Zanzibar Electricity Corporation (ZECO)
Ministry of Lands, Housing, Water and Energy
The United Republic of Tanzania

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR
THE REINFORCEMENT OF POWER DISTRIBUTION IN ZANZIBAR ISLANDS
IN
THE UNITED REPUBLIC OF TANZANIA

MARCH 2011

JAPAN INTERNATIONAL COOPERATION AGENCY

YACHIYO ENGINEERING CO., LTD

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey on the project for the Reinforcement of Power Distribution in Zanzibar Islands in the United Republic of Tanzania, and organized a survey team headed by Mr. Kiyofusa Tanaka of Yachiyo Engineering Co., Ltd. between August 2010 and March 2011.

The survey team held a series of discussions with the officials concerned of the Government of Tanzania, and conducted field investigations. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the United Republic of Tanzania for their close cooperation extended to the survey team.

March 2011

Kyoko KUWAJIMA
Director General,
Industrial Development Department
Japan International Cooperation Agency

Summary

① Country Overview

The United Republic of Tanzania (hereinafter called Tanzania) is a unitary republic founded in 1964, when Tanganyika, the mainland, and the islands of Zanzibar were united. With an area of 945,037 square kilometers and a population of approximately 43,740,000 (2009, World Bank), Tanzania is the biggest country in East Africa. Although Zanzibar is part of the country, it has its own president, a unicameral assembly, courts, etc. Zanzibar consists of many islands including Unguja, and Pemba. Unguja, the target site of the Project, contains Zanzibar City, the capital. The area of Unguja is 1,554 square kilometers and the population is approximately 620,000. It is located at latitude 6 degrees 9 minutes south and longitude 39 degrees 11 minutes east. It has a tropical climate with a heavy rainy season (March to May) and a lighter rainy season (November and December). Although it is comparatively cool from June to September, it is extremely hot from December to February. With rich tourism resources, including a World Heritage site, it is also a popular tourist destination, with about 140,000 tourists visiting every year (2008, Zanzibar Commission for Tourism). The industry breakdown of primary, secondary and tertiary industries is 37.3%, 14.6% and 39.1% (2010, MKUZA II), showing the high rate of the service industry. However, as the income of 49% of the total population of Zanzibar is below the basic poverty line (Household Budget Survey, 2004/2005) and the GNI per capita in 2009 was 557 US dollars (2010, MKUZA II), the income level is still low.

② Background and Outline of the Project

In July 2005 the government of Tanzania established the National Strategy for Growth and Reduction of Poverty (NSGRP) with the aim of poverty reduction. Zanzibar also created its own poverty reduction plan, the Mpango wa Kukuza uchumi na kuondoa umashini Zanzibar (MKUZA), which reflected the policies of NSGRP and stated that the improvement of the electricity sector, etc., would contribute to economic growth and poverty reduction. The next MKUZA II (2010-2015) states that, relating to public investments, development in such areas as airports, port facilities, roads, the environment and water resources would be actively carried out and the program would be executed through the replacement of the existing electric facilities, which are obviously aging. Moreover, the Zanzibar Energy Policy 2009, a concrete action policy for the electricity sector, mentions such solutions as the increase of the transmission capacity for hydroelectric power from the mainland that is less expensive compared with fossil fuel power.

On the mainland of Tanzania, capital investment in the electricity sector was kept low for many years due to the privatization policy; thus, the maintanance of electricity equipment became difficult. Therefore, the past policy was reviewed in 2006 and electric power development plans have been actively carried out and power transmission and distribution networks in urban areas have been improved and expanded since then. On the other hand, in Zanzibar, the development of the electricity sector has become increasingly difficult due to the lack of funds and the electricity supply is failing to meet demand. A stable power supply is not even guaranteed, as seen in the extensive three-month power outage in 2009 caused by a damaged undersea cable. Under these circumstances,

the Tanzanian government requested the Japanese government to assist in the improvement of power distribution facilities for a stable power supply in Unguja Island through such actions as the installation of new substations, rehabilitation and renewal of existing substations and the new installation and replacement of distribution lines in Zanzibar. In response, JICA conducted a preliminary survey in February 2010 to investigate existing power demand and the state of deterioration and problems of the power supply equipment and to conduct a preliminary review of the scope of cooperation. As a result, the relevance of the replacement and new installation of 33 kV transformation and distribution facilities in Unguja Island has been confirmed.

③ Outline of the Survey Results and Contents of the Project

Based on the results of the above-mentioned preliminary survey, the Government of Japan decided to carry out a preparatory study for cooperation and JICA dispatched a preparatory study team to Tanzania from September 20 to October 25, 2010, for project site investigation and collection of relevant materials as well as confirmation of the details of the request and discussion on the project activities. After returning to Japan, the study team considered the necessity, social and economic effects and relevance of the project based on the data from the field survey, and summarized the results in the draft outline design. JICA dispatched a study team for the explanation of the draft outline design report from January 21 to February 2, 2011, to explain and discuss the draft basic design report and to obtain the basic agreement of the Tanzanian government. In accordance with the principle to “supply reliable and inexpensive energy to customers”, as stated in MKUZA, the poverty reduction program created by the Government of Zanzibar in 2007, the Project aims at the reinforcement of the power distribution network on Unguja Island. Based on the survey results concerning the condition of the existing equipment of ZECO, the maintenance and management system, environmental and social considerations, etc., the Project will carry out the rehabilitation of the Mtoni Substation, the renewal of 33 kV distribution lines, etc. The results of the environmental and social consideration study conducted in Tanzania will be reflected in the plan of distribution routes and the like. When planning the scale of the equipment and other relevant matters, the necessary equipment should be considered based on the demand forecast, etc., so that the quantity of the equipment will be minimized. The outline of the Project, which consists of seven components, is shown below:

1) Expansion of 33 kV facilities for Mtoni Substation
2) Installation of 33/11 kV Mwanyanya Substation
3) Installation of 33/11 kV Welezo Substation
4) Installation of 33 kV distribution lines for the South route
5) Installation of 33 kV distribution lines for the North route
6) Replacement of 33 kV distribution lines for the Fumba route
7) Procurement of equipment and materials for distribution lines

The rehabilitation work of the 33 kV Mtoni Substation, the major component of the Project, is to distribute electricity from the mainland of Tanzania to the whole island of Unguja by the 132 kV undersea cable that will be constructed by another donor, after the voltage is stepped down to 33 kV.

All the existing 33 kV facilities will be replaced and two new lines will be added. 33/11 kV transformers necessary for the electricity supply in Zanzibar City will also be replaced at the same time. The construction of a control building with indoor-type high-voltage switchgear cubicles on the site of the Mtoni Substation will create advantages such as minimum power cuts during the rehabilitation period and easy extension in the future. The existing transformation facilities will be reusable as backup in the future. Under the Project it is planned that the electricity demand will be satisfied through the installation of 33 kV transformation facilities in new Mwanyanya and Welezo Substations, in addition to the installation of 33 kV distribution lines that will be described below. The purpose of the installation of distribution lines is to reinforce the 33 kV distribution network that supplies electricity throughout Unguja Island with the three routes (North, South and Fumba routes) from the Mtoni Substation and to improve the quality of electricity supply to the local regions that have plants, large hotels, sightseeing facilities, etc., and therefore has a large demand for electricity so that the currently unsatisfied electricity demand on Unguja Island will be satisfied. However, as the resettlement of residents will be unavoidable, the distribution routes need to be carefully considered to minimize such impact. The routes shall basically be constructed in the existing buffer zone parallel with the existing 33 kV distribution line. A bypass shall also be constructed to soften the electricity demand in the zone from Mwanyanya and Welezo Substations to the existing 33 kV branch points (Mahonda and Tunguu) in the suburbs. A concern related to the planning of 33 kV distribution routes is that there are many buildings alongside the streets and there is not much space left. Then the distribution route will intrude into right-of-ways and the use of conventional open wires will be difficult due to various road construction regulations. The resettlement of many residents in the areas along the distribution line will be unavoidable even if the line is constructed away from streets, as the ZECO standards require some safety distance between residents and the like and open wires. As a result of a joint discussion with the Department of Environment, ZECO and other relevant parties on the possibility of using insulated cables (ABC cables) for the Project to ensure safety and relaxing the regulations concerned, it has been agreed that, in the zones where distribution lines have to be constructed within the safety distance, ABC cables will be used and the safety distance will be reduced. Thus, under the Project, the routes for the 33 kV distribution lines have been planned in a way so as to minimize the resettlement of residents.

④ Construction Period and Project Cost Estimation

The organization responsible for the Project is the Ministry of Lands, Housing, Water and Energy (hereinafter called MLHWE) of the Government of Zanzibar, and the executing body is ZECO. The period of the procurement of necessary equipment including installation is expected to be around 23.5 months. The cost which will be covered by the Tanzania side required for the implementation of this cooperation project is estimated at around 169 million yen.

⑤ Project Evaluation

The following are the outcomes expected from the implementation of the Project:

1. Reduction of outage
   As there is no extra 33 kV distribution line, it is difficult to ensure a stable power supply with an alternative route in case of an accident or the like; therefore, power outage caused by an accident lasts a long time. The implementation of the Project will reduce the time required for recovery and shorten the power outage time per year from the current time of approximately 120 hours to the minimum of about 12 hours.

2. Increased Capacity of Electricity Supply Facilities
   The current electricity supply is 40 MW due to the existing facilities. If the transmitting lines are improved, the supply capacity will increase from 40 MW to 78 MW.

3. Reduction of Voltage Drop on Consumer Side
   As the existing distribution capacity has no reserve, the electricity supply to public facilities has been faced problems. The implementation of the Project will increase the supply capacity of the distribution lines and improve the voltage drop from 10-20 % to 2-9 %.

4. Decreased Power Loss
   Overloading of the existing distribution lines causes large power loss. After the implementation of the Project, the scale of the facilities will meet the demand and the power loss will decrease from the current 7 MW to 5 MW or below.

As the Project is expected to have profound effects such as the realization of stable and continuous power supply in Zanzibar and Unguja Island, and also to contribute to the promotion of the national plan of Tanzania and consequently to the improvement of the life of the entire nation through industry development and poverty reduction, it is relevant to implement this grant aid project of Japan. It does not seem that there will be a problem with the operation and maintenance of the Project as enough staff members and skills can be secured within the current organization of the recipient country if technical transfer is conducted through OJT by Japanese engineers, etc. The following are the important points that may have a direct impact on the smooth implementation of the cooperation project:

(1) If there is a delay in agreeing upon compensation for or obtaining agreement from the residents who will be affected by the construction of the 33 kV distribution lines, the construction schedule of the distribution lines will be affected. Therefore, the Tanzanian side should pay attention to the progress status of the related procedures.

(2) As for the Fumba route, which will be constructed under the Project, there is also a plan for another donor to install transformation facilities. Therefore, the Tanzanian side should carefully coordinate the facility allocation plan and installation schedule so that neither of the projects will be impeded.

(3) If there is a delay in the 132 kV construction work that will be carried out by another donor, it will affect the development of the effects of the Project. Therefore, the Tanzanian side should

carefully coordinate the facility allocation plan and installation schedule so that neither of the projects will be impeded.

(4) Tanzania has to carry out without delay the budgeting procedures for the construction work to be covered by the Tanzanian side and make sure all the necessary works will be completed before the implementation of the Project. As for land acquisition, although discussion with land users is scheduled to end in February 2011, land preparation has to be completed before construction starts and the Tanzanian side should carefully coordinate the land acquisition schedule so that the Project will not be impeded.

