Ex-Post Project Evaluation 2015: Package IV-7 (Tanzania)

January 2017

JAPAN INTERNATIONAL COOPERATION AGENCY

OPMAC Corporation

EV
JR
16-50

Disclaimer

This report compiles the result of the ex-post evaluations. These are conducted by external evaluators to ensure objectivity, and the views and recommendations herein do not necessarily reflect the official views and opinions of JICA. JICA is not responsible for the accuracy of English translation, and the Japanese version shall prevail in the event of any inconsistency with the English version.

Minor amendments may be made when the contents of this report is posted on JICA's website.

Comments by JICA and/or the Borrower (including the Executing Agency) may be added at the end of the evaluation report when the views held by them differ from those of the external evaluator.

United Republic of Tanzania

FY2015 Ex-Post Evaluation of Japanese Grant Aid Project

"The Project for Reinforcement of Power Distribution in Zanzibar Island"

External Evaluator: Sawa Hasegawa, OPMAC Corporation

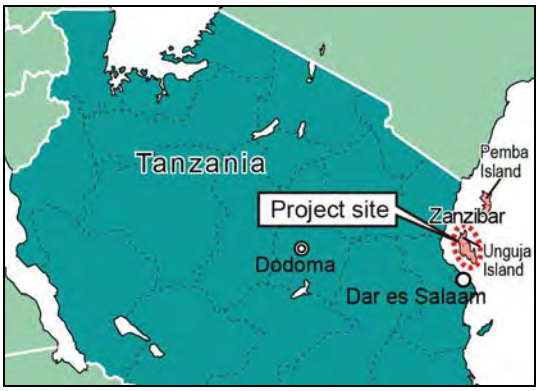
0. Summary

The objective of this project is to provide more stable power supply to local residents on Unguja Island in Zanzibar by expanding an existing substation, installing new substations, and newly installing and replacing distribution lines on the island. With the achievement of this objective, the project aimed to contribute to enhancing economic and social activities in Zanzibar.

This project was consistent with the development plan and development needs of Zanzibar, both at the time of planning and ex-post evaluations, as well as Japan's ODA policy at the time of planning. Therefore, the project relevance is high. As for the project effects, it was confirmed by local residents that the project brought about some positive effects such as decreases in frequency and length of blackout as well as improvements in stability of electricity voltage, achieved by the increased capacity of electricity supply facilities and reductions in voltage drops, power outages caused by accidents and power losses. Through these positive effects, it is considered that power supply on Unguja Island has become more stable. In addition, economic activities in Zanzibar increased after the project completion, while the living environment of local residents improved. The project was found to have contributed to these improvements, and thus, its effectiveness and impacts are high. The efficiency of the project is also high since both the project cost and project period were as planned, and project outputs were produced in accordance with the plan. The sustainability of project effects is fair since some problems were observed in the financial soundness of the implementing agency, although no problem has been identified in the operation and maintenance of the installed or replaced substations and distribution lines after the project completion as well as in the institutional and technical aspects of the implementing agency.

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

1. Project Description



Project location

The main transformer of Welezo Substation (33/11kV) newly installed by the project

1.1 Background

Zanzibar is located to the east of mainland Tanzania, off the east coast of Africa on the Indian Ocean. Zanzibar consists of two main islands, Unguja and Pemba, as well as a number of small islands surrounding them. Although Zanzibar is a part of the United Republic of Tanzania, it is governed by the highly autonomous Revolutionary Government of Zanzibar (hereinafter called the Government of Zanzibar). With its rich tourism resources such as Stone Town on Unguja Island, which is registered as a World Heritage site, and a number of marine resorts, Zanzibar is a popular tourist destination among foreigners and tourism is one of its main industries.

Zanzibar lacks its own power generation facilities[1], and electricity is supplied from mainland Tanzania by the 132kV undersea cable[2]. The electricity supplied through the 132kV undersea cable is transmitted to Mtoni Substation, located near Zanzibar City, the city center of Unguja Island, and was stepped down to 33kV and 11kV in voltage, before distributed to the entire island. However, the 132kV transformation unit and 33kV distribution lines that were used to supply electricity to these facilities have never been replaced since their installations in the 1970-80s, and therefore, have deteriorated considerably. Moreover, at the time of project planning, the peak power demand in Zanzibar had reached approximately 40MW as against the undersea cable's maximum transmission capacity of about 45MW, and with existing substations already overloading, power outages and voltage drops occurred frequently.

Under these circumstances, the Government of Zanzibar requested the international

[1] On the island of Unguja, electric power supply is supplemented by the use of diesel power generators. On the island of Pemba, supply is supplemented by the power provided from mainland Tanzania through a 33kV undersea cable and that generated on the island using diesel fuels.

[2] In mainland Tanzania, Tanzania Electric Supply Company Ltd. (hereinafter called TANESCO) oversees the generation, transmission and distribution of electricity. TANESCO's source of power generation has a relatively high rate of hydroelectric generation and the total electricity supply in the whole Tanzania including Zanzibar was approximately 1,000MW in 2015. Because hydroelectric generation uses water resources, load shedding is implemented in the mainland during dry seasons.

community for cooperation, which resulted in a project to improve the 132kV transmission line between mainland Tanzania and Unguja Island starting in 2010, financed by the Millennium Challenge Corporation (hereinafter called MCC)[3] of the USA. The understanding at that time was that the project's implementing agency, Millennium Challenge Account Tanzania Project (hereinafter called MCA-T), was to improve the 132kV transmission facility and the 132/33kV transformation unit in the existing Mtoni Substation, and the Zanzibar Electricity Corporation (hereinafter called ZECO) was to take responsibility for improving the 33kV distribution lines.

ZECO was capable of handling the operation and maintenance of the existing transmission/distribution facilities. However, improving Unguja's transmission/distribution lines required ZECO to install additional distribution lines consistent with power demand, replace a transformation unit and expand cables in order to enhance distribution capacity. These requirements were beyond what ZECO could meet with their technical capacity and budget situations at that time. As a result, the Government of Zanzibar requested the Japanese government to assist in the above-mentioned constructions, leading to the project under this evaluation.

1.2 Project Outline

The objective of this project is to provide more stable power supply to local residents on Unguja Island in Zanzibar by expanding an existing substation, installing new substations, and newly installing and replacing distribution lines on the island, thereby contributing to enhancing economic and social activities in Zanzibar.

<Grant Aid Project>

E/N Grant Limit or G/A Grant Amount / Actual Grant Amount	3,000 million yen / 3,000 million yen
Exchange of Notes Date (/Grant Agreement Date)	March 2011
Implementing Agency	Zanzibar Electricity Corporation (ZECO)
Project Completion Date	March 2013
Main Contractors	Takaoka Engineering Co., Ltd. Mitsubishi Corporation
Main Consultant	Yachiyo Engineering Co., Ltd.

[3] MCC was established in 2003, separate from the United States Agency for International Development (USAID), to administer the Millennium Challenge Account, a special account of the USA. MCC's policy is to prioritize development assistance to countries that have shown strong commitments to good governance, investments in their citizens and economic freedom.

Basic Design	March 2011
Detailed Design	June 2011
Related Projects	Technical Cooperation - Project for Capacity Development of Efficient Distribution and Transmission Systems (2009 – 2016) - Project for Formulation of Power System Master Plan in Dar es Salaam and Review of the Power System Master Plan (2012) (2014 – 2016) (Technical Cooperation for Development Planning) Other International Agencies and Donors MCA-T Project, Millennium Challenge Corporation - Zanzibar Second Interconnector (2010 – 2013)[4]

2. Outline of the Evaluation Study

2.1 External Evaluator

Sawa Hasegawa, 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: April 3, 2016 – April 16, 2016, and June 23, 2016 – July 1, 2016

2.3 Constraints during the Evaluation Study

As mentioned in "1.1 Background" above, the MCA-T project aimed to improve the undersea cable and transmission line between mainland Tanzania and Unguja Island, while this project aimed to enhance the power receiving facilities on Unguja Island. Therefore, these two projects are complementary. In measuring effects, quantitative effects of this project were captured by operation and effect indicators, but qualitative effects and impacts of this project and the MCA-T project were intertwined and difficult to separate. Therefore, although no special explanation is given in the later sections, qualitative effects and impacts confirmed by this evaluation study were achieved jointly by this project and the MCA-T project.

[4] The project which laid a 132kV submarine cable from the mainland to Zanzibar as well as construction of transmission lines.

3. Results of the Evaluation (Overall Rating: A[5])

3.1 Relevance (Rating: ③[6])

3.1.1 Relevance to the Development Plan of Zanzibar

The Government of Zanzibar, in its development and poverty reduction plan, "the Mpango wa Kukuza Uchumi na kuondoa Umasikini Zanzibar" (known as MKUZA) (formulated in 2007), stated that the electricity sector is an important sector that serves as the foundation for the improvement of all public infrastructures. The following "MKUZA II" (2010 – 2015) highlighted the need to secure adequate electricity in order to enable active public investments/ development in such areas as airports, port facilities, roads, the environment and water resources. Moreover, "the Zanzibar Energy Policy" (formulated in 2009) mentions the needs to actively promote the use of renewable energy that has less negative impacts on the environment and to stabilize electric power supply.

