United Republic of Tanzania

Ex-Post Evaluation of Japanese Grant Aid Project

"The Project for Reinforcement of Transmission and Distribution Facilities in Oyster Bay Substation (Phase I and II)"

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## 0. Summary

The objective of this project was to increase the transmission capacity in Dar Es Salaam in order to ensure stable power supply in the city by constructing a new substation and constructing transmission line between the new and existing substations. This project has been highly relevant to the country's development plan, and development needs, as well as Japan's ODA policy. Therefore its relevance is high. It was confirmed that the this project brought about the increase in transmission capacity in Dar Es Salaam, decrease in the electric load of other existing substations, and improvement in power supply including the decrease in power outages, and thus its effectiveness and impact is high. Although the project period was within the plan, the project cost exceeded the plan due to the price increases of materials. Therefore efficiency of the project is fair. Sustainability of the project effect is fair, because of the problems in the financial soundness of the implementing agency. The planned activities in the annual maintenance plan are not completed because of the lack of spare parts.

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

## 1. Project Description


Project location

Makumbusho Substation developed in this project

### 1.1 Background

In Tanzania, Tanzania Electric Supply Company Ltd. (TANESCO), which is the sole

electric utility company under the supervision of the Ministry of Energy and Minerals, has developed the power generation facilities and transmission and distribution networks by the support of development partners. However, the capacity of the transmission and distribution facilities including substations had not been fully reinforced because sufficient budget had not been allocated due to the economic turmoil in the early 1980s. The transmission and distribution facilities in urban areas had been overloaded for a long time, which caused power outages very frequently. Thus, electric power transmission losses were huge, power supplies were unstable, and the operational efficiency in transmission facilities was very low.

In Dar Es Salaam, the biggest city in Tanzania, development of transmission and distribution facilities including substations were delayed, as the emphasis was put on the development of electric power generating facilities disproportionately. At the same time, the electric demand was increasing rapidly, according to the economic development and population growth in the city. As a result, transmission and distribution facilities, especially Ilala substation, the key substation in the city, were heavily overloaded and caused many accidents, and power supply in the city was cut for a very long time. The frequent power cuts harmed the daily lives of citizens, paralyzed primary city functions, and damaged economic activities in the city.

This project is a grant aid project to construct a new substation and upgrade transmission and distribution lines, aiming at achieving stable power supplies in Dar Es Salaam, especially in the northern part where power demands were rapidly increasing.

### 1.2 Project Outline

The objective of this project was to increase power supply to the power users in Dar Es Salaam by constructing New Oyster Bay Substation[1], reinforcing Ubungo Substation and constructing a transmission line (seven km) between the substations.

| | |
|---|---|
| Grant Limit / Actual Grant Amount | Phase I: 1,813 million yen / 1,792 million yen<br>Phase II: 520 million yen / 474 million yen |
| Exchange of Notes Date / Grant Agreement Date | Phase I: May, 2008 / -<br>Phase II: March, 2009 / March, 2009 |
| Implementing Agency | Tanzania Electric Supply Company Ltd. |
| Project Completion Date | Phase I: September, 2010<br>Phase II: September, 2010 |
| Main Contractor | Mitsubishi Corporation / Takaoka Engineering Co. |

[1] New Oyster Bay Substation was renamed as Makumbusho Substation during the project implementation. In this report, it is called as Makumbusho Substation.

| | |
|---|---|
| | Ltd. (JV) (Procurement, Phase I and Phase II) |
| Main Consultant | Yachiyo Engineering Co. Ltd. |
| Basic Design | March, 2007 |
| Related Projects | Technical Cooperation<br>- The Project for Capacity Development of Efficient Distribution and Transmission Systems (2009 - 2014)<br>Development Study<br>- Master plan study on the power sector for major towns (2000 – 2002)<br>ODA Loan<br>- Iringa-Shinyanga Backbone Transmission Investment Project (2010 – 2015)<br>Grant Aid<br>- Dar-Es-Salaam electric power distribution network project (emergency equipment support) (1984)<br>- Dar-Es-Salaam electric power distribution network project (1986-1987)<br>- The project for reinforcement of power distribution network in Dar Es Salaam (1992)<br>- The Project for Power Supply Expansion in Dar es Salaam (1997-1998)<br>- The Project for Power Supply Expansion in Dar es Salaam（Phase 2）(1998-1999)<br>Other International Agencies and Donors:<br>World Bank<br>- Tanzania Energy Development and Access Expansion Project (2007 – 2015) |

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Hirofumi Azeta, Japan Economic Research Institute Inc.

### 2.2 Duration of Evaluation Study

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

Duration of the Study: August 2013 – September 2014

Duration of the Field Study: January 12 - 25, 2014, April 20 – 26, 2014

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

### 3.1 Relevance (Rating:③[3])

#### 3.1.1 Relevance to the Development Plan of Tanzania

The needs for infrastructure development for economic growth was emphasized in the Tanzania Development Vision 2025, the national development plan of Tanzania established in 2000, and in the National Strategy for Growth and Reduction of Poverty (NSGRP) in 2005. "Growth and Reduction of Income Poverty" was one of the three main agenda of the NSGRP. This agenda aimed at increasing the living standard of the people, through one of its targets- "provision of reliable and affordable energy to consumers."

The "National Energy Policy" (2003), the development vision of the energy sector in Tanzania, targeted on achieving stable power supply and increasing the electrification rate in the country. The "Power System Master Plan" (2008), an implementation plan of the "National Energy Policy", indicated a long-term power generation development plan and transmission and distribution network development plan until 2033.

At the time of ex-post evaluation, "reducing income poverty through promoting inclusive, sustainable, and employment-enhancing growth and development" is one of the main policy objectives of the "Second National Strategy for Growth and Reduction of Poverty" (2010), the national development plan of the government of Tanzania. The strategy targets on enhancing the transmission and distribution network to achieve the increase in the electric power generation amounts and electrification rate in the country. The "Big Results Now!" Initiative, which was started in 2013 to accelerate the "National Five Year Development Plan" (2011/12 - 2015/16), targets increasing electrification rates from 20% to 30% and also increasing per capita electric power consumptions from 97kWh to 236kWh by 2015, and indicate priority projects of generation, transmissions and distributions. This project, which aimed at achieving power supply stability in Dar Es Salaam through increasing transmission capacity and reducing transmission losses, was expected to contribute to the increase in per capita power consumptions. Thus, this project is consistent with the objective of the initiative.

The "National Energy Policy" (2003), the development vision of the energy sector, is valid at the time of ex-post evaluation. The "Power System Master Plan" updated in 2012, which is an implementation plan of the "National Energy Policy", indicates the transmission and distribution development plan, aiming at achieving stable power supply in the country.