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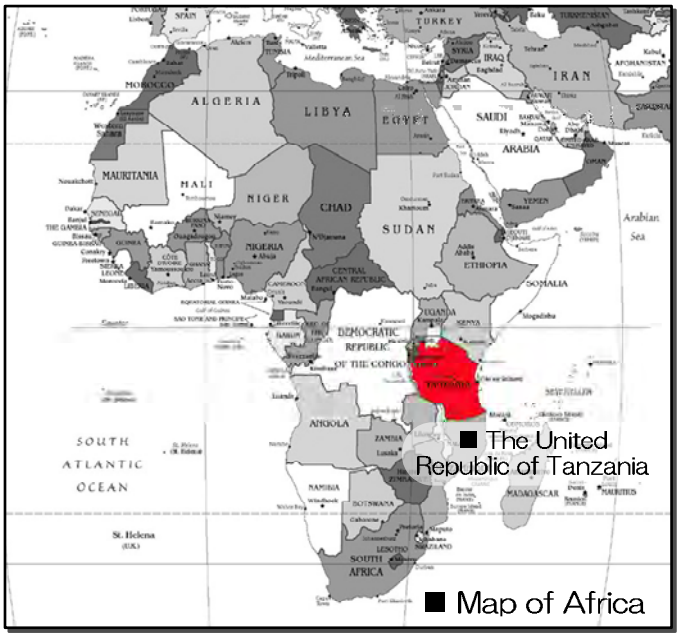

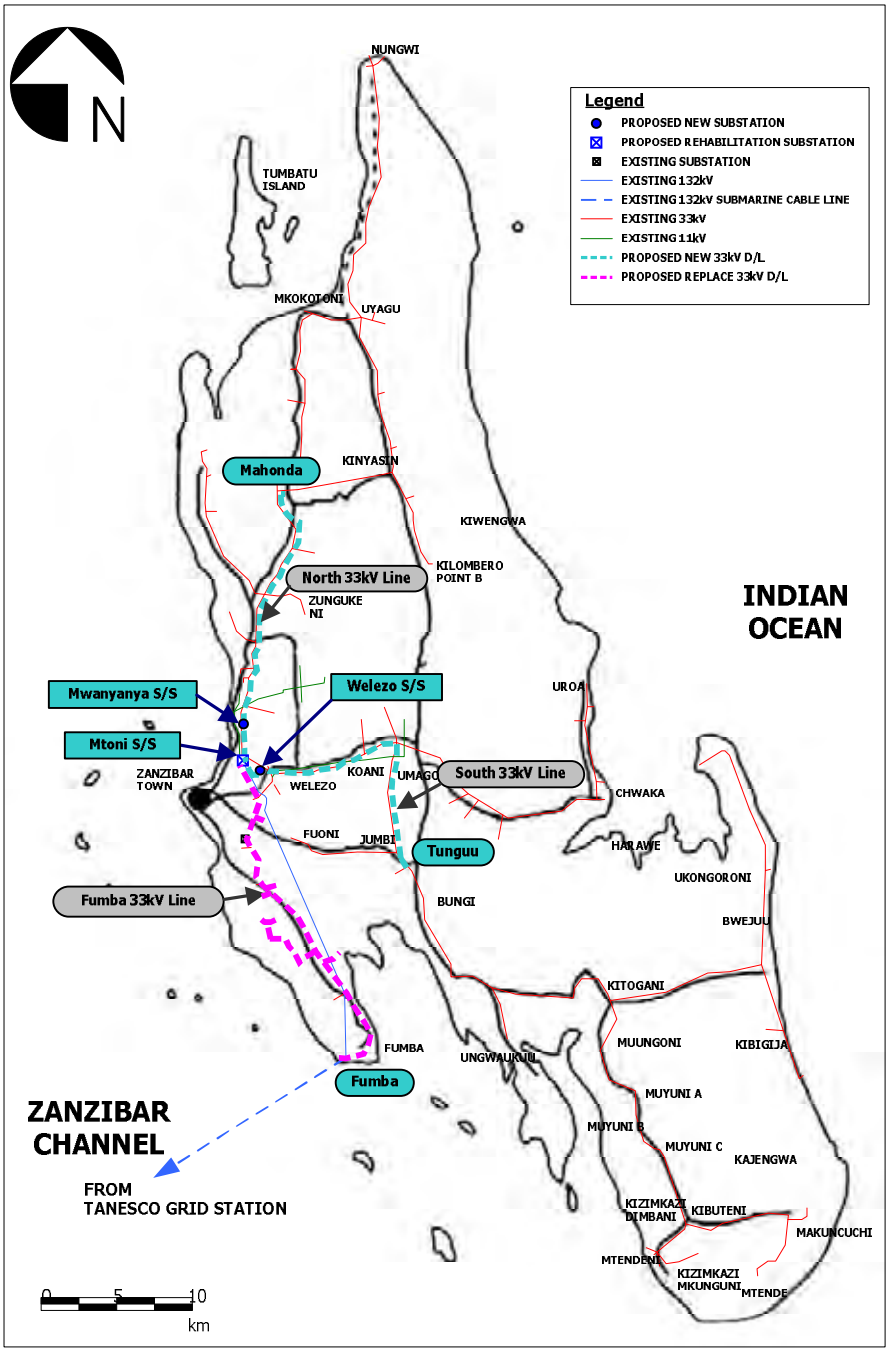

Location Map

Perspective （Mtoni S/S）

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Abbreviations

A/P	Authorization to Pay
ABC	Aerial Bundled Cable
AC	Alternate Current
ACSR	Aluminum Conductor Steel Reinforced
ASEAN	Association of Southeast Asian Nations
BOL	Benson Online
CEO	Chief Executive Officer
CCM	Chama Cha Mapinduzi
CUF	Civic United Front
DAC	Development Assistance Committee
DC	Direct Current
DFID	Department for International Development
DoE	Department of Environment
E/N	Exchange of Notes
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EWURA	Energy and Water Utility Regulatory Authority
G/A	Grant Agreement
IEC	International Electrotechnical Commission
IMF	International Monetary Fund
ISO	International Organization for Standardization
JCS	Japanese Electrical Wire and Cable Maker's Association Standards
JEC	Japanese Electrotechnical Committee
JEM	Standards of Japan Electrical Manufacturer’s Association
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standards
LBS	Load Break Switch
LED	Light-Emitting Diode
MALE	Ministry of Agriculture Livestock and Environment
MCA-T	Millennium Challenge Account-Tanzania
MCC	Millennium Challenge Corporation
MCCB	Mold Case Circuit Breaker
MEM	Ministry of Energy and Minerals
MKUZA	Mpango wa Kukuza uchumi na kuondoa umashini Zanzibar
MLHWE	Ministry of Lands, Housing, Water and Energy
MLYWCO	Ministry of Labor, Youth, Women & Children Development
NORAD	Norwegian Agency for Development Cooperation
NSGRP	National Strategy for Growth and Reduction of Poverty
O&M	Operation and Maintenance

OJT	On the Job Training
ONAN	Oil Natural Air Natural
PAPs	Project Affected Peoples
PRS	Poverty Reduction Strategy
PVC	Polyvinyl Chloride
RAP	Resettlement Action Plan
ROW	Right of Way
SIDA	Swedish International Development Cooperation Agency
SWGR	Switchgear
TANESCO	Tanzania Electric Supply Company Ltd.
TOR	Terms of Reference
TTCL	Tanzania Telecommunications Corporation
VAT	Value-Added Tax
VCB	Vacuum Circuit Breaker
ZAWA	Zanzibar Water Authority
ZECO	Zanzibar Electricity Corporation
ZRB	Zanzibar Revenue Board
ZSFPC	The Zanzibar State Fuel and Power Corporation

CHAPTER 1

BACKGROUND OF THE PROJECT

Chapter 1 Background of the Project

1-1 Background and Outline of the Project

Tanzania considers electricity to be an important base for improving the living standard of the people and promote the economy. Therefore, the Tanzanian government started to restructure the electricity sector in 1993. However, as the reform plan included the breakup and privatization of TANESCO, official support including support from donors to the electricity sector was slowed down. After that, until the decision to cancel the privatization of TANESCO in 2006, capital investment was not sufficiently made to meet the increasing electricity demand and the existing facilities were not well maintained; therefore, the electricity supply facilities in Tanzania are in extremely poor condition. Under these circumstances, while the central government is carrying out a long-term electricity development program for the 25 years until 2033 as stated earlier and is also conducting improvement and extension of power distribution lines in each city, there is no such plan in Zanzibar due to the lack of funds. In Zanzibar, where most of the foreign revenue comes from the tourism industry, the electricity supply is frequently interrupted by supply restrictions and failures of facilities due to insufficient capital investment and maintenance caused by the above-stated reforms in the electricity sector. In December 2009 there was a three-month power outage caused by an accident at the receiving end of the undersea electricity cable from the mainland of Tanzania. Regarding the electric power supply in Zanzibar being independent from the mainland, ZECO has its own organization, regulations and electricity supply services. On Unguja Island electricity is distributed by an undersea cable from the mainland, and on Pemba Island electricity is distributed by an undersea cable from the mainland and also generated with diesel fuel. Although the electrification rate in Unguja Island, the target area of the preparatory study for the Project for Reinforcement of Power Distribution Network in Zanzibar, which is planned to be conductred, has reached 82%, such factors as the increasing tourism demand, overloaded distribution lines and aging facilities have caused frequent power outages, voltage drops and other major issues that are damaging the reliability of the electricity supply. According to ZECO, the loss of transmitted electricity is 32% (system loss and transmittion/distribution loss). As a result, many hotels and companies in the island have to use private power generators as a supplementary power source and the distribution facilities in the island is failing to meet the increasing demand. Moreover, the electricity demand from schools, hospitals and other social welfare facilities as well as general households are increasing, so a stable electricity supply is not guaranteed.

Under these circumstances, the Government of Tanzania requested the Government of Japan to assist in the improvement of power distribution facilities for a stable power supply on Unguja Island through such actions as installation of new substations, rehabilitation and renewal of existing substations and new installation and replacement of distribution lines in Zanzibar.

1-2 Natural Conditions

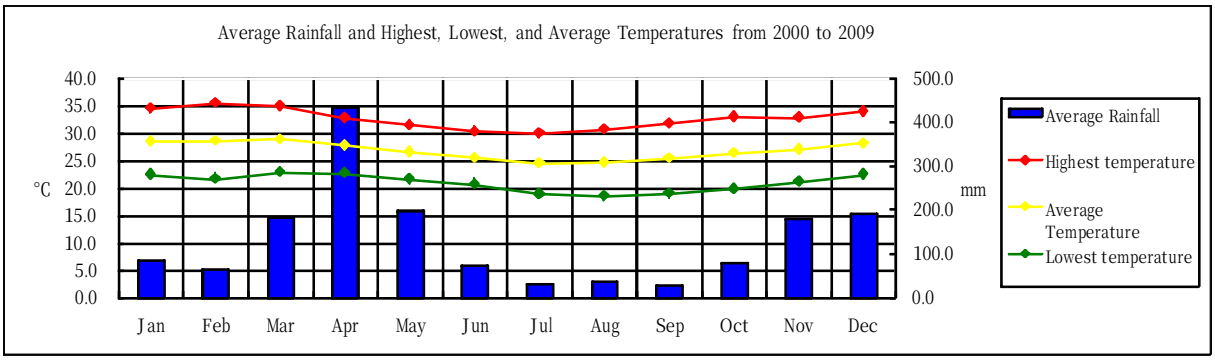
1-2-1 Location

Zanzibar consists of a group of islands, including Unguja and Pemba islands, located in the waters of the east coast of mainland Tanzania. It is located at latitude 6 degrees 9 minutes south and longitude 39 degrees 11 minutes east.