At the time of ex-post evaluation, MKUZA II's next 5-year plan (2016 – 2020) was still in the process of finalization. However, it is understood that the next plan, as was the case of MKUZA II, will continue to pursue the policy of securing sufficient electricity in order to enable public investments and development. Zanzibar's sector policy, the Zanzibar Energy Policy, was still in effect at the time of ex-post evaluation.

Therefore, it is concluded that the project was consistent with the development plan and energy policy of Zanzibar, both at the time of project planning and ex-post evaluation.

3.1.2 Relevance to the Development Needs of Zanzibar

As mentioned in "1.1 Background," increasingly unreliable electric power supply, due to the deterioration of transmission and distribution facilities and frequent blackouts and voltage drops caused by overloading, was a problem in Zanzibar. Based on the view that an independent business entity which can provide stable and efficient electricity power supply was indispensable for the development of the tourism industry, a driving force of country's economic growth, the Government of Zanzibar established ZECO in 2006 as part of the electricity sector reform. With assistance from Norway, Sweden, etc., ZECO has been striving to improve financial management and replace existing facilities. However, for the reinforcement of distribution facilities, which is central to the improvement of transmission/distribution networks, ZECO was required, but was unable, to adequately fund the investments from its limited budgets.

As seen in Table 1 and Figure 1 below, both Zanzibar's population and foreign tourists visiting Zanzibar have been increasing year by year, driving up the demand for electricity (see Figure 2). On the other hand, as mentioned in "1.1 Background," the transmission

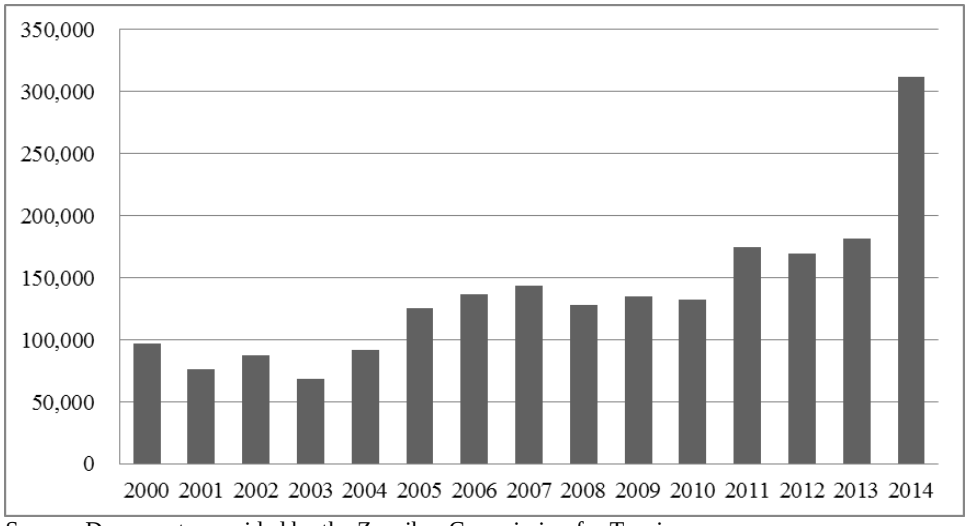
[5] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[6] ③: High, ②: Fair, ①: Low

capacity of the undersea cable at the time of project planning was approximately 45MW, and electricity demand was not fully met due to the limited supply capacity. In particular, damages in power receiving ends resulted in prolonged blackouts in 2008 and 2009 (a blackout lasted as long as 3 months in 2009). In addition, water shortage at the hydroelectric power plant dam in mainland Tanzania has caused a serious power shortage in 2011. Zanzibar, which largely depends on electric power supply from the mainland, experienced frequent power restrictions and outages. Under such circumstances, increasing and stabilizing electric power supply was an urgent task in Zanzibar.

Table 1: Population Trend in Zanzibar (Year 1988, 2002 and 2012)

	1988	**2002**	**2012**
Total population	640,685	984,625	1,303,569
Number of households	-	-	250,212

Source: National Bureau of Statistics "Population and Housing Census 1988, 2002 and 2012"
(The number of households is not available for 1988 and 2002)

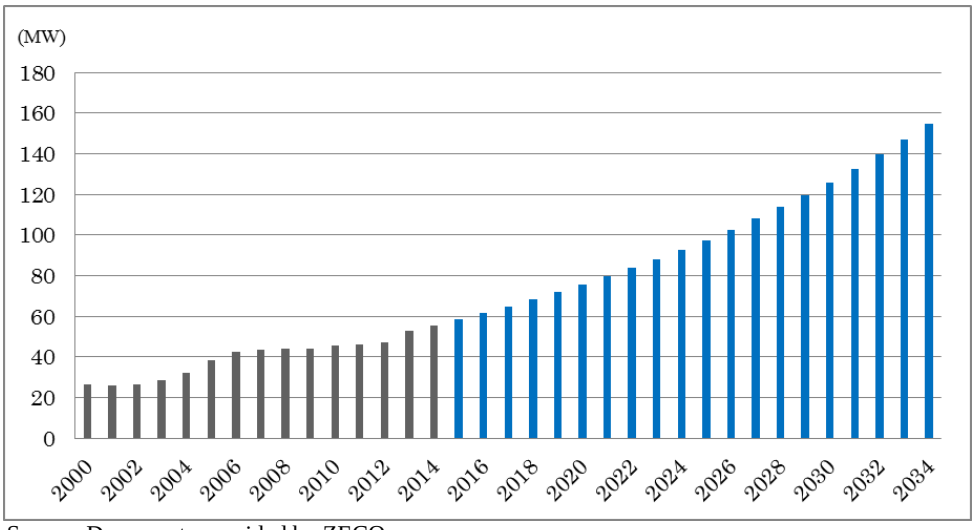


Source: Documents provided by the Zanzibar Commission for Tourism

Figure 1: International Tourists Arrivals in Zanzibar (Year 2000 – 2014)

After the completion of both this and MCA-T projects, the capacity of electricity supply facilities in Zanzibar increased markedly from 45MW to 100MW. At the time of ex-post evaluation (2016), electricity demand was approximately 60MW, well within the current facility's supply capacity. However, electricity demand has been increasing annually, and according to ZECO's estimate, demand will likely exceed 100MW in or around 2025 (Figure 2). Hence, the need to improve power supply capacity in Zanzibar remains strong at the time of ex-post evaluation. If the power demand exceeds supply again in the future, it will likely be necessary to increase power supply by using diesel generators as in the past. ZECO, however, envisages to enhance the share of renewable energy in power supply in

consideration of the high costs of diesel fuels, and was conducting a feasibility study, with assistance from EU, for the introduction of solar and wind power generations at the time of ex-post evaluation.



Source: Documents provided by ZECO

Figure 2: Power Supply in Zanzibar
(Year 2000 – 2034, predicted figures of power demand from Year 2015)

Based on the above, the project was consistent with the development needs of Zanzibar both at the time of project planning and ex-post evaluation.

3.1.3 Relevance to Japan's ODA Policy

The "Country Assistance Program for Tanzania" (June 2008) regards infrastructure development (transport and traffic such as roads, energy, 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 the country's energy sector, by replacing and newly installing equipment and materials at the substations and distribution facilities. Therefore, the project was also consistent with Japan's ODA policy towards Tanzania at the time of project planning.

In light of the above, this project has been highly relevant to Zanzibar's development plan and development needs, as well as Japan's ODA policy. Therefore, its relevance is high.

3.2 Efficiency (Rating: ③)

3.2.1 Project Outputs

The planned outputs of the project were the i) construction of 33kV facilities for Mtoni Substation, 33/11kV Mwanyanya Substation and 33/11kV Welezo Substation, ii)

procurement and installation of equipment and materials for these three substations, and iii) procurement and installation of equipment and materials for three distribution lines of the North route, South route and Fumba route (all are 33kV distribution lines). All outputs were produced as planned. The summary of produced outputs of the project is provided in Table 2.