The importance of stable power supply through the reinforcement of the transmission and distribution network was identified in the national development policy

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

and sector development policy of Tanzania at the time of both the project planning and the ex-post evaluation. It is therefore concluded that this project was highly consistent with the national development policy and sector development policy.

### 3.1.2 Relevance to the Development Needs of Tanzania

At the time of project planning, the Tanzanian economy was rapidly increasing, and the electric power demand in Dar Es Salaam was also expanding following the economic growth and population expansion. On the other hand, Dar Es Salaam suffered from frequent power outage because the existing transmission facilities were heavily overloaded and outdated, as the development of transmission and distribution facilities could not keep up with the rapid growth in power demand. This is mainly because the government planned privatization of TANESCO from 2002, development partners and the government of Tanzania suspended support and investment to TANESCO, and the transmission and distribution network was not fully reinforced.

At the time of ex-post evaluation, the electric power demand in Dar Es Salaam had been rapidly increasing following the economic growth and population expansion. The average economic growth rate in Tanzania is 7%, and the average annual growth in population in Dar Es Salaam is 5.6% from 2002 to 2012. In the Power System Master Plan, the power demand in Dar Es Salaam is expected to increase by 10% until 2020, and thus further development of substations, and transmission and distribution lines are necessary. At the time of ex-post evaluation, power outage still happens very frequently in Dar Es Salaam.

As the power demand in Dar Es Salaam is still increasing and the power outage happens frequently, it is possible to say that there has been a strong need for a stable power supply. Therefore, it is concluded that this project is consistent with the development needs of Tanzania at the time of project planning and ex-post evaluation.

### 3.1.3 Relevance to Japan's ODA Policy

At the time of project planning, one of the main agenda of the "Country Assistance Program for Tanzania" was "Improvement of living environment in urban areas through the development of basic infrastructure." The program also mentioned that the basic infrastructure in Dar Es Salaam was not sufficient to fulfill primary city functions, and further assistance would be necessary.

This project, which aimed at enhancing the power supply stability in Dar Es Salaam through developing electric power transmission and distribution facilities were in line with Japan's ODA policy.

In the light of above, this project has been highly relevant to the country's

development plan, and development needs, as well as Japan's ODA policy. Therefore its relevance is high.

### 3.2 Effectiveness[4] (Rating:③)

#### 3.2.1 Quantitative Effects

##### 3.2.1.1 Increase in transformer capacity in Dar Es Salaam

By constructing Makumbusho substation in this project, the transformer capacity in Dar Es Salaam was expected to increase up to the target mentioned in Table 1. The actual transformer capacity in Dar Es Salaam at the timing of ex-post evaluation exceeded the target as indicated in Table 1.

Table 1: Transformer capacity in Dar Es Salaam

| Item | At the time of project planning (2006) | Target (2010) | At the time of ex-post evaluation (2012[5]) |
|---|---|---|---|
| 132/33kV transformer[6] | 350MVA | 440MVA | 600 MVA |
| 33/11kV transformer | 415MVA | 445MVA | 493MVA |

Source: Basic Design Report, Answers to the Questionnaire by the Implementing agency

90MVA out of 600MVA (132/33kV transformer) and 30MVA out of 493MVA (33/11kV transformer) as of 2012 indicated in Table 1 is the transformer capacity added by the establishment of Makumbusho substation.

##### 3.2.1.2 Reduction in the electric load of Ilala substation

It was expected that the electric load on the overloaded 132/33kV transformers of Ilala substation would be reduced by 19% (25MVA), by transferring the load to Makumbusho substation constructed in this project. Before this project, Ilala substation (primary substation) provided electric power to Msasani substation and Oyster bay substation (secondary substations). Upon completion of the project, Makumbusho substation constructed in this project started providing electric power to these secondary substations. By this change, the electric load of Ilala substation was transferred to Makumbusho substation[7].

[4] Sub-rating for Effectiveness is to be put with consideration of Impact.
[5] The most updated information provided by the execution agency during the ex-post evaluation was as of 2012. Evaluation was made based on this information.
[6] "132/33kV" is a transformer which steps down 132kV electricity to 33kV. Similarly, "33/11kV" is a transformer which steps down 33kV electricity to 11kV.
[7] Originally, Ilala substation provided electric power to Oyster bay substation and Msasani substation

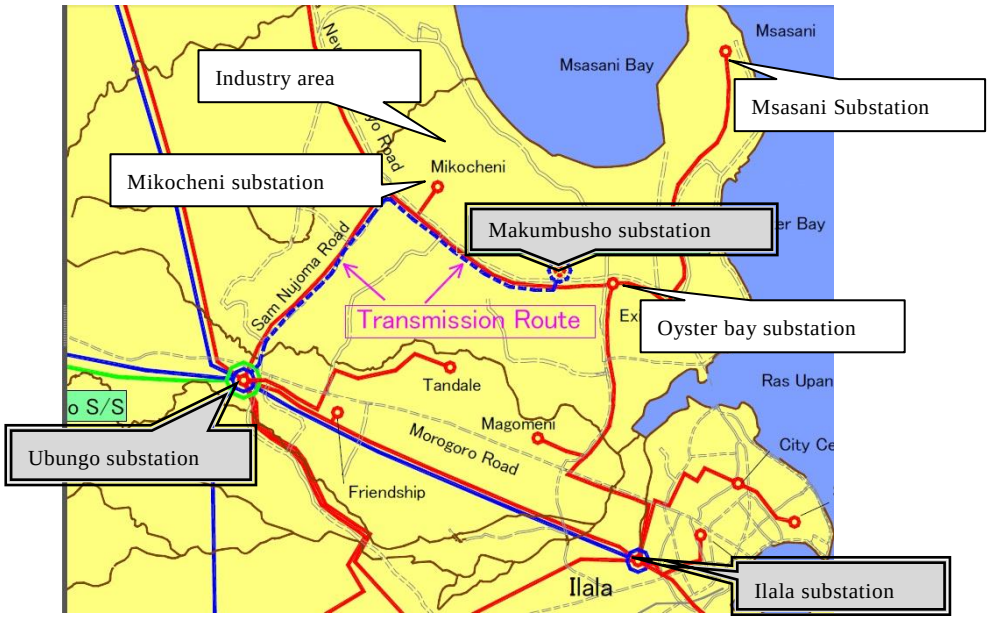



Figure 1: Primary and secondary substations related to this project

The peak demand of Msasani substation as of 2006 is 9.0MVA and that of Oyster bay substation is 17.5MVA. The electric load, which was supposed to shift from Ilala substation to Makumbusho substation, was therefore 26.5MVA[8]. Similarly, the electric load shifted from Ilala substation to Makumbusho substation as of 2010 is 34.2MVA. Because the basic design study report does not indicate the estimation of electric loads after 2010, the electric load shifted from Ilala substation to Makumbusho substation in 2013 was estimated to be 42.0MVA, based on an assumption that the peak demand of secondary substations increased constantly after 2010.