1-2-2 Climate (temperature, rainfall, relative humidity, wind velocity and lightning)

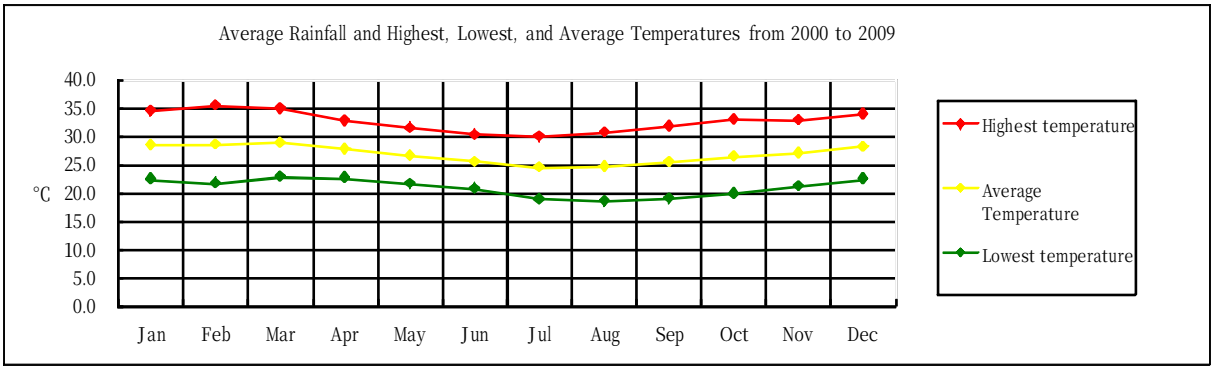
1-2-2-1 Temperature, rainfall and relative humidity

Zanzibar is in the tropical climate zone. It is hot and humid and there are two rainy seasons- the heavy rainy season (March to May) and the lighter rainy season (November and December). Although it is relatively cool from June to September, it is extremely hot from December to February, the mercury exceeds the 30-degrees-celcius point for many days. The average rainfall and highest, lowest, and average temperatures in the 10 years from 2000 to 2009 are shown in Figure 1-2-2-1.1 below, and the highest, lowest, and average humidity in the 10-year period are shown in Figure 1-2-2-1.2.



[Source] Tanzania Meteorological Agency, Zanzibar Office

Figure 1-2-2-1.1 Rainfall and Highest and Lowest Temperatures in Zanzibar

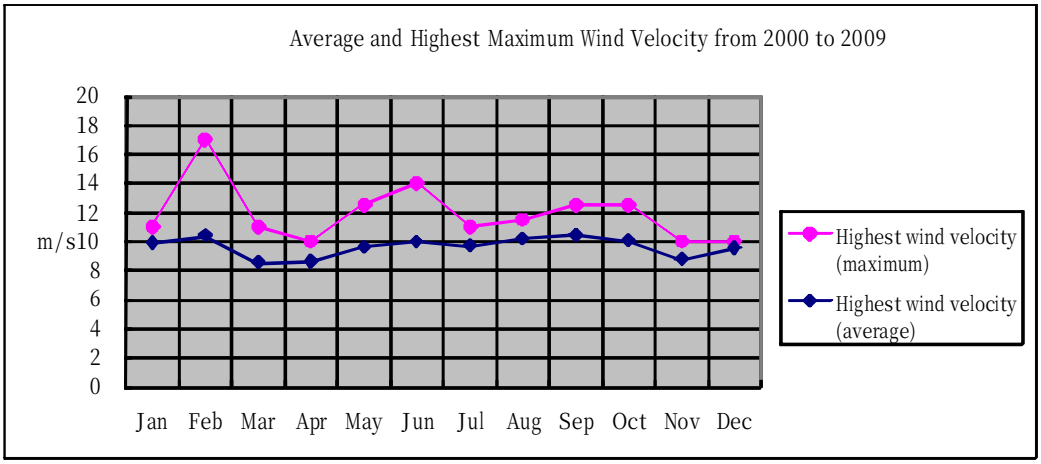


[Source] Tanzania Meteorological Agency, Zanzibar Office

Figure 1-2-2-1.2 Average and Highest Humidity in Zanzibar

1-2-2-2 Wind velocity

The average and highest maximum wind velocity in Zanzibar for the 10 years from 2000 to 2009 are shown in Figure 1-2-2-2.1.

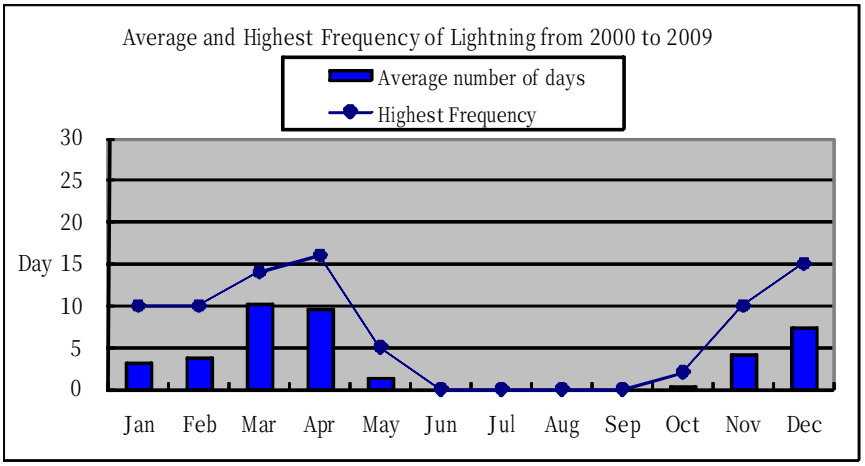


[Source] Tanzania Meteorological Agency, Zanzibar Office

Figure 1-2-2-2.1 Wind Velocity in Zanzibar

1-2-2-3 Lightning

The average number of days when lightning happened in Zanzibar in the 10 years from 2000 to 2009 and the highest frequency are shown in Figure 1-2-2-3.1.



[Source] Tanzania Meteorological Agency, Zanzibar Office

Figure 1-2-2-3.1 Occurrences of Lightning in Zanzibar

1-3 Environmental and Social Considerations

1-3-1 Overview of Project Components that Have Environmental and Social Impacts

The Project components are, as explained in 1-1, 1) Expansion of 33 kV Mtoni Substation, 2) Installation of 33/11 kV Mwanyanya Substation, 3) Installation of 33/11 kV Welezo Substation, 4) Installation of 33 kV distribution lines for the North route, 5) Installation of 33 kV distribution lines for the South route, 6) Replacement of 33 kV distribution lines for the Fumba route, and 7) Procurement of equipment and materials for distribution lines. Project components that have environmental and social impacts are from 1) to 6). The expansion and replacement of distribution lines especially require environmental and social considerations and introduction of insulated cables (ABC cables) and is examined as a measure necessary for easing the resettlement of residents.

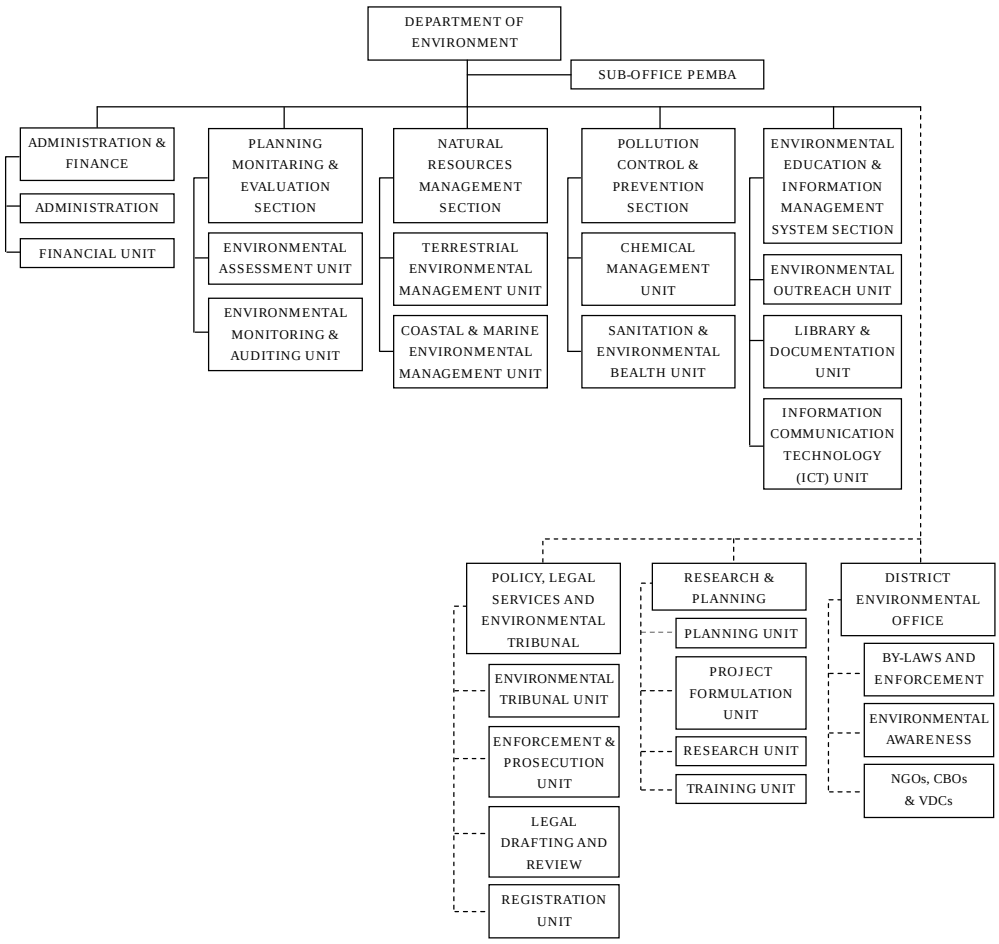
1-3-2 Environmental and Social Conditions

Zanzibar covers a total area of 2,654 km^2 with a population of 980,000. It consists of Unguja Island and Pemba Island. The Project site is Unguja Island, which covers an area of 1,554 km^2 with a population of 620,000. The island is divided into three regions: North, Urban/West and South. The center of the island is Zanzibar City, capital of the island, located on the west coast in the Urban/West region. Stone Town, which was registered as a World Cultural Heritage site in 2000, is its historic center. The main industries of Unguja Island are fisheries as well as tourism, utilizing the marine resort and other ocean resources. Agriculture is the main industry in the inland area and ecotourism is also important in conserved forest areas.

As for the natural condition, the area has rainy seasons from March to May and November and December. Thunder also occurs frequently in these seasons.

1-3-3 Organizational Frameworks of Environmental and Social Considerations in the Recipient Country

The organizational chart of the DoE as of October 2010 is shown in Figure 1-3-3.1 below.



(Sections linked with dashed lines are to be established in 2011.)

[Source] Department of Environment

Figure 1-3-3.1 Organizational Chart of Department of Environment (as of October 2010)

Environmental laws and regulations in Zanzibar are shown in Table 1-3-3.1 below.

Table 1-3-3.1 Environmental Laws and Regulations

#	Name	Enactment Year
1	Zanzibar National Environmental Policy	1992
2	Zanzibar Environmental Management Act for Sustainable Development	1996
3	National Forestry Policy	1999
4	Zanzibar Forestry Protection Management Act 10	1996
5	Zanzibar Fisheries Policy	1985
6	Zanzibar Fisheries Act	1968
7	Zanzibar Fisheries Regulations	2003
8	Zanzibar Electricity Corporation Act	2006

[Source] Department of Environment

The EIA schedule in accordance with the 2010 version of the EIA GUIDELINES AND PROCEDURES compiled by the DoE is shown in Table 1-3-3.2. According to the schedule, at the longest, 10 months is required from the production to approval of EIA.