Table 2: Summary of Produced Outputs

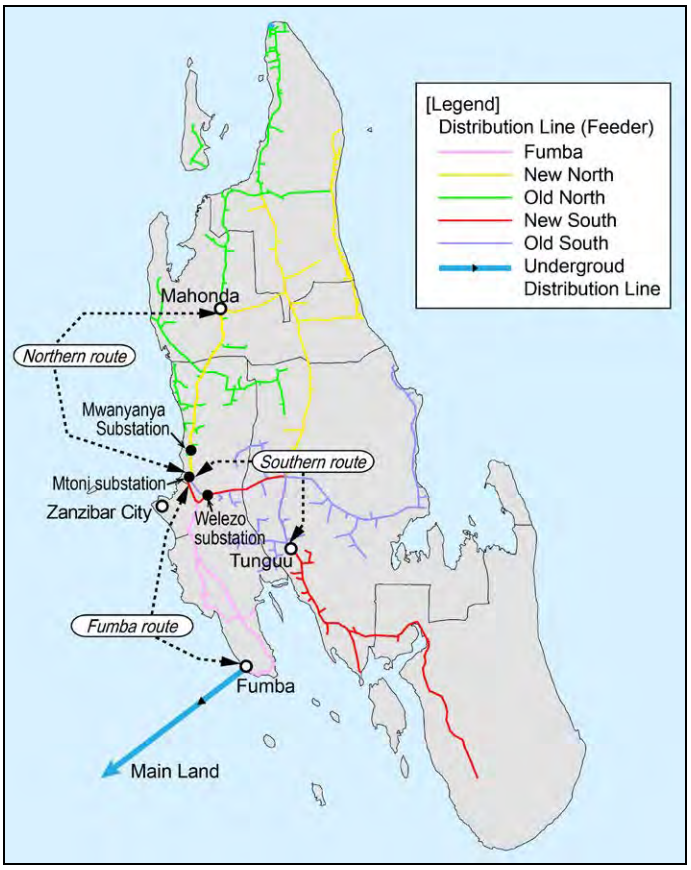
Procurement and installation of equipment and materials
1) Expansion of 33kV facilities for Mtoni Substation (Site area: 546 square meters) 2) Installation of 33/11kV Mwanyanya Substation (Site area: 840 square meters) 3) Installation of 33/11kV Welezo Substation (Site area: 840 square meters) 4) Installation of 33kV distribution lines for the North route (20.3 km between Mtoni Substation and Mahonda) 5) Installation of 33kV distribution lines for the South route (22.0 km between Mtoni Substation and Tunguu) 6) Replacement of 33kV distribution lines for the Fumba route (38.5 km between Mtoni Substation and Fumba)
Procurement of equipment and materials
1) Equipment and materials for distribution lines 2) Test devices and maintenance tools 3) Replacement parts 4) Emergency backup supply 5) Consumable goods

Source: Preparatory Survey Report, internal documents provided by JICA

Mtoni Substation expanded by the project (33kV) (adjacent to the 132/33kV Substation that was constructed by the MCA-T Project)

Terminal pole of Mtoni Substation (for the South route distribution line)

Figure 3 shows the distribution feeders on Unguja Island, including the substations and distribution lines constructed under the project.



Source: Modified from the figure provided by ZECO

Figure 3: Distribution Feeders on Unguja Island with Substations and Distribution lines constructed under the Project

3.2.2 Project Inputs

3.2.2.1 Project Cost

The planned project cost to be borne by the Japanese side was 3,000 million yen and the cost to be borne by the Tanzanian side was 26 million yen[7]. The actual project cost borne by the Japanese side was 3,000 million yen as planned. As for the cost to be borne by the Tanzanian side, the exact amount of actual cost was not available because a separate record of expenditures for the project was not made. According to ZECO, however, the actual cost was roughly as planned. In addition, the amount borne by the Tanzanian side was small compared to that of the Japanese side. Given the circumstances, the evaluation on the project cost was made only with the comparison between planned and actual project costs borne by the Japanese side. Therefore, the project cost was also as planned (100%).

[7] The compensation cost for land acquisition and resettlement is not included. The planned and actual compensation costs are described in "3.4 Impact."

3.2.2.2 Project Period

The planned project period was 24 months from April 2011 to March 2013, including the basic design and bid tender, and the actual period was also 24 months from March 29, 2011 to March 8, 2013. Thus, the project period was as planned (100%).

Both the project cost and project period were as planned. Therefore, efficiency of the project is high.

3.3 Effectiveness[8] (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, capacity of power supply facility, voltage drops on the consumer side, length of power outages caused by accidents, and power losses were selected at the time of project formulation. Furthermore, for the purpose of ex-post evaluation, additional indicators, including the frequency of power outages, length of supply restrictions and distribution loss rate, were examined in order to better understand the situations related to power outages caused by accidents and power losses. The results are provided in Table 3 below.

Table 3: Results of Indicators on Project's Quantitative Effects

Indicators	Baseline	Target	Actual		
	2010	2016	2013	2014	2015
	Baseline Year	3 Years After Completion	Completion Year	1 Year After Completion	2 Years After Completion
<Operation and Effect Indicators>[Note 1]					
Capacity of power supply facility (MW)[Note 2]	40	78	100	100	100
Voltage drop on consumer side (%)	10-20	Less than 10	±6	±6	±6
Power outage caused by accidents (hours per month)	10	1	0	0	0
Power losses (MW)[Note 3]	7	Less than 5	Approx. 5	Approx. 5	Approx. 5
<Additional Indicators>[Note 4]					
Frequency of power outage (times per year)	-	N.A.	-	625	431
Supply restriction (hours per day)	3.5	N.A.	0	0	0
Distribution loss rate (%)	30	N.A.	-	23.9	-

Source: Internal documents provided by JICA, Documents provided by ZECO

Note 1: The actual figures of the 4 operation and effect indicators between 2013 and 2015 are the same because ZECO does not collect relevant data annually and its staff responded that the figures remained roughly the same during 2013-2015.

Note 2: While the actual baseline data on capacity of power supply facility was 45MW, it was set as 40MW since ZECO had restricted power supply to 40MW after the major breakdown of the undersea cable. In addition, the actual capacity of power supply facility exceeded the target because the MCA-T project incorporated increases in the transmission capacity in light of the continuing rise in power demand expected in the future.

Note 3: ZECO did not provide accurate records on the power losses. However, the staff stated that power losses decreased after the project implementation to approximately 5MW.

Note 4: '-' indicates that the data is not available. The targets for additional indicators were not set originally. The data on additional indicators cover the entire Unguja Island.

[8] Sub-rating for Effectiveness is also provided in consideration of Impact.

As seen in Table 3, the capacity of power supply facilities have increased to 100MW as against the project target of 78MW, while the actual power supply in 2015 was approximately 60MW (Figure 2). The three distribution lines installed or replaced under this project have not encountered any power outage after project completion (0 hour), and voltage drop on the consumer sides of the three distribution lines has decreased to around 6% on average as against the target of less than 10%. The power losses also decreased after the project completion. Although the figures of additional indicators account for the entire Unguja Island, the distribution loss rate also decreased compared to before the project, and no power restriction has been conducted since the completion of the project. Thus, the project is considered to have contributed to the stabilization of power supply on Unguja Island.

3.3.2 Qualitative Effects (Other effects)

As a qualitative effect of this project, it was expected that the consumer confidence in electricity services will improve as power supply on Unguja Island becomes more stable after the project. In order to evaluate the achievement of this effect, a beneficiary survey was conducted among power users as part of ex-post evaluation[9].

The characteristics of the respondents under this survey is provided in Tables 4 to 9.

Table 4: Number of General Households Surveyed by Distribution Feeders

Distribution feeder	Region	No. of responses
North route	Kinyasini Kipandoni Upenja	14
South route	Makunduchi Bwejuu Jambiani	28
Fumba route	Fumba Nyamanzi Bweleo Kombeni Urban Centre	38

Source: Beneficiary survey (effective number of responses: 80)

[9] This survey was conducted by asking power users who receive electricity through the North, South or Fumba route distribution feeders, some questions regarding the changes in stability and reliability of electric power supply before and after the project. The structured interviews were conducted individually with power users. The number of total valid samples were 100, comprising 80 general households, 10 public facilities (school, hospital, public offices, etc.), and 10 commercial facilities (hotel, factory, retail shops, etc.). The sample general households were selected among those serviced by the three distribution feeders, with the number of samples for each route determined according to the user population. The interviewers visited the area and conducted interviews to the allocated number of people (The gender was not considered in the selection of respondents, and as a result, the ratio of male and female respondents was 6:4). Public and commercial facilities were selected by i) ensuring that the surveyed entity has been operating on the same premise since before the project; and ii) excluding small enterprises whose electricity consumption was similar to that of general households.