The electric loads of secondary substation which were shifted from Ilala substation to Makumbusho substation at the time of project planning and at the time of ex-post evaluation are as depicted in Table 2.

(secondary substations). However, at the time of project planning, Ubungo substation, another primary substation in Dar Es Salaam, provided electric power to these secondary substations. In 2006, Ilala substation started providing electric power to these secondary substations again, after two 132/33kV transformers (60MVA) were installed.

[8] The reduction of the electric load of Ilala substation is 26.5MVA, although it is mentioned as 25.0MVA above.

Table 2: The electric loads of secondary substation shifted from Ilala substation to Makumbusho substation

(Unit: MVA)

| | Target at the time of project planning | | | Ex-post evaluation |
|---|---|---|---|---|
| | 2006 (estimated) | 2010 (estimated) | 2013 (calculated[9]) | 2013 (Actual) |
| Msasani substation | 9.0 | 13.9 | 19.3 | 15.0 |
| Oyster bay substation | 17.5 | 20.3 | 22.7 | 20.0 |
| Total | 26.5 | 34.2 | 42.0 | 35.0 |

Source: Basic Design Report, Answers to the Questionnaire by the Implementing agency

The actual electric load shifted from Ilala substation to Makumbusho substation as of 2013 is 35.0 MVA, which exceed the target at the time of project planning. The peak load of Msasani substation and Oyster bay substation was 15.0MVA and 20.0MVA respectively. However, this is 83% of the calculated target in 2013 (42.0 MVA).

The peak demand of Ilala substation is depicted in Table 3.

Table 3: Peak demand of Ilala substation

(Unit: MVA)

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|
| 132/33kV | 91 | 124 | 178 | 173 | 185 | 184 | 183 | 191 |

Note: The 132/33kV transformer capacity of Ilala substation was 90MVA (72MW) until 2006, and 210MVA (168MW) after 2007. The power factor is 0.8.

Source: Answers to the Questionnaire by the Implementing agency

As the peak demand of Ilala substation as of 2013 is 191MVA, which is within its capacity of 210MVA, Ilala substation is not overloaded. This is due to the fact that the electric load of Msasani substation and Oyster Bay substation was shifted from Ilala substation to Makumbusho substation in 2010. Ilala substation has not experienced power cut (trip) due to overload since 2006.

The information on the electric load of substations and transformers mentioned above was provided by each substation in this ex-post evaluation study, but the same information is not stored in the head office of TANESCO. It is therefore possible to say

[9] The peak demand of Msasani substation and Oyster Bay substation was estimated up to 2010 in the Basic Design report. The peak demand of Msasani substation increased by 11.5% on average from 2006 to 2010, while the peak demand of Oyster bay substation increased by 3.8%. The peak demand as of 2013 was calculated based on the assumption that the peak demand increased at the same rate after 2010.

that the implementing agency has room for improvement in the information and data management of the substations and transformers.

3.2.1.3 Reduction in transmission loss

At the time of project planning, it was expected that the transmission loss from Ubungo substation to Makumbusho substation reduced from 21.0% to 7.2%.

Because the transmission line between Ubungo substation and Makumbusho substation was constructed as planned, the calculated value of transmission loss between these substations is theoretically 7.2% as planned. The transmission loss rate, measured from the gap between the electric power sent from Ubungo substation and the power received at Makumbusho substation, was 3.1%, reduced by 17.8%[10].

3.2.2 Qualitative Effects

In the ex-post evaluation, the following qualitative effects expected at the time of planning were evaluated as quantitative effects.

- The electric power supply to users (229,000 people) increases according to the enhanced transformer capacity in the city following the installation of 33/11kV transformers at Makumbusho substation.
- The stable operation of Makumbusho substation and its stable power supply is achieved by connecting Makumbusho substation and Ubungo substation by 132kV transmission lines.

The first effect mentioned above is interpreted as the increase in the distribution capacity of Makumbusho substation by installing 33/11kV transformers. As described in Table 1, the distribution capacity in the city exceeded the target. The second effect, the stable power supply by Makumbusho substation, was also achieved through the reduction in transmission losses by connecting Ubungo substation and Makumbusho substation by 132kV transmission lines.

**3.3 Impact**

3.3.1 Intended Impacts

The intended impacts at the time of project planning were (i) stability in the operation of public facilities and business establishments, (ii) activation of primary city functions and daily lives of citizens, (iii) reduction in the fuel consumptions of in-house power generation facilities, and (iv) reduction in the energy expenses of public facilities and citizens.

[10] The transmission loss rate was calculated from the actual data in January 2014. Because the electric power sent and received were recoded manually, the transmission loss rate might not be accurate.

Through an interview survey with 20 power users, who receive electric power from Makumbusho substation and also from secondary substations connected to Makumbusho substation [11], it was indentified that power users recognize the increase in the stability of the power supply, such as a decrease in the number of power cuts.

Photo 1: Industrial area where several interviewees are located

Small sized power users which receive power supplies directly from Makumbusho substation answered that the number of power cuts decreased by 93-97%. Large sized power users which receive power supplies from secondary substations answered that the number of power cuts decreased by 90%. In addition, 50% of interviewees answered that the electric voltage was more stable after the project. They also answered that the times and hours that they need to run their in-house power generators decreased as a result.

In addition, it was observed that new business establishments and residence houses were constructed near Makumbusho substation. This is due to the fact that the power supply stability in this area improved after the completion of this project.

At the time of project planning, this project was expected to be a part of the circle of transmission lines surrounding Dar Es Salaam, which was expected to enhance the satiability in the electric power supply in the city. As depicted in Figure 2, a 132kV transmission line between Ubungo substation and Ilala substation was constructed before this project was planned, and the section between Ubungo substation and Makumbusho substation was constructed by this project. The remaining section between Makumbusho substation and New City Centre, and the section between New City Centre and Ilala substation were planned to be constructed by the support of the government of Finland. When completed, the stability of electric power supply in Dar Es Salaam would further improve.

It is therefore concluded that this project contributed to the activation of primary city functions and daily lives of citizens, through achieving stable power supply.

[11] Most of the interviewees are manufacturing companies. The number of employees of the interviewees vary from 2-3 to more than 100.