- Preparation stage: within 30 days
- Compilation stage: within six months
- Decision-making stage: within three months

Table 1-3-3.2 EIA Schedule

#	Stage	Timing	Responsible agency
1	EIA. registration	EIA begins	Executing agency
2	Screening	Within 10 days after EIA registration	Agency responsible for environment
3	Screening assessment	Within 10 days after screening	Agency responsible for environment
4	TOR (draft) production if EIA is needed after screening	Within 6 months after screening approval	Agency responsible for environment
5	TOR confirmation	Several days after TOR (draft) submission	Agency responsible for environment
6	Submission of CV of 3 consulting firms and experts	Within 10 days after acceptance of TOP	From executing agency to agency responsible for environment
7	Expert evaluation	Within 10 days after submission	Agency responsible for environment
8	EIS achievement	Within 6 months	Executing agency
9	Disclosure of EIS	Within 5 days after submission	Agency responsible for environment
10	Comments	Within 20 to 30 days after EIS submission	Agency responsible for environment
11	EIS assessment	Within 30 days after comments	Agency responsible for environment
12	Required additional information	Within 5 days after assessment	Agency responsible for environment
13	Additional information required for agencies responsible for environment	Within 20 days after request	Executing agency
14	Decision-making on EIA approval	Within 10 days after assessment	Agency responsible for environment

[Source] ENVIROMENTAL IMPACT ASSESSMENT – GUIDELINES AND PROCEDURES: 2010 Version, DoE

1-3-4 Comparison of Alternatives (including zero option)

As described in 2-1, three alternative routes in Table 2-1.2 Comparison of 33 kV Distribution Line Plans are compared and the Project also chooses routes that have the least impact on residential

buildings (74).

1-3-5 Scoping

As a result of the former Preparatory Survey, the Environmental category was classified as “A.” The scoping results based on the discussions with ZECO and DoE are shown in Table 1-3-5.1. Because the major component of the project is additional construction to existing power distribution routes, it is considered to have no impact on the natural environment or it is not applicable in the items related to the natural environment and pollution based on the experiences of ZECO and DoE and the field surveys conducted in this study.

Table 1-3-5.1 Scoping Result

Impact		DRF stage			Summary and Reason
		Plan	During construction	During provision	
Social Environment	1. Involuntary resettlement	A-	D	D	The number of residents required to be resettled has decreased from the time when the Project was requested in July 2009 (from 588 houses to 74). As the scheme changed from mandatory resettlement to free selection of new locations with compensation money, the resettlement does not cause any new impact.
	○ Setback of houses, farms and water facilities	D	D	D	
	2. Local economy including employment and livelihoods	B+	D	B+	The local economy depends on primary (mainly agriculture) and tertiary (tourism) industries. The implementation of the Project helps vitalize the local economy by improvement of electric situation. Assistance must be provided for residents to prevent them from being forced to resettle under insufficient compensation.
	3. Land use and local resources use	B+	D	B+	While the Project helps vitalize the local economy, it contributes to effective use of land and local resources in concerned areas without changing them. Currently, the acquisition of partial lands used for the Weleso Substation and the Mwanayanya Substation has been underway.
	4. Social capital and other local decision-making	B+	D	B+	The Projects helps improve social capital, vitalize local exchange and improves the function as a city. Lands used for substations are neither common areas for residents nor playgrounds.
	5. Existing infrastructure and social services	B+	D	B+	The Project further improves the current social infrastructure and thus improves community services. As the construction may cause some inconvenience such as traffic regulation, measures will be put in place to ease such inconvenience.
	6. Local community	B+	D	B+	The Project eliminates the gap between communities and does not affect the relationship between them.
	7. Unfair distribution of benefits and damage	B+	D	B+	The Project is expected to correct unfair distribution of benefits and damage among areas.
	8. Gender	B+	D	B+	The implementation of the Project lessens excessive labor imposed on women, improves their rights, and is expected to enable their active participation in the community.
	9. Children’s rights	B+	D	B+	The implementation of the Project lessens excessive labor imposed on children and eliminates the gap regarding children’s rights in other areas.
	10. Cultural heritage	D	D	D	The Project Plan does not include contents that will impact Stone Town, a World Heritage site, which is located in the proximity of the Project site.
	11. Conflict of local interests	B+	D	B+	Because the Project is a public asset, no conflict of local interests, including uneven distribution of interests to certain beneficiaries, will happen. Conflicts related to resettlement can be also prevented by adequate assistance.
	12. Public health and safety	B+	D	B+	Because the implementation of the Project enables a stable supply to local hospitals, the function is expected to improve.

Impact		DRF stage			Summary and Reason
		Plan	During construction	During provision	
	13. HIV/AIDS and other infectious diseases	D	B-	D	Although the implementation of the Project is expected to bring the benefits explained above, it cannot be imagined that it will help increase those who are infected with HIV/AIDS, etc. and contact with those who are infected involved in the work is also unlikely to occur during the work. However, under the advice given by the Ministry of Health that the Project needs to take measures for possible expansion of infectious diseases associated with the construction, the Project shall be implemented without complete elimination of these possibilities.
	14. Water use, right	D	D	D	N/A
	15. Increase in accidents	D	B-	D	Accidents may happen during the implementation of the Project. Although no accident involving residents is likely to happen because the substations are surrounded by a fence, the distribution line may be cut off or may droop due to disasters, etc.
Natural Environment	16. Global warming	D	D	D	N/A
	17. Ecology and biota (animal fauna and biota)	D	D	D	Although forest conservation areas and mangrove forests exist on Unguja Island, they are not in the Project site and thus there is no impact on them. Red colobus monkeys, which habituate in some forest preservation areas, will not be regarded as an issue as those areas are situated away from the Project site (see Fig. 2-2-3-5.1). Impacts on migratory animals are not foreseen at this time, but monitoring will take place during the construction and upon completion of the Project.
	18. Characteristic topography/geology	D	D	D	The Project does not have any relationship with the geographical features of Unguja Island and have any impact on them.
	19.Soil runoff	D	D	D	Because the Project does not involve any such major digging work such as the replacement of a bridge, soil runoff during construction work is unlikely to be caused.
	20.Ground water	D	D	D	Although there are wells in some areas, the Project does not affect their use. It does not cause any permeation of wastewater underground and affect water quality of the wells during work, either.
	21.Hydrology	D	D	D	N/A
	22. Coastal region (mangrove forest, etc.)	D	D	D	Although there are mangrove forests in the coastal areas, they are not located in an area related to the Project.
	23.Weather	D	D	D	N/A
	24.Landscape	D	D	D	N/A
Pollution	25. Air pollution	D	B-	D	Because air pollution during construction or moving of vehicles is controlled by such measures as proper inspections and maintenance in order to reduce emissions, the Project does not cause any specific air pollution. However, it will be checked through monitoring during the construction.
	26. Water pollution	D	B-	D	Because water issues including water permeation during construction are safety handled, the Project does not cause any specific water pollution. However, it will be checked through monitoring during the construction.

Impact		DRF stage			Summary and Reason
		Plan	During construction	During provision	
	27. Soil pollution	D	D	D	N/A. Data will be taken before the construction, and will be evaluated during and after the construction. Monitoring for this purpose will take place.
	28. Wastes	D	B-	D	Because construction waste during construction work is appropriately removed for safe handling, there is no specific waste-related problem. However, it will be checked through monitoring during the construction.
	29. Noise/vibration	D	B-	D	Because noise pollution to be caused by heavy machines and vehicles is controlled through such measures as proper inspections, maintenance and use of noise-control devices or silencing apparatus, there is no noise-related problem. However, it will be checked through monitoring during the construction.
	30. Subsidence	D	D	D	N/A.
	31. Foul odor	D	D	D	N/A
	32. Low quality of river/lake/ocean	D	D	D	N/A
	33.Electric field, magnetic field	D	D	D	Although no impact of electromagnetic waves is assumed, it will be monitored based on the EIA.

A +/–: Serious impact is likely to be caused.
B +/–: Some impact is likely to be caused.
C +/–: Impact is unknown.
D: Almost no impact is likely to be caused.

[Source] Survey team

Figure 1-3-5.1 Map of Forest, Mangrove and home of Monkey

1-3-6 Survey Results of Environmental and Social Considerations

The EIA related to the project was approved by the Department of Environment on December 6, 2010. The EIA report is summarized as follows:

- Presented in the EIA were a summary of obtainable information on basic site conditions (including physical and air conditions, water and biological resources, cultural resources, and socioeconomic conditions in the Project site area). In the EIA process, information on basic site conditions and applicable standards and rules were used to evaluate potential environmental and social impacts of the substations and power distribution facilities proposed in the Project.
- Discussions with stakeholders (interviews and meetings with employees of governmental ministries and agencies and local governments, public organizations and private organizations) were held.
- Public hearing and discussions and meetings with stakeholders were used to examine all aspects of the Project that may cause environmental and socioeconomic changes. The importance of various aspects of the Project was evaluated based on standards. The scale, degree, sustainable duration, possibility of implementation of mitigation measures and control measures, possibility of environmental rehabilitation, and time-scale were taken in consideration of the standards.
- While national government authorities and some other stakeholders were decided based on the nature of the Project and its site, other stakeholders including groups in the site areas to whom the Project may cause impacts became clear as discussions progressed.

(1) Results of Public Hearing

It became clear in the meetings held on the Project site areas that local stakeholders agree on the development in general. They expressed opinions that include effects of the Project related to the use of local products and services they know (measures against power shortage and acceleration of economic development, etc.) as well as adverse effects (land acquisition and resettlement, etc.).

(2) Environmental and Social Impact Assessment

In the environmental and social impact assessment (ESIA), a large number of impacts related to the whole life cycle of the Project were identified.

Potential environmental impacts that were considered on the ESIA process include impacts on air quality, water resources, land resources, and socioeconomic/cultural conditions during material delivery, construction, and operation of substations and their related distribution facility infrastructure.

Measures recommended in material delivery and construction stages are:

- Control of noise pollution to be caused by heavy machines and vehicles through proper inspections and maintenance and use of noise-control devices and silencing apparatus
- Control of air pollution to be caused during construction and by vehicles moving through

proper inspections and maintenance for reducing gas emissions

- Control of adverse effects to be caused by construction waste by proper handling and immediate removal

A site waste management plan is also formulated by contractors before the beginning of closure work. Labor health and safety are carefully considered and managed through continuous inspections in order to prevent sicknesses and accidents in all stages and all workers are to be given briefings on safety and public health issues, environmental and safety issues on rescue procedures in emergencies before the inception of development work. Sufficient health and safety facilities, portable drinking water, and dust bins are supplied.

(3) Environmental Management Plan

An environmental and social management plan (ESMP) was formulated in order to implement proposed mitigation measures during the land selection, material delivery, construction, operation, and final closure stages of the Project. The plan focuses on measures to be implemented on site and in management activities in order to emphasize positive impacts while minimizing potential adverse effects.

An environmental monitoring plan was formulated in order to monitor the effectiveness of environmental mitigation measures and socioeconomic initiatives provided in the environmental management plan (EMP).

The monitoring plan consists of a series of mitigation and monitoring parameters and institutional measures to be taken during construction and operation of substations to be built in the Project as well as suggestions of action necessary to implement the measures in order to eliminate, offset, or ease adverse environmental and social effects.

(4) Assessment Results

The Project can be completed without causing any irreversible serious environmental or social impacts. Potential environmental and social impacts to be caused for land acquisition can be mitigated.

(5) Conclusion

When the nature and location of the development are considered, it is fair to conclude that potential impacts to be caused by the development of substations and distribution facilities can be mitigated, controlled, or eliminated by applying proper mitigation measures.

Both ZECO and the DoE confirmed that migrants to Kiwani Bay have not been affected by distribution facilities in the past. A field survey was conducted with the two organizations.

1-3-7 Impact Assessment

The impact assessment is described in the EIA report. The Project causes no other impact than the issue of resettlement of residents to be explained in the next section. However, the issues below are

summarized as matters of concern.