Table 5: Summary of General Households Surveyed

Category	Distribution	No. of responses	%
Age	20 – 29	8	10.0
	30 – 39	17	21.3
	40 – 49	24	30.0
	50 – 59	20	25.0
	60 and above	11	13.8
Sex	Male	50	62.5
	Female	30	37.5
Ownership of house	Own	71	88.8
	Rent	2	2.5
	Others	7	8.8
Number of members living together	2 – 4	17	21.3
	5 – 7	49	61.3
	8 – 10	12	15.0
	11 and above	2	2.5
Length of residence (years)	4 – 8	7	8.8
	9 – 13	14	17.5
	14 – 18	12	15.0
	19 – 23	20	25.0
	24 and above	27	33.8
Length of connection to electricity (years)	4 – 8	26	32.5
	9 – 13	23	28.8
	14 – 18	22	27.5
	19 and above	9	11.3
Average monthly electricity bill (TZS)[10]	9,999 and below	3	3.8
	10,000 – 19,999	19	23.8
	20,000 – 29,999	18	22.5
	30,000 – 39,999	16	20.0
	40,000 – 49,999	12	15.0
	50,000 and above	12	15.0

Source: Beneficiary survey (effective number of responses: 80)

Table 6: Public Facilities Surveyed

Type of facilities (Number of respondents)	Respondents	Distribution feeder
Hospital (1)	Alrahma Hospital	Fumba route
School (3)	Lumumba High School Zanzibar Commercial School Mahad Istiqama	Fumba route Fumba route South route
University/Institute (2)	SUMAIT University Zanzibar Institute of Tourist Development	Fumba route Fumba route
Government office (4)	Zanzibar Water Authority Zanzibar Social Security Fund Zanzibar Airport Authority Zanzibar Revenue Board	Fumba route Fumba route Fumba route Fumba route

Source: Beneficiary survey (effective number of responses: 10)

[10] 1 Tanzanian Shilling (TZS) = Approximately 0.05 yen (Exchange rate as of July 2016)

Table 7: Commercial Facilities Surveyed

Type of facilities (Number of respondents)	Respondents	Distribution feeder
Factory (3)	Zainab Bottlers Drop of Zanzibar Dunga Block factory	Fumba route North route North route
Hotel (4)	Fumba Beach Lodge Melia The Zanzibar Residence Serena inn	Fumba route South route South route Fumba route
Retail shop (2)	Abdul-razak shop Rashid shop	Fumba route Fumba route
Radio station (1)	Coconut FM Radio	Fumba route

Source: Beneficiary survey (effective number of responses: 10)

Table 8: Summary of Public Facilities

Category	Distribution	No. of responses
Length of residence (years)	4 – 8	4
	9 – 13	1
	14 – 18	2
	19 and above	3
Average monthly electricity bill (TZS)	Below 5 million	4
	5 million – 14.99 million	3
	15 million – 24.99 million	1
	25 million and above	2
Private generator	Owned	9
	Not owned	1

Source: Beneficiary survey
(effective number of responses: 10)

Table 9: Summary of Commercial Facilities

Category	Distribution	No. of responses
Length of residence (years)	4 – 8	3
	9 – 13	5
	14 – 18	0
	19 and above	2
Number of employees	Below 50	4
	50 – 99	2
	100 – 149	1
	150 – 199	2
	200 and above	1
Average monthly electricity bill (TZS)	Below 5 million	3
	5 million – 14.99 million	2
	15 million – 24.99 million	2
	25 million and above	3
Private generator	Owned	8
	Not owned	2

Source: Beneficiary survey
(effective number of responses: 10)

The results of the beneficiary survey are shown in Table 10.

Table 10: Results of Beneficiary Survey on Project's Qualitative Effects

Q1: Awareness of the project

Knew	Did not know
47	53

Q2: Current stability of electricity voltage

Very stable	Stable	Unstable	Very bad	Do not know
28	64	7	0	1

Q3: Change in stability of electricity voltage before and after the project

Improved	Same	Worsened	Do not know
83	16	1	0

Q4: Current average frequency of blackout (times per month)

1 – 2	3 – 4	5 – 6	7 and above
33	47	10	10

Q5: Change in frequency of blackout before and after the project

Decreased	Same	Increased	Do not know
92	6	2	0

Q6: Current average length of blackout (minutes)

5 – 24	25 – 44	45 – 64	65 and above
30	22	20	28

Q7: Change in length of blackout before and after the project

Decreased	Same	Increased	Do not know
91	7	0	2

Q8: Incident of electrical accidents/faults

Yes	No
27	73

Q9: Change in frequency of electrical accidents/faults before and after the project

Decreased	Same	Increased	Do not know
67	24	2	7

Q10: Type of electrical accidents/faults if answered 'Yes' in Q8

Electrical leak	Short circuit	Flashover	Others
2	8	11	6

Q11: View on current electricity tariff

Too expensive	Expensive	Reasonable	Cheap	Do not know
38	35	22	0	5

Q12: Satisfaction level of ZECO's services

Very satisfied	Satisfied	Not really satisfied	Dissatisfied	Do not know
22	56	19	1	2

Source: Beneficiary survey (effective number of responses: 100)
Note: Possible reasons for the few responses of 'Worsened' or 'Increased' to the questions on change in stability of electricity voltage (Q3), frequency of blackout (Q5) and frequency of electrical accidents/faults (Q9) are that the respondents were receiving electricity through old distribution lines with some defects, or that there are some problems in the leading wires from the distribution lines to their buildings.

As seen in Table 10, according to the results of the beneficiary survey collected from the total of 100 power users, including general households, public facilities and commercial facilities, more than 80% of beneficiaries responded that electricity voltage has stabilized (Q3), more than 90% responded that both the frequency and the duration of blackouts have decreased (Q5 and Q7), and approximately 70% responded that electrical accidents and faults have decreased (Q9).

When asked about ZECO's electricity tariffs, more than 70% of beneficiaries responded "expensive" or "too expensive" (Q11). Such responses may be because beneficiaries are now consuming more electricity with improved power supply, and as a result, their electricity bills have increased. It should also be noted that, in Zanzibar, water tariffs are not only very low (4,000 TZS or about 200 Japanese Yen monthly, regardless of the consumption volume)

but also often uncollected. Therefore, many beneficiaries feel electricity bills that are collected based on the consumption data managed by meters are high. When asked about ZECO's services, nearly 80% of the beneficiaries responded "very satisfied" or "satisfied" (Q12), indicating high satisfaction levels. The remaining 20% of beneficiaries who responded "Not really satisfied" or "dissatisfied" list such reasons as high electricity tariffs, delays in repairs of broken meters, inconveniences related to the concentration of payment centers in the Zanzibar city center, and slow responses to troubles.

Overall, the beneficiary survey confirmed the positive qualitative effects related to the stability and reliability of power supply, as seen in significant reductions in the frequency and duration of power outages, and improvements in voltage stability, among others.

3.4 Impacts

3.4.1 Intended Impacts

The project aimed to contribute to enhancing economic and social activities in Zanzibar by providing more stable power supply to local residents on Unguja Island. To confirm the impacts that were brought about by the project, such aspects as revitalization of the local economy in Zanzibar, improvement in living environment of local residents, stable operation of public facilities and improvement in productivity of commercial facilities were reviewed, mainly using the feedback from the beneficiary survey.

(1) Impact on local economy in Zanzibar

According to the feedback given by the Ministry of Lands, Housing, Water and Energy of Zanzibar and ZECO to the questionnaire and interview, there have been a number of new large investment projects and development plans in Zanzibar in recent years, showing the signs of increased economic activities. Examples include the construction of a new airport terminal (expected to be operative towards the end of 2016), a major hotel development by foreign capital, a large-scale factory manufacturing dairy products and drinks, and a new urban development accompanied by a shopping mall in the Fumba district located in the southwest of Zanzibar. Improved electric power supply and the availability of more stable and reliable electricity made possible by the project are considered to have promoted investments and served to enhance economic activities in Zanzibar.

(2) Improvement in living standards and environment

When conducting the beneficiary survey (100 valid responses) to evaluate project's qualitative effects as discussed above, impacts of this project were also examined.

The findings related to changes in living environment of general households are provided in Table 11 below.

Table 11: Project Impacts on General Households

Q1: Change in utilization of electric appliances before and after the project

Increased	Same	Decreased	Do not know
26	46	7	1

Q2: Change in frequency of breakdowns of electric appliances before and after the project

Decreased	Same	Increased	Do not know
34	34	0	12

Q3: Change in time spent on housework before and after the project

Decreased	Same	Increased	Do not know
22	45	7	6

Q4: Change in activities at night before and after the project

Increased	Same	Decreased	Do not know
19	32	27	2

Source: Beneficiary survey (effective number of responses: 80, of which 50 males and 30 females)

As shown in Table 11, when asked about the impact of the project, approximately 30% of beneficiaries responded that the utilization of electric appliances has increased (Q1), and about 40% responded that the frequency of breakdowns of electric appliances has decreased (Q2). Although most beneficiaries responded that there was no change in the length of time spent on housework or night-time activities, nearly 30% of beneficiaries mentioned that, by starting to use laundry machines and electric cooking appliances, the time spent on housework has decreased (Q3 and Q4).

As an example of the way in which the stability of power supply has contributed to their life, some respondents mentioned that using more electric appliances for a longer period of time has improved the quality of life, and watching television has made them pay more attention to the events and news in the society.

