1,379 customers are waiting to start the subscription as of March 2016.

During the four years between 2011 and 2015, power consumers in Kilimanjaro Region as a whole increased by 46,769, and the electrification rate has improved by 6.93% (Table 9). The number of consumers that receives electricity directly from substations developed by the project increased by 18,925 during the same period. This accounts for 40 percent of the increase in the entire Kilimanjaro Region. Therefore, this project is considered to have contributed to the increase in the number of power consumers in Kilimanjaro Region.



Source: TANESCO.
Note: The number of subscribers in 2016 is as of March 2016.

Figure 5: Number of Electricity Subscriber in the Target Area

Table 9: Number of Electricity Subscribers and Electrification Rate in Kilimanjaro Region

	2011	2012	2013	2014	2015
Number of Electricity Subscribers (Number)	83,938	87,448	92,654	115,923	130,707
Electrification Rate (%)	22.40	22.93	23.86	29.33	32.48

Source: TANESCO

(2) Improvement in Living Environment of Local Residents

The beneficiary survey shows that 77% of beneficiaries responded that the utilization of electric appliances increased after project implementation, 86% responded that the frequency of breakdowns of electric appliances decreased,[12] and 87% replied that they have more activities at night. Furthermore, 71% of business entities (21 respondents) replied that their business hours were extended and operational efficiency has improved after the project. Based on these responses, the project is deemed to have improved the living environment of local residents to some extent.

Table 10: Beneficiary Survey Results (Impacts)

Change in Utilization of Electric Appliances

	Number of Respondents	%
Increased	77	77
Same	9	9
Decreased	13	13
Do not know	1	1
Total	100	100

Change in Frequency of Breakdown of Electric Appliances

	Number of Respondents	%
Decreased	86	86
Same	2	2
Increased	6	6
Do not know	6	6
Total	100	100

Change in Activities after Dark

	Number of Respondents	%
More night activities	87	87
Same	12	12
Less night activities	0	0
Do not know	1	1
Total	100	100

Change in Business Hours and Operational Efficiency of Business

	Number of Respondents	%
Increased	15	71
Same	4	19
Decreased	2	10
Do not know	0	0
Total	21	100

Source: The beneficiary survey results.

(3) Impacts on Education, Medical and Local Industrial Sectors

The key informant interviews conducted with 12 electricity subscribers (one bank, two manufacturers, two hotels, two hospitals and five schools) confirmed following impacts of the project (Details on the power consumers interviewed are provided in Table 11).

[12] At the time when a power outage occurs or power supply is restored, electric currents and voltage become unstable. This can cause a breakdown of an electric appliance. Also, an electric appliance can be damaged by sudden fluctuations in power voltage during use.

Table 11: Electricity Subscribers Who Received Key Informant Interviews

Type of Business		Name of Organization/Institutions	District	Substation
Commercial Bank		NMB Bank Rombo Branch	Rombo	Makuyuni
Hotel		Lake Chala Hotel	Rombo	Makuyuni
		Nakala Hotel	Himo	Makuyuni
Manufacturing	Beverage	Bella View Fresh Fruits Processing Industry	Rombo	Makuyuni
	Tanning	Tanneriz	Himo	Makuyuni
Education	Nurses' college	Huruma Institute of Health and Allied Science (boarding school)	Rombo	Makuyuni
	Medical college	Kilimanjaro Christian Medical University (KCMU) College	Moshi	KCMC
	Primary school	St. Joseph Primary School (boarding school)	Rombo	Makuyuni
	Primary school	Kilingi Primary School	Siha	Lawate
	Secondary school	Magnificant Secondary School (boarding school)	Siha	Lawate
Medical	General hospital	Huruma Hospital	Rombo	Makuyuni
	General hospital	KCMC Hospital	Moshi	KCMC

Source: Key informant interview results.

a) Stable operations of schools and hospitals

<Schools>

Before the project, prolonged and frequent power outages hampered schools from using computers, copying machines and overhead projectors, causing difficulty in classes and operations. Especially, if an outage occurred unexpectedly during the examination period, the staff could not use office equipment and schools were often forced to cancel or postpone the planned examination. The interviewees from these schools stated that situations were improved after the project.