(1) Borrow Pits and Stone Pits

Borrow pits and stone pits in Zanzibar are located in three areas of Tunguu, Binguni, and Bweleo as shown in Figure 1-3-7.1. Those in Tunguu and Binguni are situated next to each other, approximately 15 kilometers away from the center of Zanzibar City. The borrow and stone pits in the areas are used by the Zanzibar Government under the management of MWCEL. The surrounding environment in the areas is as shown in the photographs below. Although the Tunguu site is adjacent to the official residence of the Vice President, the whole area is in a vegetated segment of bushes and weeds with a few scattered houses of the people working in the area. Because there is no pollution from the borrow and stone pits, there is no impact on the surrounding areas. The south route runs near Tunguu and Binguni and the Fumba runs near Bweleo.

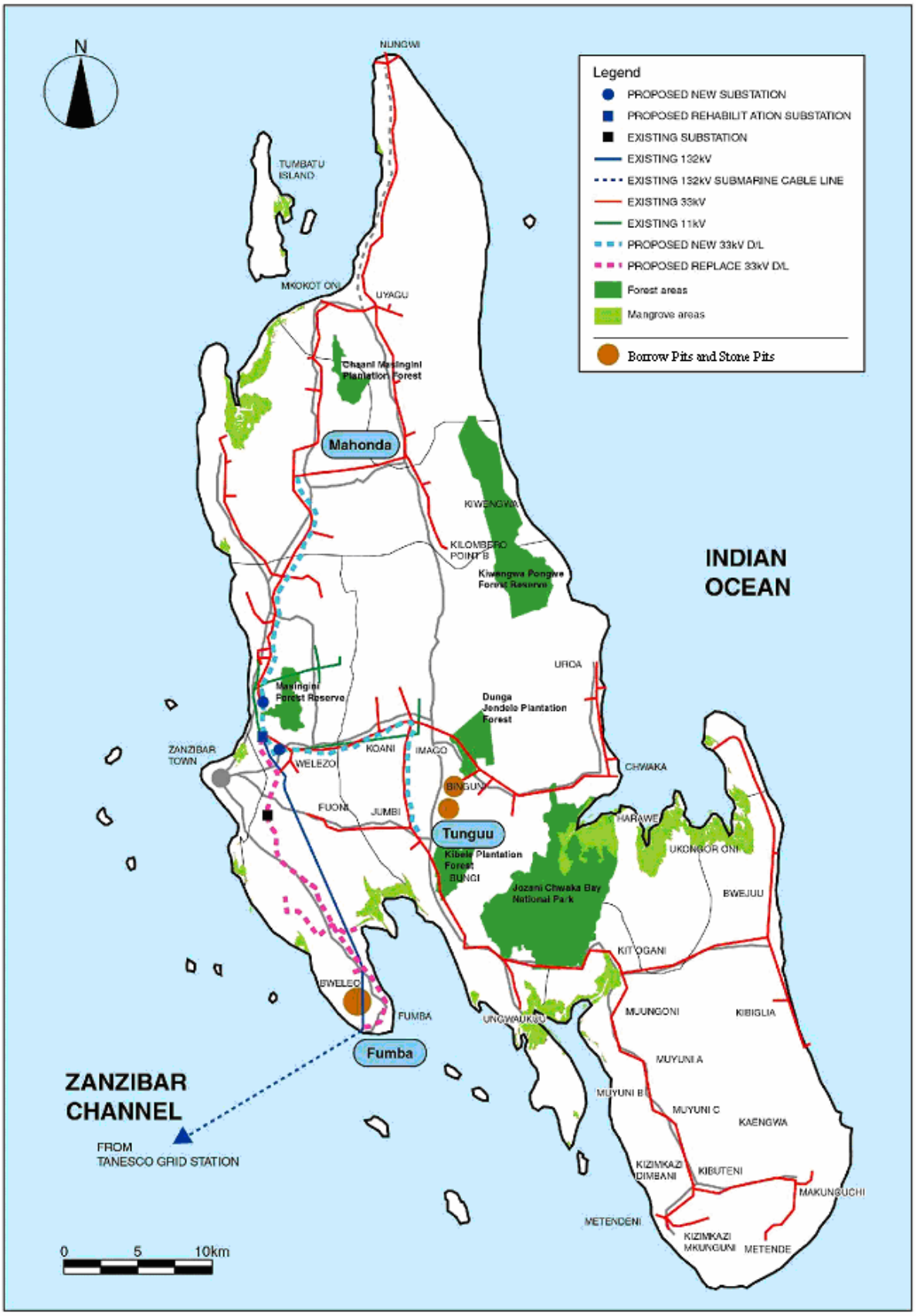


Figure 1-3-7.1 Location of Borrow Pits and Stone Pits

The photographs (A-F) below show borrow and stone pits in Tunguu.

Photo A Arterial road to borrow and stone pits

Photo B Area around borrow and stone pits

Photo C The building in the background is the official residence of the Vice President along the arterial road.

Photo D Access road in the pits is a narrow 2-lane earthen road.

Photos E and F Area of manual labor: Site visits require permission from a local leader (Shehas, the man in blue clothes on the right)

(2) System for Gender Program of the Project

With cooperation from the Ministry of Labor, Youth, Women & Children Development (MLYWCO), a gender program is planned to be implemented systematically.

(3) Assessment of Impacts of Waste Generated by Removal and Disposal of Existing Distribution Facilities

As described in Section 6.6.1.3 in the EIA report, waste generated by the removal and disposal of existing distribution facilities is disposed of at the waste disposal site in the suburb of Stone Town, according to ZECO.

The waste is industrial and thus it is usually difficult to dispose of directly at the disposal site (for general waste). In Japan, industrial waste is categorized into 12 types and the waste generated in the Project is classified as scrap metal, glass waste, concrete waste and ceramic waste and debris.

The waste disposal center is divided into a stable disposal site for general waste and a controlled disposal site for industrial waste.

(4) Impact of Electromagnetic Waves

As described in Section 6.5.2.4 in the EIA report, the report on the study of the impact by electromagnetic waves by TANESCO says that the waves have no impact. The public organizations below have made public the impact with the recognition that they have no impact on the human body.

1) World Health Organization (WHO): According to the guidelines of the international electromagnetic field project (1966) for the health risk assessment of electromagnetic fields, waves below 100 microteslas have no adverse effect. The maximum electromagnetic waves to be generated by the distribution line in the Project are below 20 microteslas.

2) According to Japanese overhead power transmission rules (Japan Electric Association), it is confirmed that the value of electromagnetic waves attenuate if the offset distance is secured. According to the study report on the impact of the electromagnetic field (1993) by the Resources and Energy Agency, the maximum electromagnetic field one meter above ground directly under the transmission line is 20 microteslas.

(5) Impact on Birds (migrants in particular)

1) Impact on Migrants

Most of the migrants to Kiwani Bay in the south of Unguja Island in Zanzibar come in the rainy season (March, April, and May). According to ZECO and the DoE, no electrocutions have been reported (see Appendix 7). Photographs below show Kiwani Bay.


Photos G and H: Kiwani Bay

2) Kinds of Migrants (information from concerned organizations)

The survey team obtained information on migrants from the following concerned organizations:

- Ministry of Agriculture, Livestock and Environment: Islam S.S. Mchenga (PhD)
- Director of Forestry: Dr. Bakar Asseid
- Officer of wildlife, Department of Environment: Mr. Alawi Hijja

According to the organizations above, the following birds live in Fumba:

- Sand piper
- Plovers
- Terns
- Herons
- Curlew sand piper
- European sand piper

Of the birds above, plovers, terns, curlews and pipers are migratory birds mostly coming from Eurasia and Asia in the rainy season.

3) Kinds of Migrants (information from specialized books)

BIRDS OF EAST AFRICA, Third edition 2006 by Struck Publishers (Kenya Tanzania Uganda Rwanda Burundi), introduces 265 species of birds. There are six migrant species to Tanzania as shown in Table 1-3-7.1, according to the book. There is no description of the migratory birds identified as such in Zanzibar.

Table 1-3-7.1 Species, Origin and Season of Migration to Tanzania

Species	Origin	Season
Black Kite	Eurasia	September to April
Little Stint	Eurasia	
Ruff	Eurasia	
European Roller	Eastern Europe, Asia	October to April
Isabelline Wheatear	Europe, Asia	October to March
Northern (European) Wheatear	Europe, Asia	September to March

[Source] BIRDS OF EAST AFRICA

Although the book contains a description of the Indian House Crow as a bird in Zanzibar, it is not categorized as a migrant. Because ZECO does not monitor the impact on migratory birds, the impact is to be monitored during construction and after provision in the Project.

1-3-8 Mitigation Measures and Their Cost

As described in Section 9.0--9.5 in the report, the cost for 19 mitigation measures totals US$19,300.

1-3-9 Monitoring Plan

As described in Section 10.0 in the EIA report, 18 items are to be monitored in the construction preparation, construction, and provision stages at a total cost of US$19,200. The overview of the monitoring plan is shown in Table 1-3-9.1. A form used for monitoring will adhere to Table 1-3-9.1 and will be created by Department of Environment.

This monitoring plan was formulated in accordance with the plan executed under MCA-T Project, and hence is considered valid. Monitoring is scheduled to take place before the commencement of the construction as well as once or twice a month during and after the construction.

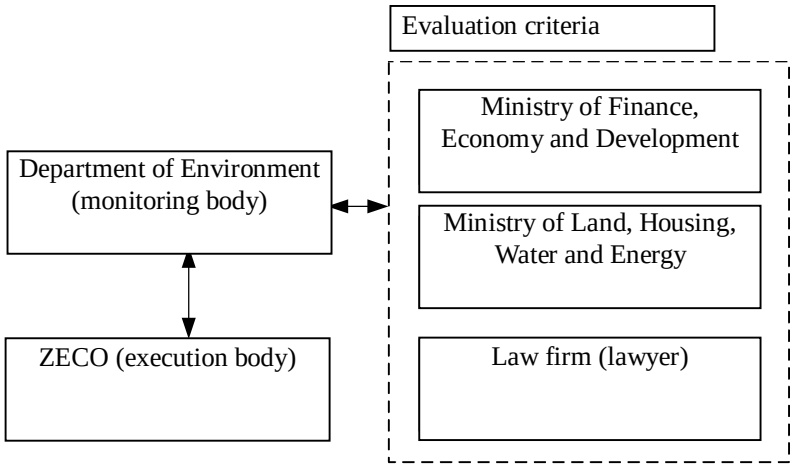


Figure 1-3-9.1 Organizations Responsible for Monitoring and Coordination with Related Institutions

Table 1-3-9.1 Environmental and Social Monitoring Plan

Aspect	Parameters	Monitoring frequency	Measurement Units	Method	Target level/ Standard	Responsibility for monitoring
Pre construction stage						
Air quality	SO_2	Once before the onstruction starts	mg/kg (hourly)	Detector tubes	0.1	DoE
	NO_x		µg/nm^3 (24 hrs)	Detector tubes	150	
	CO_2		ppm (1hr)	Detector tubes	35	
Noise Baseline	Noise level		dBA (equivalent)	Noise meter	55	
Vegetation Cover & Erosion	Vegetation Cover & Erosion	Once during pre-construction	Level of erosions	Site inspection		
Compensation and Resettlement	Rates used for crops & properties	Once before construction begins	-	File records and inquiry.	-	DoE /ZECO DoE
Disturbance to road reserve	Access to road reserve	Once before construction begins		Access to road reserve		
Construction stage						
Air pollution	SO_2	Three times a year	mg/kg (hourly)	Detector tubes	0.1	DoE
	NO_x	Three times a year	µg/nm^3 (24 hrs)	Detector tubes	150	
	CO_2	Three times a year	ppm (1hr)	Detector tubes	35	
Noise pollution	Noise level	Three times a year	dBA (equivalent)	Noise meter	55	
Soil contamination	Hydrocarbons	Twice a year	mg/kg	Liquid Chromatography–Mass spectrophotometer (LCMS)	5 (but depends on type)	DoE
	Lead	Three times a year	µg/kg	Atomic Absorption Spectrophotometer (AAS)	200	DoE
Noise/ Vibration	Noise level/ Vibration Level	Three times a year	dBA (equivalent)	Noise meter/Vibration meter	55/-	DoE
Traffic Flow	Number of vehicles	Three times a year	Traffic density	Traffic count	Number	ZECO
Occupational health and safety	Number and type of safety gears available to workers	Once a year	Number of safety measures provided	Records, inquiries and inspection	-	ZECO/District Health officers
Frequency of illness of construction workers	Illness of construction workers	Once per month	Number of cases	Health records	-	ZECO/District Health officers
Power interruption	Information on availability of services	Twice a month	Duration of cut-offs	Measuring and Observation	-	ZECO
Operation stage						
Air pollution	SO_2	Twice a year	mg/kg (hourly)	Detector tubes	0.1	DoE
	NO_x	Twice a year	µg/nm^3 (24 hrs)	Detector tubes	150	
	CO_2	Twice a year	ppm (1hr)	Detector tubes	35	
Noise pollution	Noise level	Twice a year	dBA (equivalent)	Noise meter	55	DoE
Flora and Fauna	Vegetation	Twice a year	-	Site inspection	-	DoE/ZECO