(3) Stable operation of public facilities

The changes related to the operation of public facilities are summarized in Table 12.

Table 12: Project Impacts on Public Facilities

Q1: Change in utilization of electric appliances before and after the project

Increased	Same	Decreased	Do not know
5	4	1	0

Q2: Change in frequency of breakdowns of electric appliances before and after the project

Decreased	Same	Increased	Do not know
7	1	2	0

Q3: Change in use of generator before and after the project (effective number of responses: 9)

Decreased	Same
8	1

Q4: Change in operation capacity and service quality etc. before and after the project

Improved	Same	Worsened	Do not know
9	1	0	0

Source: Beneficiary survey (effective number of responses: 10)

As shown in Table 12, project's impacts on public facilities include increased utilization of electric appliances, lower incidence of breakdowns of electric appliances and reduced use of in-house power generators. Also, 9 out of 10 beneficiaries responded that the operation

rate of their facility and the quality of services, such as education and medical services, have improved after the project (Q4).

Examples of benefits brought about by stable electricity include improvements in computer use and student learning at schools as well as better utilization of medical appliances due to fewer breakdowns at a hospital. Among public institutions, the Zanzibar Water Authority responded that their water supply services improved due to the higher operation rate of water pumps as well as reductions in fuel costs as a result of less frequent use of in-house power generators.

(4) Improvement in productivity of commercial facilities

The changes in production outputs and sales among commercial facilities are summarized as follows.

Table 13: Project Impacts on Commercial Facilities

Q1: Change in business hours before and after the project

Increased	Same	Decreased	Do not know
4	4	2	0

Q2: Change in sales before and after the project

Increased	Same	Decreased	Do not know
5	5	0	0

Q3: Change in use of generator before and after the project (effective number of responses: 8)

Decreased	Same
6	2

Q4: Change in production outputs, productivity, service quality, etc. before and after the project

Improved	Same	Worsened	Do not know
7	1	0	2

Source: Beneficiary survey (effective number of responses: 10)

As shown in Table 13, about half of the beneficiaries responded that their business hours and sales have increased (Q1 and Q2), and 7 out of 10 beneficiaries responded that production outputs, productivity and service quality have improved (Q4).

The examples of benefits brought about by stable power supply include improved quality of merchandise, such as fresh produce and frozen food items, at retail stores, constructions of new factories, and reduction in fuel expenses due to less frequent use of in-house power generators.

3.4.2 Other Positive/Negative Impacts

(1) Benefits to the residents living in the project area and its adjacent areas

In addition to the impacts confirmed in the above-mentioned beneficiary survey, a few more examples were confirmed during the interviews with the relevant parties.

The evaluator interviewed the Children Officer and the Women Officer of the Department of Women and Children at the Ministry of Empowerment, Social Welfare, Youth, Women and Children on benefits for women derived from more stable power supply by the project.

During the interview, it was mentioned that because of the stable power voltage and fewer blackouts, more households are now able to use electric appliances such as laundry machines, and consequently, hours spent by women on housework have reduced. Some women have made use of the spare time to start their own small businesses, such as making fruit juice and cakes for sale.

Moreover, some women who were already engaged in businesses, such as horticulture or raising chickens, have also started using electric appliances, including refrigerators and warmers, and increased production of these cash crops and income.

(2) Land Acquisition and Resettlement

The implementation of the project resulted in land acquisition and resettlement in the project areas. During the basic design study of the project, the installation of new substations and additional distribution lines were expected to require the involuntary resettlement in the scope of 138 houses 74 households and 509 people, and also affect the farmland of 707 households. It was planned that the compensations for the buildings and farmland to be affected by the resettlement be provided based on the Resident Resettlement Plan, formulated upon consultations with the affected people, and in accordance with the relevant laws and regulations as well as land system in Zanzibar.

As a result of the project implementation, 164 households were eventually resettled and the farmland of 913 households was affected. ZECO implemented the relocation in accordance with the Resident Resettlement Plan, and made compensations to all affected people accordingly. The entire cost of compensation was borne by the Government of Zanzibar. For the expected amount of compensation 2,372,508,125TZS (approximately 144.25 million Japanese Yen), the Government of Zanzibar allocated 2,431,928,625TZS, and the actual compensation paid by ZECO, in 11 installments to the affected people from December 2011 to July 2013, was 2,415,770,168TZS in total.

During the interviews held with four affected residents for the purpose of ex-post evaluation, some interviewees have voiced dissatisfaction with the amount of compensation despite the fact that compensations were properly paid following the Resident Resettlement Plan. Also, according to these four residents as well as local leaders in the affected areas, most of the affected residents have resettled in the areas close to their original residence, means of livelihood and fluctuations in income remained unchanged, and means of livelihood were secured after the relocation.

In light of the above, land acquisition and resettlement caused by the project were appropriately handled by ZECO in accordance with the related laws and land systems of the Government of Zanzibar as well as the Resident Resettlement Plan. The compensations for all the affected residents were also paid based on the assessed values. Therefore, it is

concluded that the process of land acquisition and resettlement under the project were properly handled.

(3) Impacts on the Natural Environment

At the time of basic design study, the environmental impact assessment was conducted to understand the project's impacts on the environment, but neither adverse impacts on the environment nor pollutions were anticipated. Nevertheless, some measures were proposed in the environment management plan to relieve the impacts of noises and wastes anticipated during the course of project implementation. These measures were duly taken and no adverse impact on the environment was observed during project implementation or ex-post evaluation.

On the other hand, due to the decreased incidence of power outages, operation hours of diesel power generators were reduced, driving down the use of diesel fuels and the amount of exhaust gas emitted. Hence, the project made some contributions to reducing negative burdens on the environment. It should be noted that, when the power supply through the undersea cable ceased for 3 months and Zanzibar faced prolonged blackouts, the Government of Zanzibar installed emergency power generators throughout Unguja Island, leading to rapid increases in the consumption of diesel fuels used for power generation.

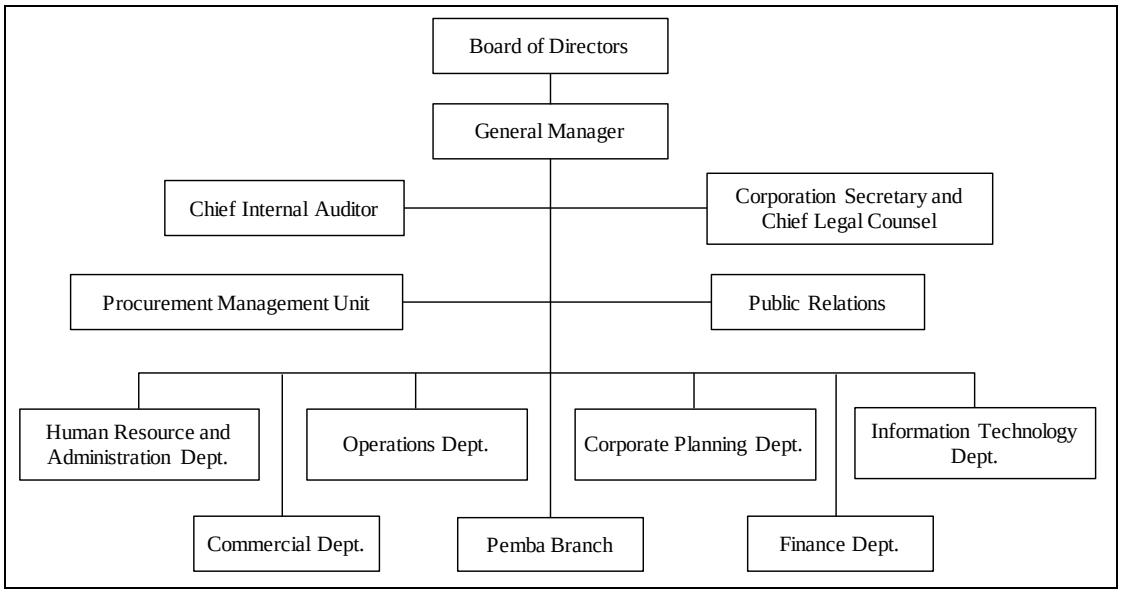
To summarize, more stable power supply achieved under this project has made such impacts as enhanced economic activities in Zanzibar, improved living environment of the residents, higher operation rates and better quality of services given by public facilities, improvements in production outputs, productivity and quality of services by commercial facilities, and more active participation by women in social and economic activities. Thus, it is concluded that the project has made contribution to stimulating economic and social activities in Zanzibar.

This project has mostly achieved its objectives. Therefore, effectiveness and impact of the project are high.

3.5 Sustainability (Rating: ②)

3.5.1 Institutional Aspects of Operation and Maintenance

The implementing agency responsible for the operation and maintenance of the facilities financed under the project is ZECO. ZECO underwent an organizational reform in July 2015, and the current structure is given in Figure 4. ZECO has 722 staff in total (as of July 2015), and is constituted by 7 departments, each with clearly-defined responsibilities.