Three of the schools interviewed are boarding schools. Before the project, lightings were often unavailable and students were not able to study at night. There were also some concerns on the safety of students boarding at these schools. When a power outage lasted for a long time, perishable foods in the refrigerator sometimes spoiled and were wasted. The implementation of the project has eased such situations. More stable power supply, in particular, enabled students to study at night and helped them improve their academic achievements. The case of the Magnificent Secondary School is a good example. After lightings became available and students could study or take supplementary classes at night, their academic performance improved. For instance, the National Standardized Test score of the students admitted to the school in 2011 improved considerably over the years. In 2012, when they were in Grade 2, their scores were less than impressive. But after introducing nighttime study in 2013, their score started to improve and moved up to the 5th place nationally in 2015 when they were in Grade 5 (1st place in Kilimanjaro Region). The school staff believes that the improvement was made possible mainly due to the environment where students can study throughout the day.

At the Kilimanjaro Christian Medical University (KCMU) College, information and communication technology (ICT) is an integral part of their education methods and many

ICT machines and equipment, including several hundred computers, are used. The stable power supply is, therefore, fundamental to the learning on campus, and the college is equipped with a large-scale generator that can generate about 25% of its power needs, as well as uninterruptible power supply (UPS) devices and voltage regulators. The use of the equipment and machines involved a large sum of maintenance cost. According to the college staff, power generation costs as well as maintenance costs, including expenses to repair electric appliances and store spare parts, have decreased after power supply became more stable since 2013.

<Hospitals>

Both the KCMC Hospital and Huruma Hospital are general hospitals in their respective district. They utilize many delicate electric medical devices and examination instruments, and are equipped with in-house power generators for backup power supply. Nevertheless, before the project was implemented, frequent power outages and sudden fluctuations in voltage often restricted the services using medical devices and examination instruments. While critical and urgent facilities such as the intensive care unit (ICU) and operation rooms were given priorities in using power supplied by in-house generators during outages, regular consultations and examinations were negatively affected. For example, during a power outage, such operations as X-ray examinations, laboratory works, accounting operations and medical record management could not be continued and patients were asked to wait. Various additional expenses were also incurred. Examples include: repair costs of damaged medical devices, fuel costs for in-house power generators, and overtime salaries for staff whose works were interrupted by outages. Because the unstable power supply affects the efficiency of the medical services provided, patients' satisfaction with the services became lower..

Since 2013, power supply became more stable, and the frequency and duration of power outages decreased. These changes reduced breakdowns of medical devices and use of the in-house power generators, and thereby, served to lower maintenance costs to some extent. Interruptions of operations due to power outages also decreased and that contributed to the improved efficiency of medical services. Nevertheless, interviewees noted that some issues related to power supply persist and further improvements are necessary.

b) Improvements in productivity and service quality of local industries

<Manufacturing>

Manufacturing consumes a relatively large volume of power compared to other industries, and can incur direct and significant negative impacts from the unstable power supply. The two manufacturing companies interviewed, too, experienced situations where their production lines needed to be stopped due to frequent power outages and unstable voltage,

and their production equipment and machines were damaged. For instance, at the Bella View Fresh Fruits Processing Industry (a beverage maker), every time a frequent and unexpected blackout occurred, its production line had to be stopped, and the fruit juice in the production process needed to be discarded in some occasions. Also, stopping the production line requires certain steps to be followed in proper sequence, and forced shutdowns of the production line sometimes resulted in damages to the equipment and systems. Sudden blackouts not only have adverse influences on the productivity and production outputs of the factory, but also add substantial financial burdens in terms of fuel expenses for the in-house power generator and operation and maintenance costs of the damaged machines.

These two manufacturing companies mentioned that the power voltage stabilized and the incidence of outages decreased since 2013, and that these changes led to some improvements in productivity and lower operation and maintenance costs. On the other hand, problems related to power supply have not been solved completely, and there are some outstanding issues.

<Hotels>

The frequent power outages and unstable voltage before project implementation made it difficult for the two hotels interviewed to fully utilize electric appliances such as water pumps, refrigerators, lightings and hot water supply facilities. Consequently, the quality of their service was compromised, and there were many complaints from hotel guests. Also, the fuel costs of in-house power generators and operation and maintenance costs, such as repair expenses of broken electric appliances, also fell on the hotels.

Stabilized power supply since 2013 ameliorated the situation, and the quality of service at these hotels improved.

(4) Outstanding Issues Identified from the Key Informant Interviews and Beneficiary Survey

The key informant interviews and beneficiary survey shed light on the following common issues.