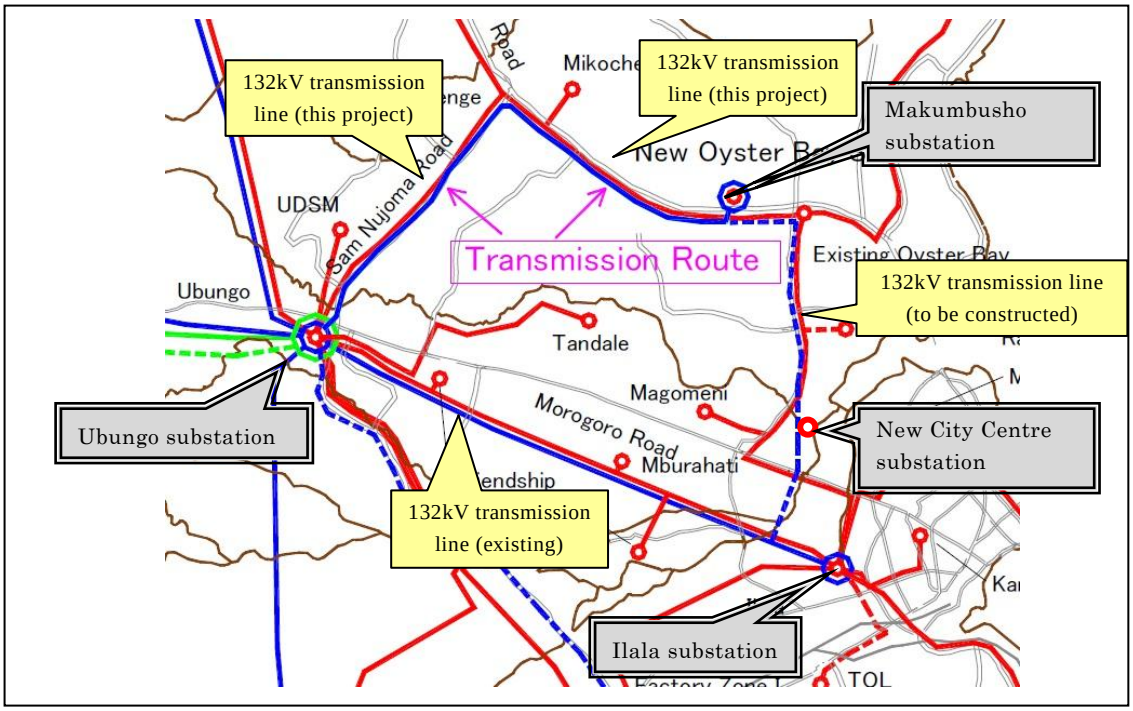



Figure 2: Progress of 132kV circle transmission line development plan in Dar Es Salaam

3.3.2 Unintended Positive Impacts

3.3.2.1 Impacts on the Natural Environment

Photo 2: A transmission pole constructed in road reserves

In this project, environmental impact assessment report was prepared by the implementing agency, which went through technical checks of National Environment Management Council (NEMC), and was approved by the Minister of Environment in 2007. The basic design study report pointed out that (i) it was necessary to consider measures to prevent noises of Makumbusho substation and oil erosion, (ii) transmission lines had to be constructed at the sufficient height and distance to secure public safety, (iii) measures had to be taken to prevent vehicles crashing into transmission poles, and (iv) announcement on the safety distance between transmission lines and residential houses had to be made to neighboring residents.

In this project, sufficient measures were taken to prevent noise and water pollution. Such measures include a three meter high concrete wall, and oil - water separation facilities. Minimum height and offset distance of transmission lines were designed

following the standard in Tanzania. The consultants of this project and the project manager of the implementing agency confirmed that the transmission lines were constructed following the standard.

At the time of planning, construction of crash barriers were considered in order to prevent vehicles crashing into transmission poles. However, as the transmission poles were constructed in road reserves[12] which are several meters away from roads, it was determined to not construct such crash barriers. In the ex-post evaluation, it was confirmed that transmission poles were not constructed near main roads, and any accidents, such as cars crashing into poles, have not happened.

When houses are newly built near the transmission lines, the implementing agency gives a briefing to residents on the safety distance from transmission lines. In case any constructions are made illegally under transmission lines, the implementing agency gives warning to owners upon its three month regular checks and gives orders for removal. When necessary, police execute the orders for removal.

Upon preparing the project completion report (before the completion of the project), the implementing agency confirmed all the comments made in the environmental impact assessment report and that negative impacts on the environment were not made by this project.

3.3.2.2 Land Acquisition and Resettlement

At the time of project planning, the land for the Makumbusho substation (6,400 $m^2$) was owned privately and the government planned to acquire it. The government successfully acquired the land as planned, following the Land Act and Land Acquisition Act and sold it to TANESCO. Upon acquiring the land, the government paid compensations to the private owner and also provided other lands for substitutions. TANESCO then paid the land costs of 310 million TSh to the government. There were not any resettlements, as there were not any residents in the land.

Upon the construction of transmission lines, the implementing agency acquired land of 2,197$m^2$ in total, and five households were resettled. The compensation amounts for land were assessed based on the market prices, and determined and paid based on the agreements between owners and the implementing agency, as indicated in Land (Assessment of the value of land for compensation） Regulation 2001. The total compensation amount for land and houses paid to owners were 469 million TSh.

3.3.2.3 Other indirect effects

In this project, the shape of transmission towers employed in this project was

[12] Road reserves are all the state-owned land used for carriageways (paved) and verge (unpaved).

"monopole[13]". A monopole was employed in Tanzania for the first time in this project. Land acquisition required in case of monopoles is smaller than usual transmission towers, and thus TANESCO employed monopoles in several projects after this.

It was confirmed that the this project brought about the increase in transmission capacity in Dar Es Salaam and decrease in the electric load of Ilala substation, and also that the improvement in power supply achieved by this project activated primary city functions of Dar Es Salaam and the lives of citizens. It was also confirmed that negative impacts on natural environment were not caused by this project, and any problems did not arise in resettlement and land acquisition processes. Based on the above result, it is concluded that this project has largely achieved its objectives. Therefore its effectiveness and impact is high.

### 3.4 Efficiency (Rating ②)

#### 3.4.1 Project Outputs

The outputs of this project are reinforcement for 33kV distribution facilities, reinforcement for 132kV transmission facilities, and equipment and materials procurement. The first bidding result in August 2008 was canceled, because the lowest bid price exceeded the project budget due to the price increase of construction materials and oil. As a result, this project entered into a second bidding at the same project budget, and the project outputs covered in the bidding was reduced, so that the contract price was within the initial project budget. As a result, a part of 33/11kVdistribution facilities was excluded from the project components, and it was determined to be implemented in the second phase. Eventually, this project was implemented through two phases, and the total outputs achieved through two phases are same as the initial plan.

The final outputs and the original plans are compared in Table 4 below.

[13] A monopole tower is usually employed for transmission lines in urban area. This is mainly because monopole towers do not harm landscape more than usual transmission towers. For the actual shape of a monopole tower, see Photo 2.