Aspect	Parameters	Monitoring frequency	Measurement Units	Method	Target level/ Standard	Responsibility for monitoring
Demographic changes	Population influx	Once in two years	Population influx	Monitoring population increase	-	LGAs
EMFs and Safety Hazards	Electric fields	Twice a year	Volts	Direct measurements by Electrometer		ZECO/DoE

1-3-10 Stakeholders' Meetings

Stakeholders' meetings were held separately for the military, concerned organizations, local leaders, and local communities. Table 1-3-10.1 shows the acceptance level of the meetings. Opinions expressed in the meetings are to be handled by ZECO, which now holds stakeholders' meetings regarding the resettlement plan (RAP).

Table 1-3-10.1 Acceptance Level of Stakeholders of the Project

Stakeholders	Acceptance Level		
	High	Medium	Low
Central Government: Ministries and Government Departments/Agencies	√		
Local Authorities: Regional and District Councils	√		
Local stakeholders/communities	√		
Other stakeholders	√		

ZECO distributes reports via She has, the local leaders in communities (Shelia) in relation to the EIA disclosure. They can be copied without any time limitation. It is understood as a transparency method regarding resettlement compensation demanded by local residents. Furthermore, the summary of the EIA report has been translated into Swahili and made comprehensible to local residents.

Tables 1-3-10.2 and 1-3-10.3 summarize the stakeholders' meetings explained above.

Table 1-3-10.2 Summary of Stakeholder Meetings (1) (Military and Concerned Organizations)

Date	Stakeholders	Opinions/Comments	Policies of the executing body
04/10/2010	Mtoni Military Camp	It did not know of the Project at first. After receiving detailed explanations, it strongly supports it as it is a government project.	Will provide sufficient explanation and promote information sharing.
	Mwanyanya Military Camp	As long as existing Row (land for public roads) is used for the distribution line, the Project does not contain any problem as it is a governmental initiative. A matter of concern is that the Project site includes farms and buildings. Sufficient compensation for them should be provided.	Will provide adequate compensation through adherence to third-party assessment.
	Welezo Military Camp	It cannot oppose a project for national development (such as the power distribution project).	Consult with related departments in ZECO and

Date	Stakeholders	Opinions/Comments	Policies of the executing body
		A memorandum should be concluded between ZECO and the military government for handling infrastructure safety. ZECO needs to allocate a budget for security units (such as kiosks).	the Ministry of Agriculture and Natural Resources, an upper institution, to take measures.
05/10/2010	Ubangi Military Camp	It knows of the Project and has no objections. However, it advised ZECO to use the left-side of the existing transmission line along the camp, because the military authorities have special use/facility on the left-side transmission line near Row. Compensation should be paid properly to all who are affected regardless of their rank or power.	Will create a route in accordance with the advice. Will provide adequate compensation through adherence to third-party assessment.
06/10/2010	Department of Land Administration	It knows of the Project and supports it as it helps development. It knows that ZECO filed an application for the title deed with the department and it is currently in the approval procedure stage. Under the law, those who have lived or cultivated land for over 10 years are deemed to be legal occupants of the land and thus compensation is required for them in such cases.	Will provide adequate compensation through adherence to third-party assessment.
	Mimi District – District Administrative Secretary	It is a beneficial project. It is significantly meaningful for sustainable development. Compensation is most important.	Will provide adequate compensation through adherence to third-party assessment.
	Department of Roads	ZECO has to guarantee that the Project does not interrupt the access right to roads that enable future road development and that it will reduce deaths in road accidents.	Will take necessary precaution to prevent equipment used for the Project from affecting the traffic.
	Ministry of Labor, Youth, Women and Children Development – Community Development Department	Payment of compensation should be made and meetings for it should be held not only with the head of the household (men) but also for and with each member (including women and children). By doing so, all family members can enjoy the benefits fairly. As a result of a stable supply of electricity – the advantage for women is that their capacity to conduct socioeconomic activities that require power improves. Health enhancement (use of electricity vs. use of firewood and charcoal)	Will provide adequate compensation through adherence to third-party assessment.
	Zanzibar Municipal Council	Improvement/stabilization of power supply helps local economy expand and improve services provided by local governments (improvement of waste management by incineration, etc.). RAP has to formulate a realistic resettlement plan to prevent return of residents who were moved after receiving compensation.	Will formulate a carefully considered plan to prevent return of the residents who are forced to move after receiving compensation.
	Department of Surveys and Urban Planning	It did not know of the Project plan at first. Compensation is extremely important in order to avoid disputes. ZECO should find out whether it is possible to conclude a written agreement with each military camp in order to operate the Project smoothly in their zone.	Will provide adequate compensation through adherence to third-party assessment. Will continue to share information with the military government.

Date	Stakeholders	Opinions/Comments	Policies of the executing body
07/10/2010	Western District – District Administrative Secretary	It strongly supports the Project. EIA and RAP need to solve all environmental and social impacts and disputes. It agreed that meetings are held for all Shehas (leader of Shehias, the smallest unit of autonomous bodies) at the local director's office in order to improve their awareness of the Project as well as meetings with communities in each area where the project is implemented.	Will continue to share information with the local community through discussion.
	Western District – District Council	It supports the Project. The EIA team has to come up with measures to prevent illegal collection of sand near electric poles. (It is often observed in Mwanakwerekwe and some other areas on Unguja Island) The executing agency needs to study measures to prevent disposal of solid waste and controlled burns currently carried out on the existing RoW that is planned to be used in the Project.	Formulated ESMP to implement environmental measures. Will use this plan to take appropriate measures.
	CODECOZ – NGO	Farming is conducted on a large scale along the buffer zone [1]. RAP needs to pay careful attention to the socioeconomic loss due to the loss of land (calculated based on past land use). (Actual physical appraisal at assessment is not sufficient.)	Will provide adequate compensation through adherence to third-party assessment.
	Department of Commercial Crops, Fruits and Forestry	Deforestation should be avoided as much as possible. Because part of the Project site may be adjacent to water sources (including Welezo and Mwanyanya S/S), ZECO needs to have discussions with ZAWA (Zanzibar Water Authority) in the design stage.	No problem has been identified from the discussion with ZAWA. Will have follow-up discussion with the authority when necessary.
	Zanzibar Water Authority (ZAWA)	It strongly supports the project. It is extremely beneficial for ZAWA. There is a major water pipe near Welezo S/S. ZECO needs to have discussions with ZAWA in the design stage to make the final plan acceptable for both parties.	No problem has been identified from the discussion with ZAWA. Will have follow-up discussion with the authority when necessary.
08/10/2010	Northern B. District – District Administrative Secretary (DAS)	The project benefits the Zanzibar economy and people's happiness. Education/awareness improvement is needed for residents before paying compensation so that they will understand the importance of their moving from the buffer zone. This will prevent their short-term return. ZECO needs to clarify the border of the buffer zone and manage it so that residents will not feel like entering it.	Will continue to provide local residents with explanation through stakeholder meetings.
	Commissioner for Agriculture Research and Extension	The Project will help improve the Zanzibar economy. While leaders of local governments need to be involved in the RAP process, the involvement of experts in agriculture who are familiar with the guidelines for compensation for tillable land is essential. ZECO needs to set a clear border 30 meters around the buffer zone.	Will provide adequate compensation through adherence to assessment conducted by a third-party familiar with compensation guidelines.

[1] In accordance with the power standards in Tanzania, the area within 30 meters of an electric pole shall be set as the buffer zone for the ACSR power distribution system that uses open wire.

28/1/2011	Zanzibar Water Authority (ZAWA)	Because the substation in the project is more than 500 meters away from the water source, it does not cause any water pollution. Electric power is essential for water facilities and thus the project should be begun as soon as possible.	No problem has been identified from the discussion with ZAWA. Will have follow-up discussion with the authority when necessary.

[Source] Survey team

Table 1-3-10.3 Summary of Stakeholders' Meetings (2)
(Local Leaders and Local Communities)

Date	Stakeholders	Opinions/Comments	Comment
09/10/2010	Local leaders (Shehas) in West District	They have shown their appreciation to the Government of Zanzibar and JICA for the Project. Past experience: Values for compensation agreed in the RAPS changed in the actual payment. They will evaluate the compensation in RAP accurately if ZECO-JICA implements the Project.	Will provide adequate compensation through adherence to third-party assessment.
13/10/2010	North "B" District Shehas	It should be made clear that compensation and the time for resettlement is given sufficiently for people who need to transfer. If there are poor people in the Project site, sustainability of the compensation needs to be considered. It should be made clear whether residences or buildings are within or outside the buffer zone. Those concerned with RAP need to know the process for obtaining realistic compensation. It is also necessary to notify the stakeholders about the scope of compensation-whether land usage within the buffer zone and non-landowners are also included in the scope. The stakeholders need to be assured that there is no danger related to distribution lines, which will be installed under the Project, as these lines are installed within the existing routes.	Will have a sufficient time frame for resettlement. Will continue to provide local residents with explanation through stakeholder meetings.
	Local Communities in Welezo, Magogoni and Mtofaani Shehias	They are positive regarding the Project of installing distribution routes in Unguja. However, any damage foreseen under the Project needs to be clarified. Therefore, formulation of RAP should include participation from local leaders and PAPs. The current and past land use needs to be understood for official compensation. Official and clear measures need to be put in place to minimize frustration within the communities subject to resettlement. ZECO needs to measure houses that are affected by the Project and toughen the clearance to distribution routes.	Will continue to provide local residents with explanation through stakeholder meetings.
14/10/2010	Local Communities in Kisauni and Maungani Shehias	It is a good project for the development of Zanzibar in general. Compensation should not be government-centered but people-centered. Misconduct in payment of compensation should be prohibited and transparency and fairness need to be maintained.	Will provide adequate compensation through adherence to third-party assessment. Will also make sure to prevent any misconduct when providing compensation.

Date	Stakeholders	Opinions/Comments	Comment
	Local Communities in Mtopepo, Kidatu and Welezo Shehias	People need to clarify the guidelines for compensation as well as space for the buffer zone (for ABC cable or ACSR). ZECO needs to protect areas to be affected in order to implement the Project. The due date of specific actions needs to be announced in order to give sufficient time to concerned parties in conducting PAPs.	Will continue to provide local residents with explanation through stakeholder meetings.
15/10/2010	Local Community in Mwera Shehia	It supports the Project that helps development. Compensation to PAPs is regarded as an issue. Because the primary goal is to protect and improve PAPs' life, the agenda should not be hidden and an assessment should be properly made. Patience and transparency are needed in the process of assessment and current conditions need to be considered. Prejudice, misconduct, and personal interest need to be eliminated in the assessment. Compensation needs to enable people to maintain or improve their life with consideration given to PAPs' sustainability. Although compensation should provide a new environment (land, house, farmland, etc.) to people as compensation, it should be remembered that Zanzibar is a rocky island where fertile and tillable land is limited.	Will provide adequate compensation through adherence to third-party assessment.