Information communication of planned power outage

To communicate information on the location and time of planned power outages to general power consumers (general users), TANESCO utilizes such media as televisions, radios, newspapers and its website. For large power consumes, TANESCO also contacts them directly in addition to the media-based announcements. However, many general power consumers feel that the current media-based communication is insufficient, and hope to see an improved communication method that is accurate and easily accessible. Also, it was found that some large power consumers were not contacted directly before the planned

outages. Therefore, the way in which information is communicated through direct contacts also needs to be reviewed.

Customer Service

Many large clients requested that TANESCO improve communications with its clients and strengthen customer services. Many interviewees expressed their hope that TANESCO provide more technical support to large clients, not to mention stable power supply. They are confident of TANESCO's technical capability as an electricity sector professional and think TANESCO can offer more specific technical support to its customers. For example, when a business is planning on an expansion of its facility, TANESCO may give advice on the specification and designs of electrical works. Another example is that TANESCO can provide technical services when a business is installing transformers at its site. Also, one interviewee pointed out that large power consumers sometimes take longer a time to settle electricity bills due to internal procedures, and TANESCO can be more flexible with the payment due date and offer consultations on payment methods.

3.4.2 Other Positive/Negative Impacts

(1) Impacts on the Natural Environment

Because the project dealt with the upgrading and new installation of substations and transmission/distribution facilities, some negative impacts on the environment, such as deforestation and land acquisition, were anticipated. Therefore, under the *"JICA Guidelines for Environmental and Social Considerations (2004),"* the project was rated as Category B. On the other hand, the project was not expected to have major impacts on air, water quality, noises, etc. as the project was to be implemented for new construction and upgrading of substations, transmission and distribution lines. The Environmental Impact Assessment (EIA) report of the project was approved by the Government of Tanzania in June 2011.

As for the environmental monitoring during project implementation, it was conducted by reviewing the environmental monitoring reports submitted by the consultant as well as by visiting the project sites regularly by TANESCO staff. No adverse impact of the project was confirmed at the time of ex-post evaluation. TANESCO staff also stated that no negative impact had been reported since project completion.

(2) Resettlement and Land Acquisition

This project was expected to require land acquisition of 11,398m^2 of farm land for the new construction of Makuyuni Substation, and 654,000m^2 of farm land for the way-leave under the 66kV transmission line and an access road. The area of land acquired for the project was as planned, and a series of procedures related to land acquisition, including negotiations and

payments of compensations, were properly taken in accordance with the Land Law in Tanzania. No resettlement of residents was necessary under the project. According to the implementing agency, it was reported that no complaints was received from the local people after land acquisition.

To summarize, the targets set for the operation and effect indicators "reduced time of power interruptions due to failures" and "voltage drop" were attained, but the achievement of "reduced time of restricted power supply" could not be verified against the actual data as the implementing agency did not measure and record this data. The beneficiary survey showed that more than 80% of residents think that "stability of electricity voltage improved," "frequency of blackout decreased," and "frequency of electrical accidents/faults decreased." 74% of respondents expressed that they were either very satisfied or satisfied with the current electricity supply services. Therefore, the stability of power supply in Kilimanjaro Region, an objective of this project, is seen to have been achieved. In addition, the project is also seen to have contributed to the increase in the number of power consumers, improvements in the living environment of local residents, stable operations of schools and hospitals, and improvement in the productivity and service quality of local industries to some extent.

In light of the above, the implementation of the project brought about most of the expected effects, and therefore the effectiveness and impact of the project are high.

3.5 Sustainability (Rating: ②)

3.5.1 Institutional Aspects of Operation and Maintenance

The operation and maintenance agency responsible for the facilities developed by the project is TANESCO. As of March 2016, TANESCO had 6,591 full-time staff (5,263 male staff and 1,328 female staff).

The responsibility for the operation and maintenance of transmission and distribution networks rests with respective zonal offices. TANESCO has seven zones, and Kilimanjaro Region belongs to the North Zone.[13] The responsibilities of the on-site operation and maintenance of project facilities rest with Regional Manager of Kilimanjaro Region Office in the North Zone. The operation and maintenance sections in charge of each project facility are listed in Table 12.