Source: Documents provided by ZECO

Figure 4: Organization Chart of ZECO

Within ZECO, the Operations Department is responsible for the operation of the substations and the maintenance of the distribution lines financed by the project. The Operations Department which houses a total of 202 staff (as of April 2016) consists of three units, namely the 'Power Generation Unit' that oversees power generation, 'System Control, Plant, Transmission Unit' that oversees power transmission, and 'Power Distribution Section' that oversees power distribution. The staff in the Operations Department are ranked according to their qualification levels: Engineers (principal engineers, college graduates, there were 14 Engineers as of April 2016), Technicians (engineers, with a certificate or diploma, 21 Technicians) and Artisans (workers, no qualification, 162 Artisans). According to the result of a questionnaire and an interview given to the Operations Manager, the current number of staff and department structure are adequate for the operation and maintenance of subsections and distribution lines.

Regarding the operational system of the expanded or newly installed Mtoni Substation, Mwanyanya Substation and Welezo Substation, it was mentioned that 4 operators station in rotation for 24 hour-monitoring at each substation. In order to have some margins in the rotation system, the department intends to increase two more operators for each substation in the future. However, due to budgetary constraints, it will be difficult to hire new staff, and the plan is to transfer existing staff from the Commercial Department.

As for the maintenance of distribution lines, 9 teams (7 staff per team) attend to the regular inspections and such work as cutting tree branches off the distribution lines. The North route, South route, and Fumba route have approximately 30, 30, and 20 staff, respectively.

Based on the above, no problem was observed related to the operation of substations and the maintenance of distribution lines, and ZECO's organization structure, operation and maintenance structure, and staffing arrangements are in order.

3.5.2 Technical Aspects of Operation and Maintenance

From October 2012 to February 2013 of the project implementation period, project members (main contractors) conducted an on-the job training (hereinafter called OJT) for 11 staff of ZECO's Operations Department (1 project coordinator, 3 substation staff, and 7 distribution line staff), on how to operate and maintain the procured equipment and materials. According to the feedback from Operations Manager, the staff who participated in the OJT continues to be engaged in the same tasks in the Department and no technical problem has occurred in the regular operation and maintenance of the substations and distribution lines. The manuals that were provided during the procurement of equipment and materials were utilized where appropriate.

On the other hand, operators stationing at each substation are mainly in charge of managing records and data (taken every 30 minutes by hand). When there is a problem in an area controlled by a substation, operators will contact a technical staff so that the latter can go to the substation and deal with the problem. Although the three substations that were constructed under the project have yet to encounter problems, troubles have occurred at older substations. It has been pointed out that troubles can be tackled more swiftly if the operators themselves can deal with some problems.

Recording by an operator at Welezo Substation

Recorded data

In Tanzania, JICA implemented a technical cooperation project "The Project for Capacity Development of Efficient Distribution and Transmission Systems" (August 2009 – March 2016), to support the TANESCO Training School (hereinafter referred to TTS)[11], and 73 ZECO staff (all Artisans) have so far participated in their training courses such as the "operation and maintenance of distribution lines." Because the training at the TTS allows participants to learn practical skills on how to conduct regular inspections and trouble-shooting, and it is the only such training opportunity available for ZECO staff, the satisfaction level among ZECO participants is high, and the knowledge obtained has been put to use in the actual operations. According to Operations Manager, wrong approaches to maintenance work have been corrected as a result of the training. ZECO hopes to have more staff attend the training – not only Artisans, but also the newly-graduated Engineers, relatively inexperienced Technicians and staff outside of the Operations Department. However, the number of staff which ZECO can afford to send to TTS training is limited as TTS collects fees and ZECO's budget is tight.

In sum, while no particular technical problem has been observed in terms of ZECO's regular operation and maintenance, ZECO wishes to further improve skills of its staff.

3.5.3 Financial Aspects of Operation and Maintenance

ZECO is a financially independent company. Its income and expenditure accounts since its establishment in fiscal year 2006/07 (a fiscal year in Tanzania starts in July and ends in June of the following year) till fiscal year 2013/14 are summarized in Table 14, while the number of its customers since fiscal year 2010/11 is provided in Table 15.

Table 14: Income and Expenditure of ZECO

Unit: TZS

	FY2006/07	**FY2007/08**	**FY2008/09**	**FY2009/10**
Operating income	18,001,362,000	17,127,869,019	25,108,092,151	35,619,530,000
Non-operating income	20,880,209,000	21,089,935,798	1,948,692,063	2,233,426,000
Income in total	**38,881,571,000**	**38,217,804,817**	**27,056,784,214**	**37,852,956,000**
Cost of electricity	6,256,471,000	24,137,957,710	29,371,109,167	22,081,722,000
Other expenses	5,169,587,000	5,869,475,547	7,481,151,268	12,511,855,158
(Of which maintenance)				1,466,362,500
Expenditure in total	**11,426,058,000**	**30,007,433,257**	**36,852,260,435**	**34,593,577,158**
Balance	**27,455,513,000**	**8,210,371,560**	**-9,795,476,221**	**3,259,378,842**

[11] TTS was established as an internal training institution for TANESCO's technical staff. JICA has assisted in the 1) development of training curriculum, syllabus and teaching materials for electrical engineers, technical staff and engineers, 2) installation of a training facility and equipment as well as procurement of training tools and expendables, 3) execution of training of trainers, and 4) development of a training certification system.

	FY2010/11	FY2011/12	FY2012/13	FY2013/14
Operating income	28,321,080,807	32,483,344,167	46,571,577,193	56,968,070,013
Non-operating income	2,127,554,864	2,492,806,440	3,604,178,799	3,980,112,809
Income in total	**30,448,635,671**	**34,976,150,607**	**50,175,755,992**	**60,948,182,822**
Cost of electricity	28,939,500,717	31,315,005,686	34,210,751,044	41,875,542,460
Other expenses	15,597,332,502	16,875,666,819	18,217,899,280	20,418,048,180
(Of which maintenance)	637,103,906	453,045,952	352,007,009	316,636,940
Expenditure in total	**44,536,833,219**	**48,190,672,505**	**52,428,650,324**	**62,293,590,640**
Balance	**-14,088,197,548**	**-13,214,521,898**	**-2,252,894,332**	**-1,345,407,818**

Source: Financial Reports of ZECO (FY2010/11, FY2011/12, FY2012/13, FY2013/14), Preparatory Survey Report
Note 1: The breakdown of specific expense items such as the maintenance and repair expense has been added from the Financial Report for FY2009/10.
Note 2: The Financial Reports for FY2014/15 and FY2015/16 have not been officially approved.
Note 3: Other expenses include carry-forward of a previous year's operating loss.

Table 15: Number of Customers of ZECO

Unit: Customer

FY2010/11	FY2011/12	FY2012/13	FY2013/14	FY2014/15	FY2015/16
105,294	111,261	118,208	127,553	140,577	145,330

Source: Documents provided by ZECO

According to ZECO's Finance Manager, negative balances in the income and expenditure accounts of fiscal years 2008/09, 2010/11 and 2011/12 depend to a large extent on the significant shortages of power supply due to the damages of undersea cable in 2008 and 2009 as well as the water shortage in mainland Tanzania in 2011 as mentioned in "3.1.2 Relevance to the Development Needs of Zanzibar," which necessitated the continuous use of diesel power generators on Unguja Island, resulting in substantial fuel costs. Although both customer numbers and operating income have been increasing since then, costs of electricity (e.g. cost of power purchase from TANESCO on mainland Tanzania, cost of diesel fuels used to supply power on Pemba Island, etc.) have also increased, resulting in operating losses on a single-year basis. According to Finance Manager, although the financial reports for fiscal years 2014/15 and 2015/16 have not been officially approved, operating losses have been on the decrease since fiscal year 2010/11, and the financial conditions of ZECO are improving.

The electricity tariff of ZECO was revised in November 2013, and the current tariff structure is provided in Table 16 below. Finance Manager mentioned that ZECO itself has been considering further tariff increases in order to improve its financial standing. However, tariff increases will require the approval from the Government of Zanzibar, and cannot be decided solely by ZECO. At the same time, there is no budgetary supplement from the Government of Zanzibar to compensate for the operating losses, and the only government subsidy available is dedicated to the electrification projects in the countryside, accounting only a small portion of ZECO's income.