[Source] Survey team

1-3-11 Land Acquisition and Resident Resettlement

1-3-11-1 Necessity of Land Acquisition and Resident Resettlement

If there are buildings and crops within the buffer zone designated by ZECO, they need to be transferred to locations outside of the zone, where there are no effects, in consideration of the selected route for distribution lines installed for the Project. Taking this into consideration, ZECO will formulate and disclose its resident resettlement plan, and conduct necessary discussions. ZECO's resettlement policy changed from resettlement to prearranged locations to free selection of new locations upon compensation payments. ZECO's opinions on the compensation criteria and legal grounds for the policy change are described below.

(1) Criteria of Compensation

Compensation paid for people subject to resettlement under the Project will be based on the criteria used for MCA-T Project. The compensation which allows people to purchase new lands and secure houses will also apply for illegal property owners who are subject to resettlement. Under the Project, there are no illegal property owners.

(2) Legal grounds for the change in the resettlement policy

The above change of the resettlement policy is legally based on Legal Supplement (Part I) of Zanzibar Government Gazette Vol. CXV No. 6151 of 19th May, 2006. .

1-3-11-2 New Locations

Because ZECO's resettlement policy changed from resettlement to prearranged locations to free selection of new locations upon compensation payments, no new location will be suggested. While

sufficient resettlement time will be allocated, residents who are unable to find new locations before the construction will be asked to temporarily move to different locations at the time of construction. ZECO will have sufficient discussion with resettlement households in order to complete resettlement prior to the construction, and will also assist households who are unable to resettle for some reasons through means such as the provision of temporary shelters. There has been no official department responsible for compensation within ZECO, but for the purposes such as compensation, a team consists of the following members will be created under the Project;

- Ministry of Finance, Economy and Development Planning
- Ministry of Land, Housing, Water and Energy
- ZECO
- Department of Environment
- Law firm (lawyer)

1-3-11-3 Legal Framework Related to Land Acquisition and Resident Resettlement

Environmental laws and regulations in Zanzibar are shown in Table 1-3-3.1.

1-3-11-4 Scale, Scope, Cost and Financial Resources of Land Acquisition and Resident Resettlement

Tables 1-3-11-4.1, 1-3-11-4.2 and 1-3-11-4.3 show the scale of resident resettlement. A total of 138 buildings (including 74 households for resettlement) are affected, which involves resettlement of 509 people. According to Table 1-3-11-4.4 which shows the number of households with affected farmlands, 707 households are affected. Discussions with the affected people will be individually held to determine whether resettlement or set-back is needed for their houses. The results of the survey conducted by ZECO's land valuation team since November 2010 show that the same amount of compensation will be paid for both resettlement and set-back. Since the budget of RAP for the Project will be finalized in July 2011, decisions regarding resettlement or set-back need to be discussed and made by the end of June 2011.

Table 1-3-11-4.1 Affected Buildings and Residents

Number	Component	Area	Affected buildings	Residents Who Need Resettlement
1	Installation of 33 kV distribution lines for the North route	Chuini/Mwanyanya	30	145
		Mfenesini	5	36
		Kitope	4	31
		Mahonda	9	20
		Mkataleni	1	0
2	Replacement of 33 kV distribution lines for the Fumba route	Kisauni	0	0
		Maungani	0	0
		Kombeni	9	45
		Dimani	4	44

Number	Component	Area	Affected buildings	Residents Who Need Resettlement
		Fumba	8	56
		Bweleo	16	63
3	Installation of 33 kV distribution lines for the South route	Magogoni	9	13
		Mtofaani	23	28
		Mwera	17	22
		Ubago	3	6
		Jumbi	0	0
4	Land for new substation	Mwanyanya	0	0
		Welezo	0	0
	Total		**138**	**509**

[Source] ZECO Valuation Report

Table 1-3-11-4.2 Affected Buildings by Building Type

Component	Area Community	HOUSES	INCOMPLETE BUILDINGS	FOUNDATION	WALL	HUT	MADRASA /MOSQUE	SHOP	HEALTH CLINIC	TOILET	Total
Installation of 33 kV distribution lines for the North route	Chuini	11	2	5		11					29
	Mwanyanya			1							1
	Mfenesini			2		3					5
	Kitope	1			1	2					4
	Mahonda	2	1	1		5					9
	Mkataleni		1								1
	Subtotal	**14**	**4**	**9**	**1**	**21**	**0**	**0**	**0**	**0**	**49**
Replacement of 33 kV distribution lines for the Fumba route	Kisauni										0
	Maungani										0
	Kombeni	5	2	2							9
	Dimani	2		1		1					4
	Fumba	2	2			4					8
	Bwelezo	6	6	1	1	1	1				16
	Subtotal	**15**	**10**	**4**	**1**	**6**	**1**	**0**	**0**	**0**	**37**
Installation of 33 kV distribution lines for the South route	Magogoni	1	2	5		1					9
	Mtofaani	6	3	13	1						23
	Mwera	6	3	5	2	1					17
	Ubago	3									3
	Jumbi										0
	Subtotal	**16**	**8**	**23**	**3**	**2**	**0**	**0**	**0**	**0**	**52**
Total		**45**	**22**	**36**	**5**	**29**	**1**	**0**	**0**	**0**	**138**

[Source] ZECO Valuation Report

Note: Of the above, the number of households to be relocated totals 74—45 houses and 29 huts.

Table 1-3-11-4.3 People Who Need Relocation by Building Type

Component	Area Community	HOUSES	INCOMPLETE BUILDINGS	FOUNDATION	WALL	HUT	MADRASA /MOSQUE	SHOP	HEALTH CLINIC	TOILET	**Total**
Installation of 33 kV distribution lines for the North route	Chuini	84				61					145
	Mwanyanya										0
	Mfenesini					36					36
	Kitope	17				14					31
	Mahonda	10				10					20
	Mkataleni										0
	Subtotal	**111**	**0**	**0**	**0**	**121**	**0**	**0**	**0**	**0**	**232**
Replacement of 33 kV distribution lines for the Fumba route	Kisauni										0
	Maungani										0
	Kombeni	45									45
	Dimani	42				2					44
	Fumba	48				8					56
	Bwelezo	61				2					63
	Subtotal	**196**	**0**	**0**	**0**	**12**	**0**	**0**	**0**	**0**	**208**
Installation of 33 kV distribution lines for the South route	Magogoni	11				2					13
	Mtofaani	28									28
	Mwera	20				2					22
	Ubago	6									6
	Jumbi										0
	Subtotal	**65**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**69**
Total		**372**	**0**	**0**	**0**	**137**	**0**	**0**	**0**	**0**	**509**

[Source] ZECO Valuation Report

Table 1-3-11-4.4 Households Whose Farmland Is Affected

Component	Area	District	NO.	Community	Affected Households
Installation of 33 kV distribution lines for the North route	NORTH	NORTH B	1	KITOPE	63
			2	MAHONDA	30
			3	MKATALENI	20
			Subtotal		
	URBAN WEST	WEST	1	CHUINI	77
			2	MFENESINI	18
			Subtotal		
Installation of 33 kV distribution lines for the South route & Replacement of 33 kV distribution lines for the Fumba route	SOUTH	CENTRAL	1	UBAGO	64
			2	KOANI	15
			3	JUMBI	38
			4	TUNGUU	1
			Subtotal		
		WEST	1	MWERA	23
			2	MTOFAANI	19
			Subtotal		
	URBAN WEST	WEST	1	MAGOGONI	10
			2	MWANAKWEREKWE	7
			3	MOMBASA	43
			4	TOMONDO	7
			5	KISAUNI	68
			6	MAUNGANI	42
			7	KOMBENI	39
			8	DIMANI	46
			9	BWELEO	49
			10	FUMBA	28
			Subtotal		
Total					707

[Source] ZECO Valuation Report

1-3-11-5 Concrete Plans of Compensation and Support

The assessment for compensation payable for buildings and crops subject to resettlement in the Project was conducted by the organizations shown in Table 1-3-11-5.1. Currently, ZECO is studying concrete measures for compensation and support in time for discussion, which will be based on the assessment result and will be held in the early 2011 to determine compensation for respective targets. A compensation payment scheme and a complaint procedure are shown in Section 2 of 1-3-13-2.

Table 1-3-11-5.1 Organizations Conducting Compensation Assessment for Resident Resettlement

Assessment bodies (names of organizations)	MLHWE, DoE Ministry of Agriculture and Natural Resources
Assessor	DoE Commission for Agriculture, Research and Extension
Assessment period	From November to December in 2,010

1-3-11-6 Implementation System and Complaint Handling Mechanism

ZECO, the executing agency of the Project, mainly promotes the implementation system. There is an urgent need to secure expert human resources who will handle various complaints from affected local residents in addition to environmental issues and land issues and work on the system. Because it is decided that, the local leaders serve as the contact point of the disclosure of EIA and RAP while ZECO is in charge of the management and storing, the leaders are also expected to handle complaints. As for monitoring by the executing agency, issues of human resources development, production of monitoring form and other related issues are to be conducted through discussion with DOE, because ZECO has no past experience. A monitoring scheme needs to be set up before the beginning of the Project at the latest, and is currently studied in concrete terms. For implementation of the Project, currently the scheme described in Issue 2 of 1-3-13-2 is discussed.

1-3-11-7 Implementation Schedule (beginning of physical resettlement after completion of compensation payment for lost assets)

Table 1-3-11-7.1 shows the resettlement schedule.

Table 1-3-11-7.1 Resettlement Schedule

Stage	Contents
1	ZECO's resettlement plan (employment of private firm for formulation of plan) (1) Stakeholders' meeting for PAPs (2) Survey for relation plan (3) Formulation of RAP
2 Case 1 Case 2	ZECO's action RAP is evaluated by MWCEL. Farms are evaluated by MALE.
3	Contents to be implemented after evaluation of ZECO plan (1) Detailed resettlement plan (2) Budget securing for compensation cost (3) Payment of compensation cost (4) Resettlement
4	Construction

[Source] RAP report

1-3-11-8 Residents' Meeting

(1) Concrete Compensation Policy

As mentioned earlier, because ZECO's resettlement policy changed from one in which it prepared for the new location to free selection of the new location after compensation payments, the contents were explained and individual interviews were held at the stakeholders' meeting. RAP was made public in the same manner as the disclosure of EIA explained earlier.

(2) Livelihoods/Major Industries

Of the population of 980,000 in Zanzibar, 620,000 live on Unguja Island where the Project is to be implemented. The main industries are agriculture (copra, spices, palm oil, etc.), fisheries, and tourism. The livelihoods and major industries in the Project site are related to the farms.

(3) Advantages and Disadvantages of Changes of Lifestyle

Mainland Tanzania and Zanzibar consist of ethnic groups who are Islamic, Christian and local religions. However, there is no discrimination or conflict between religions (ethnic groups) and they live peacefully, maintaining the lifestyle of Zanzibar. In such an environment, the Project does not cause any lifestyle changes as people can choose their new location freely with compensation money without forced resettlement.

(4) Compensation by the Government of Zanzibar

There is a gap in the amount of compensation paid by the Government of Zanzibar to the resettling residents between the results of valuation by ZECO and demands of the residents. The issue shall be discussed later. According to the appraisers, the houses affected are worth between 2,000,000 to 155,000,000 TZS.

(5) Reference Materials

A map and photos in Figures 1-3-11-8.1 and 1-3-11-8.2 to 4 show the location of the venue of RAP stakeholder meetings and scenes of the meetings, respectively.