Table 4: Comparison of Original and Actual Outputs

| | | Plan | | | Actual | |
|---|---|---|---|---|---|---|
| | | Before seperating project | After seperating project scopes | | Phase 1 | Phase 2 |
| | | | Phase 1 | Phase 2 | | |
| **Reinforcement for 33kV Distribution Facilities** | | | | | | |
| A | Procurement & Installation of Equipment & Materials for 33kV & 11kV Distribution at New Oyster Bay Substation | | | | | |
| | (1) 33kV switchgears | 12 feeders | 5 feeders | 7 feeders | 5 feeders | 7 feeders |
| | (2) 11kV switchgears | 8 feeders | 0 feeder | 8 feeders | 0 feeder | 8 feeders |
| | (3) 33kV control & protection panel | 4 units | 3 units | 1 units | 3 units | 1 unit |
| | (4) 11kV control panel | 1 unit | 0 unit | 1 unit | 0 unit | 1 unit |
| | (5) 132/33/11kV meter panel | 2 units | 1 unit | 1 unit | 1 unit | 1 unit |
| | (6) 33/11kV distribution transformer (15MVA) | 2 units | 0 unit | 2 units | 0 unit | 2 units |
| | (8) Station service transformer (33/0.4kV, 100kVA) | 2 units | 1 unit | 1 unit | 1 unit | 1 unit |
| | (7) Station service facilities (DC・AC) | 1 set | 1 set | - | 1 set | - |
| | (9) Dead end steel tower (gantry type) | 1 set | 1 set | - | 1 set | - |
| | (10) Earthing system (including conductors) | 1 set | 1 set | - | 1 set | - |
| | (11) Outdoor lighting system | 1 set | 1 set | - | 1 set | - |
| | (12) Fire extinguisher (ABC, portable type) | 1 set | 1 set | - | 1 set | - |
| | (13) 33kV XLPE cables | 1 set | 1 set | 1 set | 1 set | 1 set |
| | (14) 11kV XLPE cables | 1 set | - | 1 set | - | 1 set |
| | (15) Construction of central building (363m2, one-story building) | 1 set | 1 set* | | 1 set* | |
| | (16) Associated civil facilities | 1 set | 1 set* | | 1 set* | |
| **Reinforcement for 132kV Transmission Facilities** | | | | | | |
| B | Procurement & Installation of Equipment & Materials for 132kV Transmission at New Oyster Bay Substation | | | | | |
| | (1) 132kV feeder equipment | 1 set | 1 set | - | 1 set | - |
| | (2) 132kV switchgear | 1 set | 1 set | - | 1 set | - |
| | (3) 132/33kV main transformers (45MVA) | 2 units | 2 units | - | 2 units | - |
| | (4) 132kV control & protection panels | 1 set | 1 set | - | 1 set | - |
| | (5) Earthing equipment | 1 set | 1 set | - | 1 set | - |
| | (6) Associated civil facilities | 1 set | 1 set* | | 1 set* | |
| C | Procurement & Installation of 132kV Lead-out Equipment at Ubungo Substation | | | | | |
| | (1) Dead end steel tower (gantry type) | 1 unit | 1 unit | - | 1 unit | - |
| | (2) 132kV lead out equipment | 1 set | 1 set | - | 1 set | - |
| | (3) 132kV switchgear | 1 set | 1 set | - | 1 set | - |
| | (4) Transfer of existing voltage measuring instrument (CVT) | 1 set | 1 set* | | 1 set* | |
| | (5) Modification of existing control system | 1 set | 1 set* | | 1 set* | |
| | (6) Earthing system | 1 set | 1 set | - | 1 set | - |
| | (7) Associated civil facilities (foundation, etc.) | 1 set | 1 set* | | 1 set* | |
| D | Construction of 132kVTransmission Lines (Ubungo Substation to New Oyster Bay Substation) | | | | | |
| | (1) 132kVtransmission pole foundation | 1 set | | | | |
| | (2) 132kV transmission monopole | 38 units | 38 units | - | 38 units | - |
| | (3) Materials for transmission line (conductors, insulators & earthing | 1 set | 1 set | - | 1 set | - |
| **Equipment & Materials Procurement Plan** | | | | | | |
| E | Procurement of the following equipment & materials | | | | | |
| | (1) 33kV lighting arresters | 12 units | 6 units | 6 units | 6 units | 6 units |
| | (2) 11kV lighting arresters | 12 units | 0 unit | 12 units | 0 unit | 12 units |
| | (3) Spare parts for equipment & materials, maintenance tools | 1 set | 1 set | - | 1 set | - |

*Tanzanian portion

Source: Basic design study report, Project completion report

The planned project outputs were mostly achieved through the first and second phases of this project. In the first phase, only minor changes in project specifications were made, such as changes in the size of basements, changes in the heights of poles, and changes in the location of fences and gates. In the second phase also, major changes were not made. One of the minor changes in the second phase was made on the location of cables.

3.4.2 Project Inputs

3.4.2.1 Project Cost

The project cost planned to be covered by the Japanese side was 1,807 million Japanese Yen, and other costs planned to be covered by the Tanzanian side was 47 million Yen. The planned and actual project cost coved by the Japanese side is compared in Table 5. It indicates that the project costs covered by the Japanese side through the first and second phase, was 2,266 million Yen, which was 25% more than the planed project cost. The increase in the project cost was inevitable, as this was because of the price hike of steel, the main material for the transmission and distribution lines, and oil.

Table 5: Comparison of Original and Actual Project Costs (Japanese Portion)

(Unit: million yen)

| Item | Planned | Actual | | |
|---|---|---|---|---|
| | | Phase I | Phase II | Total |
| Constriction cost | 541 | 0 | 0 | 0 |
| Equipment cost | 1,166 | 1,715 | 452 | 2,167 |
| Detailed Design and Supervision Work | 100 | 77 | 22 | 99 |
| Total | 1,807 | 1,792 | 474 | 2,266 |

Note: Actual equipment cost include construction cost
Source: Basic design study report, Project completion report

The actual project cost covered by the Tanzanian side, which was 97 million Yen, exceeded the planned cost, shown in Table 6. The actual project cost does not include the construction costs for removing existing 33kV distribution lines, as it was not identified in the ex-post evaluation study. The reason why the project cost of the Tanzanian side increased is that the land cost, which was not determined to be covered by the government or TANESCO, was covered by TANESCO. TANESCO was also demanded by Tanzania National Roads Agency to pay 41 million (831 million TSh) for the change in the planned location of street light.

The costs for the change in the planned location of the street light include design costs and material costs, as the location of street lights on Sam Nujoma Road were changed because of this project.