Makuyuni and Kiyungi Substations are manned substations where the staff is present for 24 hours a day. On the other hand, YMCA, KCMC, Lawate, and Trade School Substations are unmanned substations, and staff from either Kilimanjaro Region Office or Hai Office

[13] The North Zone includes Kilimanjaro, Arusha and Tanga Regions.

patrol these substations for daily maintenance. No problem has been observed in institutional setup and staffing of the operation and maintenance at Kilimanjaro Region. The organization chart of TANESCO is provided in Figure 6.

Table 12: O&M Sections in Charge of Project Facilities

Section	Facilities	Number of staff
Kilimanjaro Region Office	YMCA Substation, KCMC Substation, Trade School Substation (Unmanned substations) 66kV transmission lines, 33kV distribution lines	10
Hai Office	Lawate Substation (Unmanned substation)	4
Makuyuni Substation	Makuyuni Substation	4
Kiyungi Substation	Kiyungi Substation	8

Source: TANESCO

"The Electricity Supply Industry Reform Strategy and Roadmap," which was approved by the cabinet decision of the Government of Tanzania in 2014, states that TANESCO will first unbundle its generation business by 2017, and later unbundle its distribution business, which will be managed by several zonal distribution companies (current zonal offices of TANESCO) in the future. Following the Government's policy, TANESCO is currently undertaking organizational reforms, including decentralization of personnel and budgetary responsibilities from its head office to each zonal office. The operation and maintenance of project facilities, however, will continue to be handled by North Zone Office.

Therefore, no problem is observed in the institutional aspect of operation and maintenance.

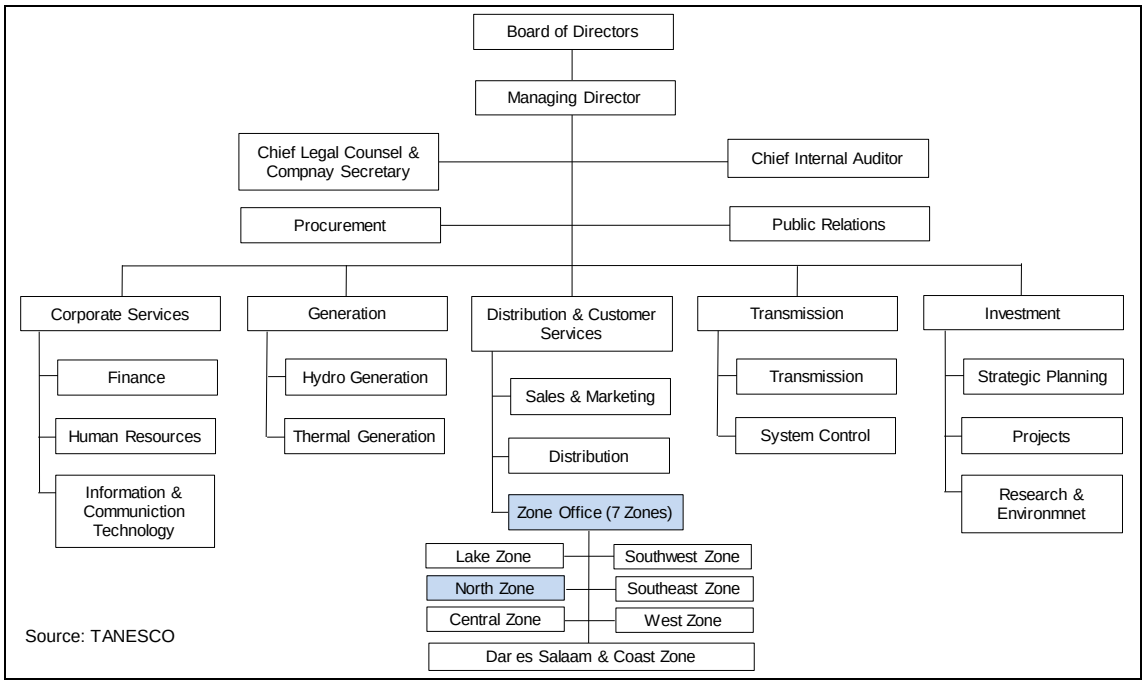


Figure 6: Organization Chart of TANESCO

3.5.2 Technical Aspects of Operation and Maintenance

From January 17, 2013 to February 5, 2013 of the project implementation period, the Japanese contractor responsible for procurement and installation provided an OJT[14] on how to operate and maintain the procured equipment and materials to eleven technical staff of TANESCO. Also, JICA provided a technical cooperation assistance "The Project for Capacity Development of Efficient Distribution and Transmission Systems (2009-2014)," with TANESCO's Technical Training School (TTS) as its counterpart. The technical cooperation project supported the improvement in TANESCO's staff training system through the development of TTS' training system for distribution and substation facilities and introduction of Quality Management (QM) activities[15] among others.