Table 16: Electricity Tariff of ZECO (since November 2013)

Unit: TZS

	Type of tariff	Utility rates for units (kWh)	Unit price	Service charge per month	Price per kVA demand
1	Lifeline	1 to 50 units	66	2,100	-
		Consumption in excess of 50 units	240		
2	General service	1 to 1,500 units	222	2,100	-
		Consumption in excess of 1,500 units	240		
3	Small industries	1 to 5,000 units	172	16,500	15,000
		Consumption in excess of 5,000 units	213		
4	Large industries	1 to 10,000 units	169	240,000	15,000
		Consumption in excess of 10,000 units	141		
5	Street light	1 unit to infinity	222	240,000	15,000

Source: Documents provided by ZECO

Aside from tariff increases, ZECO has been promoting tariff collections through the prepaid method since around 2000, so as to decrease non-payments of electricity charges by power users, and thereby, improve its financial conditions. ZECO's Commercial Manager mentioned that approximately 70% of the power users are currently using the pre-paid method. Accordingly, the incidence of non-payments is on the decrease, but ZECO aims to further improve the collection rate of electricity charges in the future.

It is also noted that maintenance-related expenditure has been decreasing annually. According to Operations Manager, while the necessary maintenance and operation cost is secured, the installation of substations and the use of durable ABC cables and insulation cables for distribution lines under this project as well as the MCA-T project contributed to the decrease in the incidence of troubles and breakdowns, and therefore, reduced repair expenses and led to the decrease in the whole maintenance expenses of ZECO.

As seen above, although ZECO's financial situations are improving, the company has been running operating losses for the past 5 years. In the future, there will also be a need to secure funds for maintenance and repair expenditures, which will likely increase as the facilities, equipment and materials become degraded and deteriorated with age.

3.5.4 Current Status of Operation and Maintenance

Based on the feedback given by ZECO's Operations Manager on the questionnaire and interview, Mtoni Substation, Mwanyanya Substation and Welezo Substation that were newly installed or expanded under the project have been operating without troubles and no repair work has been necessary. In addition, distribution lines that were additionally installed or replaced under the project (North Route, South Route and Fumba Route) have been regularly inspected, and no power outage has been caused by accidents. No problem has been observed on all concerned substations and distribution lines with visual checks during ex-post evaluation. In addition, Operations Manager mentioned that they still have spare parts procured during project implementation in stock and no problem is expected to locally

procure spare parts of all the equipment in the future.

In sum, no problem was observed in the current status of operation and maintenance since the substations and the distribution lines have been operating normally and maintenance and inspection work has been conducted regularly.

In light of the above, and considering the problems observed in the financial aspect of ZECO, the sustainability of the project effects is evaluated to be fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of this project is to provide more stable power supply to local residents on Unguja Island in Zanzibar by expanding an existing substation, installing new substations, and newly installing and replacing distribution lines on the island. With the achievement of this objective, the project aimed to contribute to enhancing economic and social activities in Zanzibar.

This project was consistent with the development plan and development needs of Zanzibar, both at the time of planning and ex-post evaluations, as well as Japan's ODA policy at the time of planning. Therefore, the project relevance is high. As for the project effects, it was confirmed by local residents that the project brought about some positive effects such as decreases in frequency and length of blackout as well as improvements in stability of electricity voltage, achieved by the increased capacity of electricity supply facilities and reductions in voltage drops, power outages caused by accidents and power losses. Through these positive effects, it is considered that power supply on Unguja Island has become more stable. In addition, economic activities in Zanzibar increased after the project completion, while the living environment of local residents improved. The project was found to have contributed to these improvements, and thus, its effectiveness and impacts are high. The efficiency of the project is also high since both the project cost and project period were as planned, and project outputs were produced in accordance with the plan. The sustainability of project effects is fair since some problems were observed in the financial soundness of ZECO, although no problem has been identified in the operation and maintenance of the installed or replaced substations and distribution lines after the project completion as well as in the institutional and technical aspects of ZECO.

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

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

As mentioned in "3.5.2 Technical Aspects of Operation and Maintenance," ZECO has sent its staff, mainly its Artisan, to the TTS training courses in mainland Tanzania. They are of

the opinion that the training was highly useful and wish to send more staff - not only Artisans, but also those Technicians who lack field experience and newly-graduated Engineers. While the number and skill levels of ZECO staff who handles the regular maintenance works, including the operation of substations and inspection of distribution lines, are adequate, experienced engineers are too busy with daily operations to take time to train the newly-graduated young technicians and inexperienced staff. ZECO wishes to have these technicians and workers take part in the TTS training, thereby allowing them to acquire necessary skills and knowledge. However, due to budgetary constraints, the number of staff that ZECO can afford to send to the fee-based TTS training courses each year is limited.

ZECO has sent a total of 73 Artisans to the TTS training to date. In order to strengthen the ability of ZECO staff more efficiently, ZECO may consider selecting some past TTS trainees and training them to be lecturers (or trainers), who can provide in-house training to the newly-recruited staff in the future. Although it will be difficult for ZECO to introduce a comprehensive facility like TTS, it is proposed that ZECO start introducing training which can be provided without large equipment, train staff – especially past TTS trainees – to become lecturers (or trainers), thereby gradually increasing the number of in-house training offerings.

4.2.2 Recommendations to JICA

Under its technical cooperation project "The Project for Capacity Development of Efficient Distribution and Transmission Systems," JICA provided TANESCO with technical assistance related to the implementation of training at TTS. JICA is also planning to continue similar assistance to TANESCO under the phase 2 of the above technical cooperation expected to commence this year.

In order to support ZECO establish its in-house training program as mentioned above, it is recommended that considerations be given to include ZECO staff in such opportunities as the training of trainers and/or counterpart training under the phase 2. Such opportunities will provide ZECO with the similar expertise provided to TANESCO in developing training curriculum, syllabus and teaching materials as well as training of lecturers and establishment of a certification system. Such assistance is expected to further strengthen the linkage and synergy between this project in Zanzibar and the above-mentioned technical cooperation in mainland Tanzania.

4.3 Lessons Learned

None

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

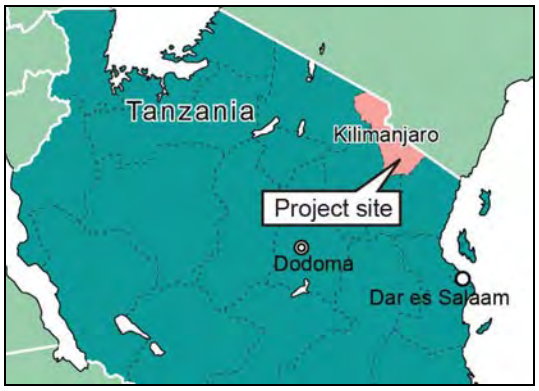
0. Summary

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.

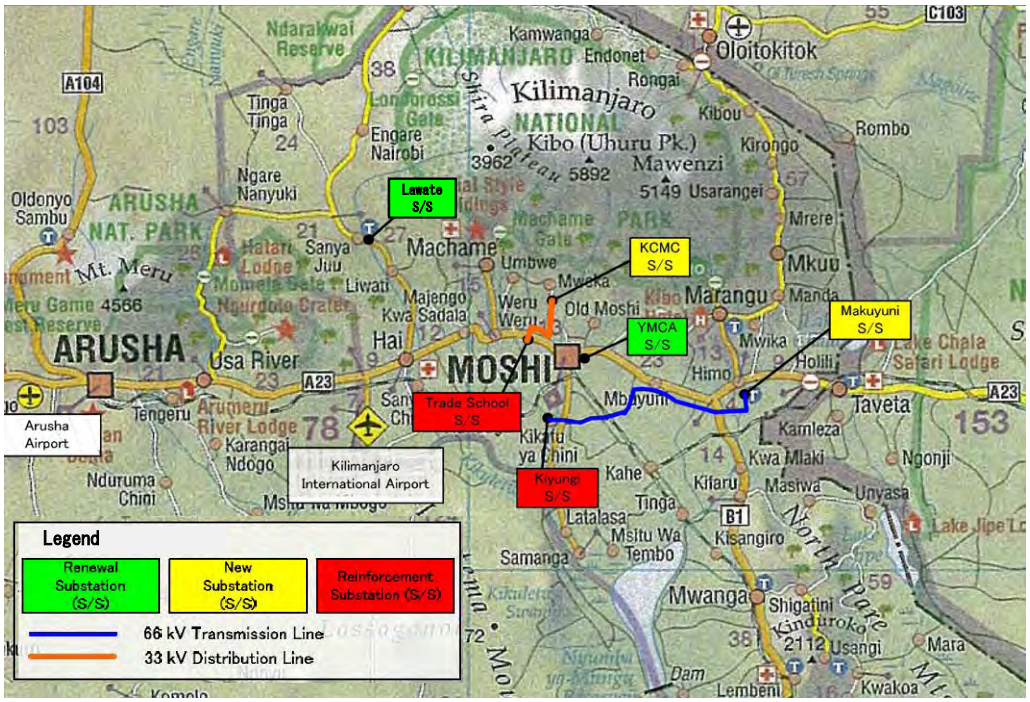
The summary of produced outputs of the project is provided in Table 2, and the project sites are marked in Figure 2.