Table 6: Comparison of Original and Actual Project Costs (Tanzanian Portion)

(Unit: million Yen)

| Item | Plan | Actual |
|---|---|---|
| Land creation cost, etc. for new substations | 26 | 17 |
| Construction cost for removing underground infrastructure on 132kV transmission route | 16 | |
| Construction cost for removing 33kV distribution lines | 5 | N/A |
| Costs for the change in the location of planned location of street light (Design and equipments) | | 41 |
| Land acquisition cost | | 39 |
| Total | 47 | 97 |

Source: Basic design study report, documents provided by the implementing agency

Evaluation on the project cost was made only on the Japanese portion, as a part of actual costs of the Tanzanian portion was not identified in the ex-post evaluation.

3.4.2.2 Project Period

The initial planned project period was 31 months, which was revised to be 33 months until February 2011 upon re-bidding of the first phase of the project[14]. Among several project processes, which were implemented in parallel in two project phases, the longest was the construction of 132kV transmission lines, and it was planned to be completed in February 2011. The detailed project schedule of the construction of 132kV transmission line is as indicated in Table 7. The removal of 33kV distribution line was planned to be started after the E/N of the second phase was concluded in March 2009.

Table 7: Detailed project schedule of 132kV transmission line construction

| Item | Period |
|---|---|
| (Tanzanian portion) Removal of 33kV distribution lines on Sam Nujoma Road | March 2009 - October 2009 |
| Construction of foundation for 132kV transmission lines | October 2009 - April 2010 |
| Construction of monopoles | April 2010 - November 2010 |
| Installation of 132kV transmission lines | November 2010 - February 2011 |

Source: Detail design study report of the second phase

The actual project period of the first phase was 28 months (from May 2008 to September 2010) and the second phase was 18 month (from March 2009 to September

[14] Detailed design survey of the second phase.

2010). The project period in total was 28 months, which was 85% of the planned project period (within the planned project period).

As mentioned above, this project was completed in May 2009, five months earlier than the planned completion date. This was achieved by starting the removal of 33kV distribution lines (Tanzanian portion) before concluding the E/N of the second phase of the project, based on the discussions between the project consultant and the implementing agency. Accordingly, the following project process of the construction of the 132kV transmission line was also completed five month early, and ultimately the project itself was completed ahead of schedule, in September 2010.

Based on the above result, although the project period was within the plan, the project cost exceeded the plan. Therefore efficiency of the project is fair.

### 3.5 Sustainability (Rating: ②)

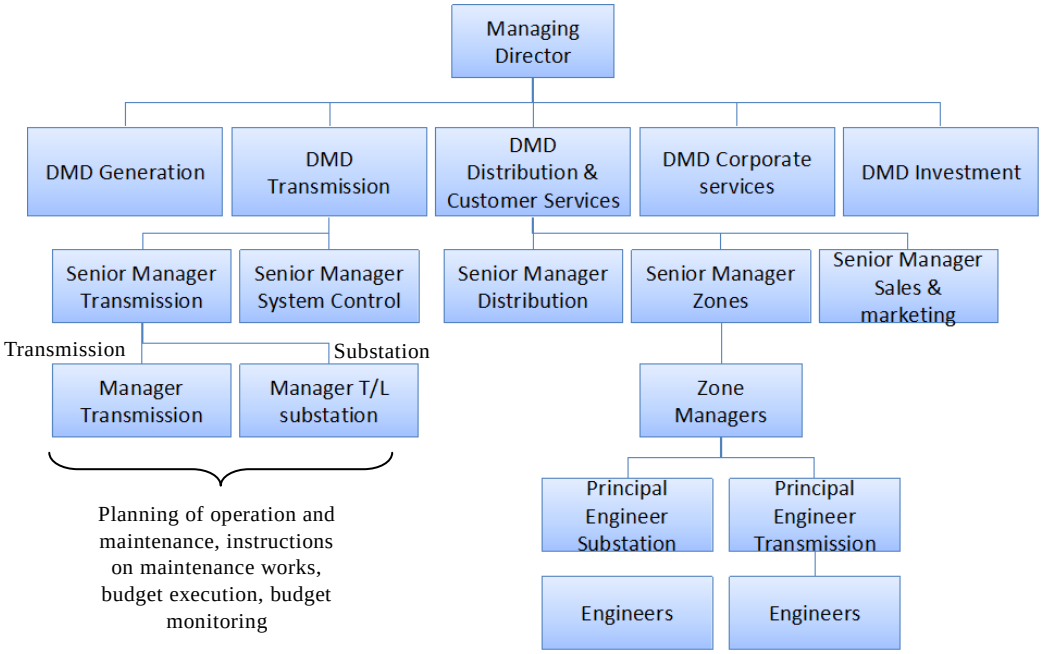
#### 3.5.1 Institutional Aspects of Operation and Maintenance

TANESCO, the implementing agency of this project, is the sole electric utility company in Tanzania (excluding Zanzibar). It has units for generation, transmission and distribution, and the total number of staff members as of December 2013 is 5,936.

At the time of planning, the transmission and substation department was supposed to be responsible for the operation and maintenance of Makumbusho substation. At the time of ex-post evaluation, the Manager Transmission Line Substation under the transmission business unit at head office, which was established in the organizational reform in 2011, is responsible for the planning, budget execution, and budget monitoring of the operation and maintenance of substations. The actual operation and maintenance works of substations are carried out under the responsibility of principal engineers at zone offices[15], by the instruction of the Manager Transmission Line Substation. The responsibilities in the substation maintenance are therefore separated for those of the Manager Transmission Line Substation at the head office and those of principal engineers substations at zone offices.

Similarly, the Manager Transmission at head office is responsible for the planning and budget of the operation and maintenance of transmission lines, while the actual operation and maintenance works of transmission lines are the responsibility of principal engineers transmission at zone offices.

[15] There are five zone offices in Tanzania. The transmission lines and the substation constructed in this project is the responsibility of Dar Es Salaam and Coastal zone office.




Source: Documents provided by the implementing agency

Figure 3: Organization structure of TANESCO (for operation and maintenance)

In the Dar Es Salaam and Coastal zone office, there are twenty engineers and staff members in charge of substations and ten engineers and staff members for transmission. It has been pointed out that the number of the engineers and staff is not enough, because engineers at Dar Es Salaam zone office support other zone offices very often. As a result, they complete only 90% of planned maintenance works of substations[16].

The operation of the Makumbusho substation is the responsibility of the Kinondoni North regional office. At the Makumbusho substation, eleven people (two engineers per shift x four shifts, and three managers) are stationed for 24-hour monitoring, as in the initial plan.

Based on the above, it is concluded that the institutional aspect of operation and maintenance has minor problems, as the number of staff for operation and maintenance is not always sufficient, although engineers and staff were assigned as planned.

### 3.5.2 Technical Aspects of Operation and Maintenance

Engineers in TANESCO have obtained basic technical skills necessary for the operation and maintenance of transmission lines and substations, through their experiences in actual operations. They also received OJT for the operation and maintenance of Makumbusho substation, which was provided by the Japanese contractors

[16] Source: Interviews with the implementing agency

during the installation and test operation period of this project.