Training for TANESCO staff in TTS

Substation staff is monitoring the operation of facilities (Makuyuni Substation)

Building on the outcome of the above technical cooperation project, TTS implements training for TANESCO staff every year, and as many as 2,000 staff, both technical and non-technical, were trained in 2015. The training programs provided at TTS include training for: maintenance of distribution lines, operation of transmission systems (designed for substation staff), disaster management, new staff (general training on electrical technology) and safety.

In addition, TTS also sends its evaluation team to each region once a year to monitor if past TTS trainees have been utilizing the knowledge and skills obtained in its training courses on on-site operations. The findings of such monitoring and evaluations will not only be reflected in the future training programs to improve their quality, but also reviewed to improve TANESCO's operations and management. In addition, TANESCO currently has a total of twenty 5S Facilitators[16] assigned to each department. TANESCO also has the system of staff performance reviews by ranks, and evaluate staff performance regularly.

[14] OJT: On-the-Job Training.

[15] More specifically, the technical cooperation project provided support for: (1) development of a training system pertaining to distribution and substation facilities provided at TTS; (2) training of artisans, technicians and engineers working at substations and distribution facilities at TTS; (3) introduction of Quality Control (QC) activities at TANESCO; (4) establishment of model maintenance operations for distribution and substation facilities; and (5) development of standardized technical operation routines for operation and maintenance works at substations and distribution facilities.

[16] The role of the 5S Facilitators is to engage in dissemination and promotion of 5S activities at TANESCO's headquarters and its regional offices. 5S is a set of 5 principles aimed at improving the operational environment to achieve goals. It stands for Japanese words of "*seiri* (sort)," "*seiton* (set in order)," "*seiso* (shine)," "*seiketsu* (standardize)" and "*shitsuke* (sustain)."

At Kilimanjaro Region Office, all staff has taken some TTS training courses, including the 5S training, and its engineers sometimes give OJT to technicians and artisans. Kilimanjaro Region Office also houses several 5S Facilitators, who supervise and instruct other staff to better implement 5S principles. Regional Manager, Kilimanjaro Region Office mentioned that the introduction of 5S principles under JICA's technical cooperation project improved work environments and efficiency, while making staff better understand the safety and risks at the workplace. The operation and maintenance manuals were being utilized on-site as well.

The project facilities have not experienced any problems in operations and maintenance, and no problem is identified in terms of technical aspects of operation and maintenance.

3.5.3 Financial Aspects of Operation and Maintenance

At the time of ex-post evaluation, whereas financial reports of three years from FY2011 to FY2013 were available, the financial reports in FY2014 or later had not been approved by TANESCO's Board of Directors, and hence, could not be obtained.[17] Therefore, TANESCO's financial standing in FY2014 or later was not properly analyzed during ex-post evaluation.

TANESCO's income statements from FY2011 to FY2013 are summarized in Table 13. Due to political considerations, electricity tariffs are set lower which do not satisfy the cost recovery level in Tanzania. Hence, TANESCO faces a structural problem that its operating income falls short of its cost of sales. Although the Government of Tanzania has been providing some assistance in the forms of government subsidies and corporate tax refunds, TANESCO's ordinary income had constantly been negative from FY2011 to FY2013. Of particular concern is the increasing accumulated losses, which stood at 1,450,380 million TZS (approximately 68.7 billion yen[18]) at end of FY2013. There are two main reasons for the growing accumulated losses: (1) Because of a drought in 2011, power generated by hydroelectric power plants went into short supply. TANESCO purchased power from the private sector (independent power producers) as an emergency source of power, resulting in additional outlays. Also, TANESCO increased the power generation by thermal power plants to compensate for the shortage caused by declines in hydroelectric power generation. As a result, TANESCO's fuel expenses surged; and (2) Fluctuations in the foreign exchange market raised the costs of equipment and materials. Following the power shortage and the

[17] At the time of ex-post evaluation, FY2014 financial report (including financial statements) was already completed. However, the new government, which was inaugurated in December 2015, dissolved TANESCO's Board of Directors in January 2016, and at that stage, the FY2014 financial report had not been officially approved by the board. Although the new Board of Directors was appointed in June 2016, company's financial report has yet to be officially approved. In addition, the official financial year was changed from January-December to July-June in 2014. Therefore, FY2014 financial report covers 18 months from January 2014 to June 2015 exceptionally.