[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

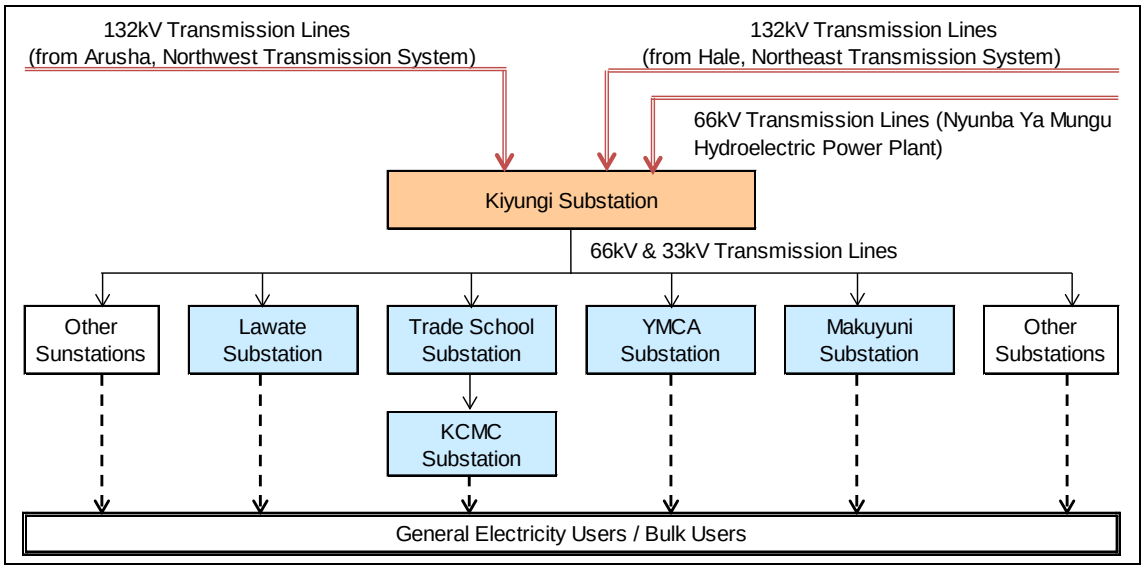
Source: The Preparatory Survey Report and documents provided by JICA.
Note 1: KCMC (Kilimanjaro Christian Medical Centre)
Note 2: YMCA (Young Men's Christian Association)



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

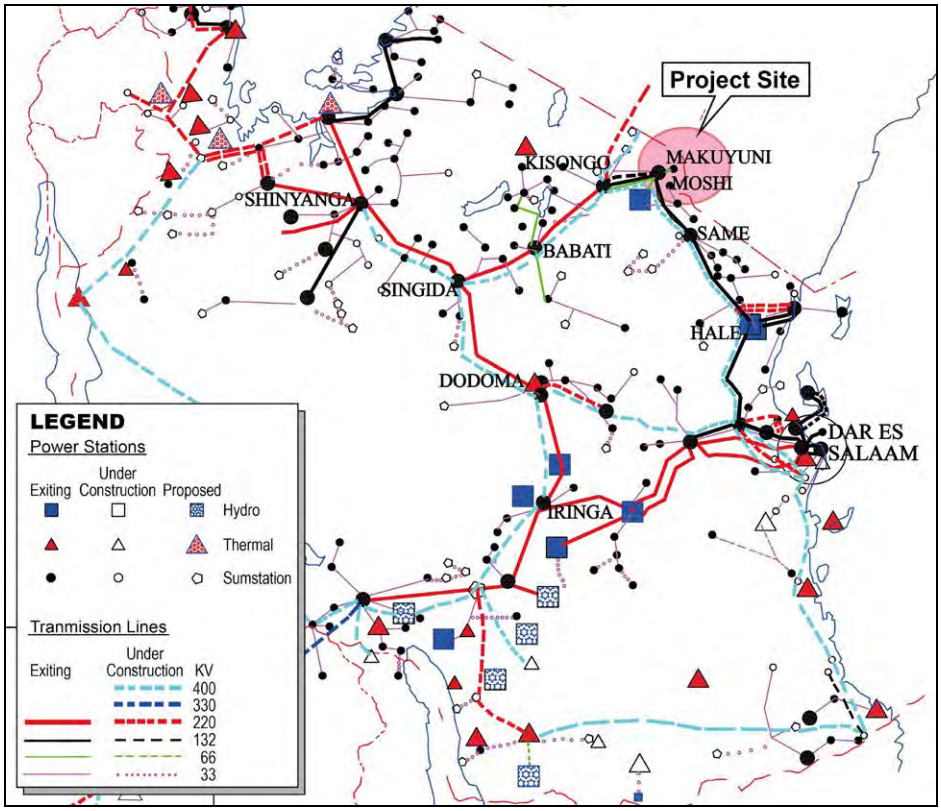
Source: Ex-ante Evaluation Summary Sheet (JICA) and TANESCO.
Note 1: The 2016 data is for 6 months from January to June.
Note 2: The power outage period arising from the shortage in power supply, excluding repair outage hours (maintenance outage hours), which is the time of temporary outage conducted 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.

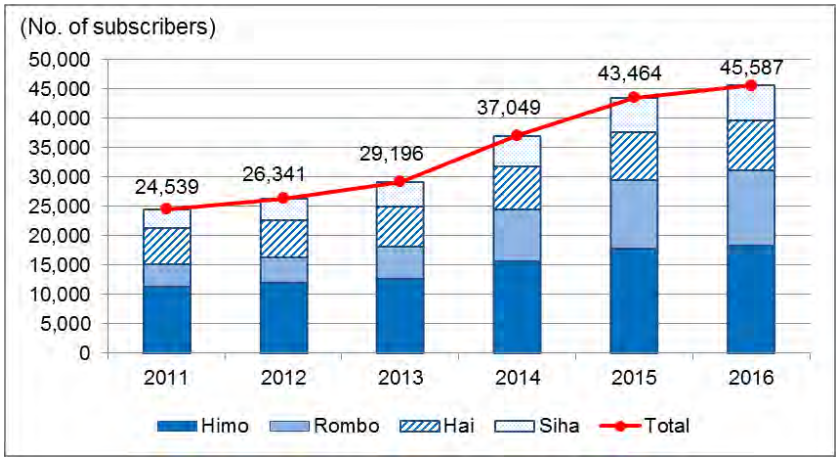
3.4 Impacts

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.

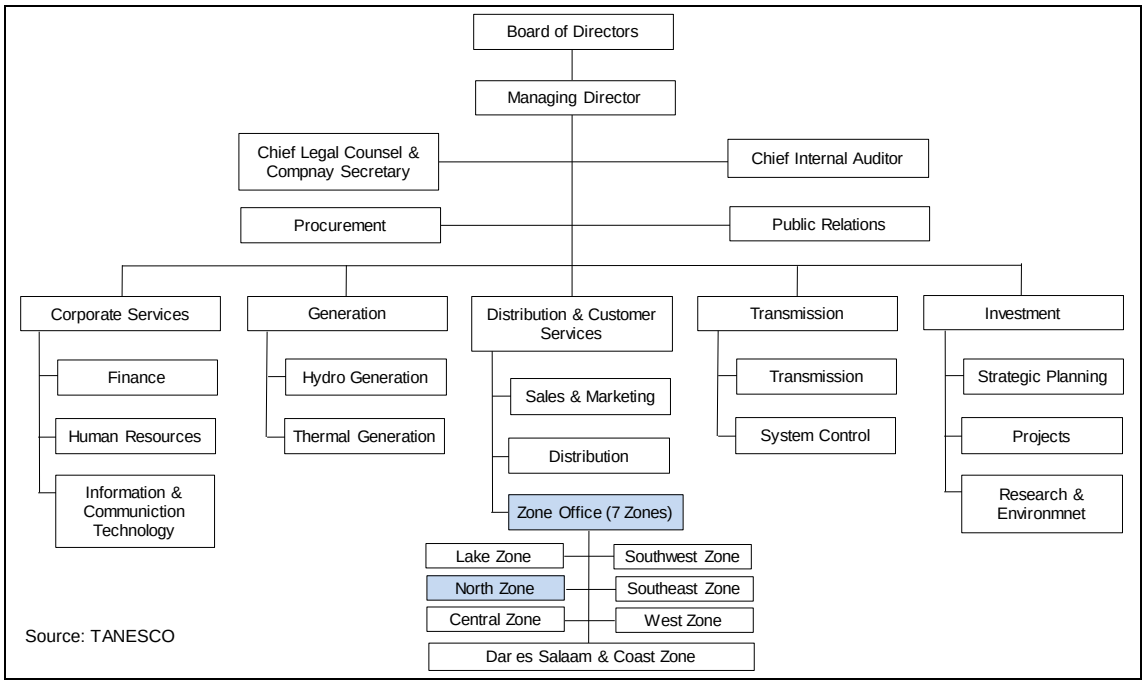


Figure 6: Organization Chart of TANESCO

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.