Training on the operation of substations has been provided since July 2012 by TANESCO Training School (TTS), which was established in 2011. All engineers and staff members in Dar Es Salaam and Coastal zone office received training on the planning and practical works of substation maintenance. The durations of training are based on the level of engineers and staff, which vary from four weeks to three months. Engineers and technicians receive four week training, while artisans receive three month training.

Photo 3: TANESCO Training School

Training on transmission and its training curriculum were under preparation at the time of ex-post evaluation. Technical level on transmission has been enhanced through internal OJT and staff dispatches to projects by development partners.

At the time of ex-post evaluation, any transmission lines or substations were not identified, which have problems in maintenance due to the technical problems at TANESCO.

### 3.5.3 Financial Aspects of Operation and Maintenance

The maintenance budget of TANESCO in 2012 was 58,731 million TSh and the execution was 24,160 million TSh. The basic design study of this project indicated that the annual cost for the spare parts necessary for the maintenance of the substation facilities is 220 million TSh. The annual cost is much smaller than the annual maintenance budget and its un-executed amount, thus it is possible to say that the implementing agency has sufficient budget for the maintenance of the facilities developed in this project.

The maintenance budget and execution of TANESCO is as indicated in Table 8.

Table 8: Maintenance budget and execution of the implementing agency
(Unit: million TSh)

| | Budget (mil TSh ) | Execution (mil TSh ) | Execution rate |
|---|---|---|---|
| 2005 | 11,804 | 9,263 | 78.5% |
| 2006 | 8,289 | 5,989 | 72.3% |
| 2007 | 56,447 | 5,316 | 9.4% |
| 2008 | 42,296 | 15,136 | 35.8% |
| 2009 | 45,033 | 24,262 | 53.9% |
| 2010 | 43,030 | 25,230 | 58.6% |
| 2011 | 41,683 | 28,675 | 68.8% |
| 2012 | 58,731 | 24,160 | 41.1% |

Source: Documents provided by the implementing agency

The annual budget of the implementing agency is prepared before late December of the previous year. Based on this, the departments in charge of maintenance start preparing the annual maintenance plan, submit the plan to the procurement department in the head office, and then send the procurement requests for equipment. It takes at least five months for the procurement of equipments and materials. Normally it takes seven - eight months, because procurement documents need revisions in many cases. Other reasons for the delays in the procurement process would be the heavy work loads at the procurement department, and that the human resources at the procurement department might not be enough for its work load. As a result, the planned activities in the annual maintenance plan are not completed because of the lack of spare parts, when the departments in charge of maintenance do not have enough stocks of spare parts[17].

In addition, the procurement process of equipments and materials are sometimes suspended because of the lack of available funds at TANESCO due to its deficits. As a result, departments in charge of maintenance cannot obtain spare parts necessary for maintenance. Due to the reasons mentioned above, the execution rate of the maintenance budget is not high.

The income statement and balance sheet of the implementing agency is as in Table 9 below.

[17] It is also pointed out that one of the reasons for the inefficiency in the procurement process is that the specification of procured equipments and materials are not standardized in TANESCO.

Table 9: Income statement and balance sheet of the implementing agency

(Unit: million TSh)

| | 2010 | 2011 | 2012 |
|---|---|---|---|
| Revenue | 466,477 | 545,658 | 820,436 |
| Cost of sales | (492,252) | (753,397) | (1,162,437) |
| Gross profit/loss | (25,775) | (207,739) | (342,001) |
| Selling and general administrative expenses | (80,874) | (106,277) | (130,956) |
| Operating profit/loss | (106,649) | (314,016) | (472,957) |
| Non-operating income | 107,628 | 282,754 | 300,808 |
| Non-operating expense | (44,908) | (44,949) | (51,934) |
| Ordinary profit/loss | (43,929) | (76,211) | (224,083) |
| Extraordinary profit/loss | | | |
| Profit/loss before tax | (43,929) | (76,211) | (224,083) |
| Income tax | 0 | 0 | 0 |
| Profit/loss for the year | (43,929) | (76,211) | (224,083) |

| | 2010 | 2011 | 2012 |
|---|---|---|---|
| Current assets | 333,672 | 425,134 | 583,511 |
| Non-current assets | 2,232,921 | 2,488,213 | 2,735,329 |
| Total asset | 2,566,593 | 2,913,347 | 3,318,840 |
| | | | |
| Current liabilities | 486,103 | 674,968 | 1,207,967 |
| Non-current liabilities | 842,741 | 1,042,671 | 1,090,594 |
| Total liabilities | 1,328,844 | 1,717,639 | 2,298,561 |
| Total equity | 1,237,749 | 1,195,708 | 1,020,279 |
| Total equity and liabilities | 2,566,593 | 2,913,347 | 3,318,840 |

Source: Documents provided by the implementing agency

The revenue of TANESCO has increased following the increase in the amount of electricity sales. However, because the cost of sales has increased more rapidly than revenue, the gross loss of TANESCO has also increased. The cost of sales increased because the amount of electric power that TANESCO purchased from emergency power producers (EPPs) significantly increased, due to the fact that the electricity supply by the power plants of TANESCO could not meet the increasing demands in the country. As a result, TANESCO has constantly purchased electricity from EPPs, not only for emergency cases, although the unit price of power purchase from EPPs are set higher than the unit sales price of TANESCO. In order to cover the deficits from the power purchases from EPPs, the government has provided subsidies to TANESCO (subsidies are included in non-operating profits of TANESCO).

At the end of 2013, the electricity price was increased by 40%, and TANESCO is

expected to achieve net profit of 35,000 million TSh in 2014[18]. At the same time, the government significantly reduced the amount of subsidies for TANESCO. However, it is difficult for TANESCO to clear the accumulated losses by the profit in a short time, because no matter if TANESCO achieves the net profit mentioned above, it takes 28 years to clear its accumulated losses of 982,676 million TSh.

TANESCO is aiming at increasing the domestic power supplies by completing several electric power generating plants after 2014, and also by developing pipelines to send domestically produced natural gas to power plants by around 2016, in order to reduce power purchase from EPPs and to improve its financial status.

Based on the above result, it is concluded that there are some problems in terms of financial aspects. As mentioned above, there are some concerns about the procurement of spare parts and the execution of the maintenance budget, although the implementing agency seems to have allocated enough budgets for operation and maintenance. Besides, the implementing agency cannot clear its accumulated losses, although it expects to make net profits.

### 3.5.4 Current Status of Operation and Maintenance

The maintenance status of the substations and transmission lines constructed in this project is good. There are not any problems which need repair work and which have not been repaired for long time. The transmission lines in Dar Es Salaam and Coastal zone, which experienced problems at least once a year until several years ago, went through replacement of decrepit equipments and parts, and have not experienced any serious problems recently.