[18] 1 TZS=0.0474 yen (Source: Bank of Tanzania, Interbank Foreign Exchange Market Middle Rate, August 1, 2016).

need to develop emergency power sources after the drought in 2011, electricity tariffs were raised substantially. The new government inaugurated in December 2015, however, later implemented a minor reduction in tariffs from April 2016 (The rate of reduction was 1% or less). In any case, TANESCO's revenue continues to fall short of its cost to this date.

Table 13: Financial Status of TANESCO (2011-2013)

Unit: Million Tanzanian shilling

	2011	2012	2013
<Income Statement>			
①Revenue	545,658	820,436	933,525
②Cost of sales	△753,397	△1,162,437	△1,417,515
③Gross loss (①－②)	△207,739	△342,001	△483,990
④Other operating income (Government subsidy)	279,331 (171,134)	299,389 (185,903)	325,974 (225,301)
⑤Operating expense	106,277	130,956	228,637
⑥Operating loss (③＋④－⑤)	△34,685	△173,568	△386,653
⑦Interest income on bank deposit	3,423	1,419	4,335
⑧Financial cost	44,949	51,934	85,386
⑨Loss before tax (⑥＋⑦－⑧)	△76,211	△224,083	△467,704
⑩Tax credit	△32,784	△45,629	-
⑪Other comprehensive income after tax	78	1,055	-
⑫Total comprehensive loss/income of the year (⑨－⑩＋⑪)	△43,349	△177,399	△467,704
<Balance Sheet>			
Non-current asset	2,488,213	2,735,329	3,142,107
Current asset	425,134	583,511	631,755
Total assets	2,913,347	3,318,840	3,773,862
Capital and reserve (Accumulated losses)	1,195,708 (△804,222)	1,020,279 (△982,676)	750,571 (△1,450,380)
Non-current liabilities	1,042,671	1,090,594	2,101,848
Current liabilities	674,968	1,207,967	921,443
Total equity and liabilities	2,913,347	3,318,840	3,773,862

Source: TANESCO Financial Report 2012-2013.

According to TANESCO staff, the company's accumulated losses have decreased to 1,000,000 million TZS (about 4.7 billion yen) in FY2014 owing to the receipt of government subsidies, increased revenue associated with the growth in the number of electricity subscribers, and expiration of power purchase agreements signed with the private sector to supplement power shortfalls. In order to further improve its financial standing, TANESCO intends to promote: (1) further increase in the number of electricity subscribers, (2) increase in revenue through the introduction of a pre-paid bill collection system, (3) gas thermal power generation using relatively cheap domestic gas, (4) strengthening of power generation capacity (an increase by 142 MW), and (5) reduction in transmission/distribution losses and improved efficiency through new constructions or expansions of substations.

TANESCO's annual business plan, *"Corporate Business Plan 2015"* (formulated in December 2014), states that the company was estimated to have run the total comprehensive loss of 25,358 million TZS (approximately 1.2 billion yen) for FY2014, but was expecting the total comprehensive income of 25,215 million TZS (approximately 1.2 billion yen) for FY 2015. Table 14 provides the status of the country's power sector from 2011 to 2015. As can be seen, both Tanzania's total generated electricity energy and household electrification rate have been growing continuously, while transmission and distribution losses improved to 17.47% in 2015. At the same time, the electricity bill collection rate has been staying at high levels of around 97%. If the conditions of the power sector status continue to improve, TANESCO will more likely to turn profitable on a single-year basis.