However, all the maintenance works included in the annual maintenance plan of TANESCO as a whole have not been implemented, mainly because of the delays in the procurement of spare parts necessary for maintenance works. It is also because of the lack of human resources at Dar Es Salaam and Coastal zone office, which is in charge of the maintenance of Makumbusho substation. Human resources of the zone office are not always sufficient, as it provides support to other zone offices.

Based on the above results, it is concluded that some problems have been observed in terms of financial aspects. All maintenance works are not implemented due to the delays in the procurement of spare parts, and temporary shortages in human resources,

[18] Based on the documents provided by the implementing agency (revised in the ex-post evaluation study). In the document provided by the implementing agency, it prepared a profit forecast based on the assumptions that the electricity rate is increased by 67.87% and that it received subsidies from the government. However, the government decided to increase the electricity rate by 40% and to reduce subsidies significantly. These changes in assumptions were reflected in the profit forecast of this ex-post evaluation study.

however serious problems were not identified in the operations of transmission lines and substations. The financial status of the implementing agency is not strong enough, thus it would not be able to clear its accumulated losses in short term in spite of its expected net profits. Therefore sustainability of the project effect is fair.

## 4. Conclusion, Lessons Learned and Recommendations

### 4.1 Conclusion

The objective of this project was to increase the transmission capacity in Dar Es Salaam in order to ensure stable power supply in the city by constructing a new substation and constructing transmission line between the new and existing substations. This project has been highly relevant to the country's development plan, and development needs, as well as Japan's ODA policy. Therefore its relevance is high. It was confirmed that the this project brought about the increase in transmission capacity in Dar Es Salaam, decrease in the electric load of other existing substations, and improvement in power supply including the decrease in power outages, and thus its effectiveness and impact is high. Although the project period was within the plan, the project cost exceeded the plan due to the price increases of materials. Therefore efficiency of the project is fair. Sustainability of the project effect is fair, because of the problems in the financial soundness of the implementing agency. The planned activities in the annual maintenance plan are not completed because of the lack of spare parts.

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

### 4.2 Recommendations

#### 4.2.1 Recommendations to the Implementing Agency

##### 4.2.1.1 Improvement in the institutional aspects of maintenance

In the implementing agency, the organizational structure for maintenance, responsibilities in maintenance, and budget allocation for maintenance are not consistent among each other. The Manager Transmission Line Substation at the head office has responsibilities in the budgeting and planning of maintenance of substations and gives instructions of maintenance works to zone offices, while actual maintenance works of substations are the responsibilities of zone offices.

As a result, inefficiency in maintenance works was observed because the responsibilities in maintenance are not necessarily clear in the implementing agency. Therefore it is recommended that the implementing agency enhances the coordination among departments and offices in charge of maintenance to achieve efficiency and timeliness in the planning and execution of maintenance works and budget.

4.2.1.2 Improvement in spare parts procurement

The implementing agency has not implemented all the maintenance works indicated in its annual maintenance plan, due to the fact that the materials and equipments necessary for maintenance have not been procured on time. This is mainly because the budget of the implementing agency is approved right before the beginning of next fiscal year, and then the implementing agency starts preparing its annual maintenance plan and procurement plan. Therefore there is room for improvement in the planning aspects of procurement processes.

One of the possible improvements in the procurement planning is setting up a temporary budget for the next fiscal year in July of the previous fiscal year, having it internally approved, and start preparing its annual maintenance and procurement plan for the next fiscal year. In that case, it would be possible for the implementing agency to have the delivery of procured materials and equipments from the beginning of the fiscal year, by starting the preparation of procurement six months before the beginning of the fiscal year, no matter if procurement requires designated periods.

4.2.1.3 Enhancement in the financial soundness of the implementing agency

It is necessary for TANESCO to continue its efforts to improve its financial soundness, as it is not possible for TANESCO to clear its accumulated loss in a short run, in spite of its expected net profits. TANESCO especially needs to make sure that the development of electric power generating facilities are completed on time, so that it can reduce the power purchases from EPPs, which have been the main reason for the recent increase in its cost of sales.

4.2.1.4 Enhancement in the data management of transmission

Although each substation has the electric load data of each transformer in the substation, its monthly report submitted to System Control at the head office indicates the electric load of the substation as a whole and does not include such transformer-wise data. Therefore, it is difficult for the implementing agency to set up a plan for the reinforcement of substations based on transformer-wise electric load data. In the long run, constructing a mechanism to automatically collect data from substations would be possible. However, in the short run, it is recommended to revise the existing monthly report format to include transformer-wise electric load data of each substation. When receiving such data from substations, System Control at the head office is recommended to analyze the data and then give the feedback to Senior Manager Research and Investment regularly, who is responsible for investment planning at TANESCO.

4.2.2 Recommendations to JICA

Development partners, including the World Bank and International Monetary Fund, have provided supports for the enhancement of financial soundness of TANESCO, and monitored the progresses. JICA is recommended to continue its coordination with other development partners including the World Bank to make sure the implementing agency makes progress. It is especially recommended for JICA to monitor the progress of the development of electric power generating facilities to confirm that the implementing agency can reduce or cease the power purchases from EPPs when the generating facilities are completed at the end of 2014, as the power purchases from EPPs are the main reasons for the increase in the domestic electricity costs.

**4.3 Lessons Learned**

4.3.1 Improvement in the procurement process at the implementing agency

According to the implementing agency, some maintenance works are not implemented as planned due to the delays in procurements, despite that it has sufficient budget for maintenance. When similar problems happens in the infrastructure sector including power sector in Tanzania and other countries, it is desirable to provide training and technical supports for the improvement in budget formulation and procurement processes. Such technical supports would include capacity building for procurement planning and capacity development for the preparation of procurement documents.

4.3.2 Flexibility in revising project implementation schedule by the coordination between Japan and recipient country

In this project, delay in the project implementation was expected when the project schedule was revised upon re-bidding. In the revised project implementation schedule, the longest process of the project implementation was the construction of a 132kV transmission line. The sequence to complete this process was the construction by the Tanzanian side, civil works by the Japanese side, construction of monopoles for transmission lines, and installation of 132kV transmission lines.

In order to shorten the project period, the construction of the Tanzanian portion was started before concluding E/N of the second phase of the project, so that the construction of the Japanese portion could start ahead of the planned schedule, based on the discussions between the project consultant and the implementing agency. By this flexibility in revising project implementation schedule, the project was completed in a shorter period, in spite of the expected delays. As a result of the shortened project period, increase in additional costs such as equipment rental costs or personnel costs were avoided.

When delays in project implementations are expected in other project for any reasons, it is important to keep the flexibility in the project implementation schedule to avoid delays, such as by revising the project schedule of both the Japanese portion and the recipient portion.

(End)