Table 14: Power Section Status in Tanzania

	2011	2012	2013	2014	2015
1. Installed Generation Capacity (MW) (Note 1)	1,271	1,438	1,501	1,226	1,516
2. Total Generated Electricity Energy (GWh) (Note 1)	5,050	5,535	5,758	6,029	6,195
3. Peak Electricity Demand/Supply					
a) Peak Electricity Demand (MW)	920	937	945	957	1,083
b) Peak Electricity Supply (MW)	829	851	990	935	988
c) Peak Demand/Supply Gap (MW)	-91	-86	45	-22	-95
4. Electricity Loss					
a) Transmission Loss (%)	6.14	6.11	6.20	6.13	6.20
b) Distribution Loss (%)	14.9	13.96	13.14	12.62	11.27
c) T&D Loss (%)	21.04	20.07	19.34	18.75	17.47
5. Household Electrification Rate (%)	17.17	18.77	24.10	27.44	31.00
6. Electricity Bill Collection Rate in TANESCO (%)	94.49	95.16	98.59	97.34	96.57

Source: TANESCO
Note 1: Installed generation capacity and total generated electricity energy include the Independent Power Producers (IPPs) and Emergency Power Producers (EPPs).
Note 2: The reason for a temporary reduction in installed generation capacity in 2014 was that some EPPs were de-commissioned in 2014. But later in 2015, some new IPPs were commissioned in order to cope with increasing power demand.

Table 15 shows the operation and maintenance budget of both the entire TANESCO and project facilities. TANESCO allocates 80 million TZS (approximately 3.8 million yen) every year for operation and maintenance of project facilities (in order to cover the expenses for repairs of facilities and replacements of parts). However, there have been no major accidents or faults either at substations or transmission and distribution lines financed under the project, and no expense for the repair of facilities or replacement of parts has been incurred[19]. TANESCO staff mentioned that, should there be any need for repairs in the future, necessary budgetary measures will be taken.

[19] As mentioned in "3.5.4 Current Status of Operation and Maintenancespare", spare parts for the project facilities are stored at the workshop in Tanga. There has been no need to purchase additional spare parts so far.

Table 15: Operation and Maintenance Budget

Unit: 1,000 Tanzanian Shilling

	2013		2014		2015	
	Plan	**Actual**	**Plan**	**Actual**	**Plan**	**Actual**
Entire TANESCO	1,079,543	464,203	187,451	76,855	1,237,010	630,875
Project facilities	80,000	0	80,000	0	80,000	0

Source: TANESCO

Based on the above, TANESCO has been securing a certain level of maintenance budgets for project facilities every year. Furthermore, recent years have seen improvements in the financial standing of TANESCO as a whole, resulting from the increase in the number of electricity subscribers, decrease in transmission and distribution losses and improvement in the electricity bill collection rate. On the other hand, the accumulated losses at the end of FY2013 reached as high as 1,450,380 TZS million, and TANESCO ran single-year losses between FY2011 and FY2013. Because financial statements in FY2014 or later were not available, the financial analysis could not be made based on the data, and hence, the prospect of financial sustainability remains uncertain. Therefore, it is concluded that financial aspects of operation and maintenance face some challenges.

3.5.4 Current Status of Operation and Maintenance

At Kilimanjaro Region Office, the substations, and 66kV transmission lines and 33kV distribution lines are maintained through daily inspections, regular maintenance and preventive maintenance based on the predetermined schedule. In each of TANESCO's seven operation zones, a workshop is set up. The main office and workshop for the North Zone (North Zone Office), which includes Kilimanjaro Region, are located in Tanga Region's capital, Tanga. The spare parts for the project facilities are stored at this workshop and will be made available as needed. The project facilities have been well maintained since project completion, and no major accident or fault occurred before ex-post evaluation.

Therefore, no issue has been observed in the current status of operation and maintenance.

In sum, some problems have been observed in terms of financial aspect. Therefore sustainability of the project effect is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of this project is to ensure a stable power supply to local residents in Kilimanjaro Region in the northeastern part of Tanzania by installing and upgrading substations, transmission, and distribution equipment, and thereby contributing to vitalizing social and economic activities in Kilimanjaro Region.

The project was consistent with the development plans of the Government of Tanzania and development needs of Kilimanjaro Region, both at the time of project planning and ex-post evaluation. Also, the project was also consistent with Japan's ODA policy towards Tanzania at the time of project planning. Therefore, the relevance of the project is high. Although the project cost was within the plan, the project period exceeded the plan. Therefore, the efficiency is fair. As for the project effects, anticipated targets for the "reduced time of power interruptions due to failures" and "stable electricity voltage" have been attained. The results of the beneficiary survey also confirmed that improvements were made in such areas as "stability of electricity voltage," "reduction in the frequency of blackout" and "reduction in the frequency of electrical accidents/faults" after project implementation. As for the "reduction in restricted power supply time," however, there was no data available to show the results and its achievement could not be verified. Some positive impacts were noted in the increase in the number of power consumers (customers), improvement in the living environment of local residents, operational stability of schools and hospitals, and improvement in productivity and service quality of local industries. Therefore, the effectiveness and impacts of the project are high. The sustainability of project is fair since some problems were observed in the financial position of the implementing agency, although no problem was identified in its institutional and technical aspects of the operation and maintenance of the facilities developed by the project.

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

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

(1) Improvements in communication of information regarding planned power outage

To communicate information on planned power outages to general power consumers (general users), TANESCO utilizes such media as televisions, radios, newspapers and its website. For large power consumers and public facilities, TANESCO also contacts them directly in addition to the media-based announcements. However, results of the beneficiary survey indicate that many general power consumers feel that the current media-based communication is insufficient, and hope to see the improved communication method that is accurate, swift and easily accessible. Also, key informant interviews indicated that some large power consumers and public facilities were not contacted by TANESCO directly

before the planned outages.

Currently, TANESCO is developing a new system which transmits information to customers' mobile phones by using SMS/Text mails. The new service using this system is planned to start before the end of 2016. TANESCO is recommended to utilize this new service to communicate the information related to the planned power outages in an accurate and prompt way. Furthermore, TANESCO is also recommended to reconfirm the customer information and suitable contact method with its large power consumers and public facilities.

(2) Enhancement of Customer Services

Interviews with key informant have revealed that many customers hoped that TANESCO improve communications with its customers and strengthen customer services. Interviewees expressed their hope that TANESCO provides more technical services to customers, let alone a stable power supply. They are confident of TANESCO's technical capability as an electricity sector professional and hope that TANESCO can offer more specific technical support to its customers. For example, when a business is planning on an expansion of its facility, TANESCO may give advice on the specification and design of electrical works. Another example is that TANESCO can offer technical service when a business is installing transformers at its site. TANESCO may also offer its customers consultations on payment methods. The zonal offices of TANESCO hold regular meetings (stakeholder meetings) with large power consumers and public facilities. It is recommended that TANESCO take advantage of such opportunities to increase communications with its customers, better understand their needs and requests, and improve the quality of its operations and services.

4.2.2 Recommendation to JICA

None.

4.3 Lessons Learned

Setting of operation and effect indictors measurable for the implementing agency

At the time of project planning, "restricted power supply time," was selected as one of the operation and effect indicators. The ex-post evaluation, however, could not verify the degree of achievement of this indicator as the implementing agency did not measure and record the data for this indicator on a regular basis. When setting the operation and effect indicators in the similar projects in the future, it is important to identify the operation and effect indicators that the implementing agency can measure and collect their actual data on a regular basis.

More effective and efficient coordination with technical cooperation projects

In parallel with this project, JICA implemented technical cooperation "The Project for Capacity Development of Efficient Distribution and Transmission Systems" (2009-2016). The technical cooperation project supported such activities as the development of a training system at TTS for distribution and substation facilities and introduction of Quality Management (QM) activities. The assistance has contributed to improving the staff training system of TANESCO, as well as strengthening the technical levels of the staff at its Kilimanjaro Region Office, who is in charge of operation and maintenance of the project facilities. For instance, Kilimanjaro Region Office has several staff, who took the training to be a 5S Facilitator. These staff, in turn, supervise and train other staff at the office to improve the quality of operation and services. In addition to the project, JICA also has implemented or is implementing a number of projects focusing on the development of transmission and distribution sectors, with TANESCO as the implementing agency. Such projects include: the grant aids for "The Project for Reinforcement of Transmission and Distribution Facilities in Oyster Bay Substation (Phase II)" (2009-2011) and "The Project for Power Distribution in Dar es Salaam" (2014-2018), as well as ODA loans for "Iringa-Shinyanga Backbone Transmission Investment Project" (2010-present) and "Kenya-Tanzania Power Interconnection Project" (2016-present). Technical cooperation projects aimed at strengthening the staff training systems of the implementing agency is considered to be playing an important role in improving the sustainability of Japan's related development projects provided to the transmission and distribution subsectors in Tanzania.

Therefore, in the case of an ODA loan or grant aid projects aimed at improving infrastructure and providing equipment, if there is any concern related to the operation and maintenance capabilities of the implementing agency, providing additional technical cooperation to strengthen these capabilities including human resource developments is expected to enhance the effectiveness and sustainability of the main project.