Figure 1-3-11-8.1 Location of Venues of RAP Stakeholder Meetings


Chuini


Mfenesini


Kitopei


Mahonda and Mkataleni

Figure 1-3-11-8.2 Scenes of RAP Stakeholder Meetings (North route)


Mtofaani


Mwera | Jumbi


Ubago

Figure 1-3-11-8.3 Scenes of RAP Stakeholder Meetings (South route)


Kisauni and Maungani


Kombeni and Dimani

Figure 1-3-11-8.4 Scenes of RAP Stakeholder Meetings (Fumba route)

1-3-12 Environmental Checklist

Table 1-3-12.1 shows the environmental checklist produced by ZECO and DoE through discussions.

Table 1-3-12.1 Environmental Checklist

	Category	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and explanations	(1) EIA and Environmental Permits	(a) Have EIA reports already been prepared in the official process?	(a) Y	(a) Already prepared and 3 copies were submitted to DoE.
		(b) Have EIA reports been approved by authorities of the host country's government?	(b) Y	(b) Approved by the Ministry of Environment on December 5, 2010.
		(c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?	(c) Y	(c) Carry out environmental management plan.
		(d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(d) N	(d) No approval needs to be obtained other than above.
	(2) Explanation to the Local Stakeholders	(a) Have the contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Has understanding been obtained from the Local stakeholders?	(a) Y	(a) Stakeholder meetings for EIA and RAP were held separately and they were given explanations and expressed their understanding.
		(b) Have the comments from the stakeholders (such as local residents) been reflected in the project design?	(b) Y	(b) Consideration is given to the compensation issue in the resettlement plan in particular.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Examined.

	Category	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
2 Pollution Control	(1) Water Quality	(a) Will soil runoff from the exposed surfaces of embankments and cut earth deteriorate the water quality in the surrounding downstream areas of rivers? If so, are there any countermeasures?	(a) N	(a) N/A
3 Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there the possibility that the project will affect the protected areas?	(a) N	(a) N/A
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)?	(a) Y	(a) Although forest conservation areas and mangrove forests are in neighboring areas of the Project site, the Project does not affect them.
		(b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions?	(b) Y	(b) Although there are some areas in forest conservation areas where red colobus monkeys live, the Project does not affect them.
		(c) If significant ecological impact is anticipated, are adequate protection measures taken to reduce the impact on the ecosystem?	(c) N	(c) N/A
		(d) Are adequate measures taken to prevent disruption of migration routes and habitat fragmentation of wildlife and livestock?	(d) N	(d) N/A
		(e) Is there any possibility that the project will cause a negative impact, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystems due to the introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impact considered?	(e) N	(e) N/A
		(f) In cases where the project site is located in undeveloped areas, is there any possibility that the new development will result in extensive loss of natural environments?	(f) N	(f) N/A
	(3) Topography/ geology	(a) Is there any soft ground on the route of power transmission and distribution lines that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed?	(a) N	(a) N/A
		(b) Is there any possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides?	(b) N	(b) N/A
		(c) Is there the possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken?	(c) N	(c) N/A

	Category	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impact caused by the resettlement?	(a) Y	(a) There is some involuntary resettlement. Ways to minimize the impact of resettlement were examined.
		(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?	(b) Y	(b) EIA and RAP stakeholder meetings were held separately to give briefings.
		(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards, developed based on socioeconomic studies on resettlement?	(c) Y	(c) It is examined in RAP and is now being formulated.
		(d) Is the compensations going to be paid prior to the resettlement?	(d) Y	(d) To be carried out.
		(e) Is the compensation policy prepared in document form?	(e) Y	(e) Materials for briefing are being compiled.
		(f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?	(f) Y	(f) Because there is assistance from other organizations and ZECO plans to carry it out with full awareness of this.
		(g) Are agreements with the affected people obtained prior to resettlement?	(g) Y	(g) An action plan which will be agreed on has been formulated.
		(h) Has the organizational framework been established to properly implement resettlement? Are the capacity and budget secured to implement the plan?	(h) Y	(h) An organizational framework is being created.
		(i) Are any plans developed to monitor the impacts of resettlement?	(i) Y	(i) Because the need for a plan is well recognized, it is being coordinated with other organizations.
		(j) Has the grievance redress mechanism been established?	(j) Y	(j) An organizational framework for making the structure is being created.
	(2) Living and Livelihood	(a) Is there the possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impact, if necessary?	(a) Y	(a) T here is recognition that compensation should be first paid properly. Support will be provided for mitigating adverse effects. Also, the support scheme shown in Issue 2 of 2-2-6-2 is currently planned.
		(b) Is there the possibility that diseases, including infectious diseases, such as HIV, will be brought due to the immigration of workers associated with the project? Is adequate consideration given to public health, if necessary?	(b) N	(b) Although there is no concern over the issue, the possibility cannot be denied and cooperation with campaigns conducted by other organizations is given. Also, the Project will receive advice from the Ministry of Health.
		(c) Is there any possibility that the installation of structures, such as power line towers, will cause radio interference? If any significant radio interference is anticipated, are adequate measures considered?	(c) N	(c) Because the Project does not include a steel tower, there is no concern over radio interference.
		(d) Is the compensation for transmission wires given in accordance with the domestic law?	(d) Y	(d) To be carried out.
	(3) Heritage	(a) Is there the possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) N/A
	(4) Landscape	(a) Is there the possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) N/A
	(5) Ethnic Minorities and Indigenous Peoples	(a) Is consideration given to reduce the impact on the culture and lifestyle of ethnic minorities and indigenous peoples?	(a) N	(a) N/A
		(b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(b) N	(b) N/A

	Category	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project?	(a) Y	(a) To be observed.
		(b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials?	(b) Y	(b) Consideration is given as described in the EIA report.
		(c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.?	(c) Y	(c) Consideration is given as described in the EIA report.
		(d) Are appropriate measures taken to ensure that security guards involved in the project do not violate the safety of other individuals involved, or local residents?	(d) Y	(d) Consideration is given as described in the EIA report.
5 Others	(1) Impact during Construction	(a) Are adequate measures considered to reduce the impact during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?	(a) Y	(a) Consideration is given as described in the EIA report. Impacts are expected to be minimized through monitoring by DoE.
		(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce the impact?	(b) Y	(b) Consideration is given as described in the EIA report. DoE is currently studying mitigation measures. Through these measures, impacts are expected to be minimized.
		(c) If construction activities adversely affect the social environment, are adequate measures considered to reduce the impact?	(c) Y	(c) Consideration is given as described in the EIA report. DoE is currently studying mitigation measures. Through these measures, impacts are expected to be minimized.
	(2) Monitoring	(a) Does the proponent develop and implement a monitoring program for the environmental items that are considered to have a potential impact?	(a) Y	(a) Consideration is given as described in the EIA and RAP reports. It is now planned that DoE will conduct monitoring.
		(b) Are the items, methods and frequencies of the monitoring program appropriate?	(b) Y	(b) Consideration is given as described in the EIA and RAP reports.
		(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?	(c) Y	(c) Consideration is given as described in the EIA and RAP reports. Currently, ZECO is studying this matter.
		(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(d) Y	(d) Consideration is given as described in the EIA and RAP reports. For implementation of the Project, the scheme shown in Issue 2 of 1-3-13-2 is planned.
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Road checklist should also be checked	(a) -	
	Note on Using Environmental Checklist	(a) If necessary, the impact on trans-boundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as trans-boundary waste treatment, acid rain, destruction of the ozone layer, and global warming).	(a) -	

[Source] Survey team

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located differ significantly from international standards, appropriate environmental considerations are requested to be made. In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experiences).
2) The environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

1-3-13 Policies for Issues Concerning Environmental and Social Considerations

1-3-13-1 ZECO's policies for EIA

The following describes policies taken by ZECO for issues concerned in environmental and social aspects of the project implementation.

Issue 1: Handling of wastes including harmful materials. **ZECO's policy:** If wastes include harmful materials that are not environmentally friendly, catalytic converters (that cause redox reaction for cleaning up) will be used and they will be disposed in Wazo Hill (at a cement factory), Dar es Salaam.
Issue 2: Handling of the impacts of 1) soil borrowing, 2) garbage handling and open burning and 3) cutting of trees in the buffer zone on the water source. **ZECO's policy:** New construction and soil borrowing in the zone will be restricted. The DoE and the local authorities will be responsible for informing the local community of proper management of solid wastes.
Issue 3: The risk of collision between migrating animals and power distribution lines installed under the Project. **ZECO's policy:** Migrating animals may hit specific parts of power lines (when the lines are on the way to feeding grounds, habitats or traveling routes, etc.) due to their height. However, because the electric poles for power distribution to be constructed are lower than the tower for the distribution lines, the variety of birds that may be affected by the lines is limited. Because the distribution lines are added to the existing route, they are not likely to affect migrating animals. The DoE will identify and count the number of migrating animals in the period from December to February, when the number reaches its peak.
Issue 4: Resettlement policies concerning a cemetery within the buffer zone of the route for distribution lines/ Compensation/ Problems related to culture, custom or religion. **ZECO's policy:** A cemetery is located (on the northern route of the distribution line in Mfenesini) within the project site. However, because tombs have not been constructed above the surface of the ground affected by installation of distribution lines, the cemetery will not be relocated, and thus there will be no cultural, custom-related or religious problems.
Issue 5 : Protection measures such as landscaping after securing soil and stones for the Project. **ZECO's policy:** The amount of soil and sand necessary for the project is obtained as approved governmental land. No pollution problem has occurred there. Restoration programs are carried out under the supervision of the Department of Commercial Crops, Fruits and Forestry.

Issue 6:

Impacts on the water source near the project site.

ZECO's policy:

Zanzibar Water Authority (ZAWA) and ZECO had discussions. It does not have such impact as water pollution because the project site is far enough from the water source and water line.

Issue 7:

Impacts of electromagnetic waves and magnetic fields associated with the addition and construction of new substations and the construction of new power distribution lines on the residents.

ZECO's policy:

ZECO will put up posters describing impacts of electromagnetic waves and electromagnetic fields to raise public awareness. In cooperation with local leaders, it will ensure that there will be no new settlers within the buffer zone.

Because DoE does not possess instruments to measure environmental issues, the measurement was commissioned to the organizations below and they are conducting various examinations.

1) Water, drainage and wastewater
   - ZAWA
   - Institute Marine Science
   - Chief Government Chemist

2) Air, noise and vibration
   - Private companies related to environmental issues in mainland Tanzania

1-3-13-2 ZECO's policies for RAP

The following describes ZECO's policies for issues that are particularly concerned with resident resettlement caused by the project implementation.

Issue 1:

Appraised prices for lands and buildings/Assessment on the validity of these prices/Measures taken for a gap in valuation of lands and buildings between the Project (ZECO) and residents.

ZECO's policy:

Since experts in charge of valuation of land and buildings are well aware of BOQ (bill of quantities), economic preparations for construction and other issues related to construction, they also have sufficient knowledge on construction costs. Moreover these experts have assessed various projects in Zanzibar (farming electrification project, expansion of Zanzibar Airport and MCC project, etc.), and they have abundant experience in this field. Complaints on valuation made by these experts will be handled by the District and Regional Commissioners, which are expected to provide better and fairer solutions.

Issue 2:

A means to ensure fairness and openness of the corruption prevention measures as well as the compensation payment procedure at the time of compensation payment.

ZECO's policy:

<u>Compensation payment procedures</u>

The payment procedures are as follows:

1. The compensation assessment is witnessed by local leaders or members of the local committee.
2. Information below is obtained and confirmed for the procedures.

a. Photograph of owner holding the assessment identification number in front of the building or crops
b. Owners' identification card, valid passport, worker ID or personal reference in Zanzibar
c. Confirmation of local leaders (each district)

3. After the confirmation of building ownership by local leaders (because many owners have no building-related document), all concerned parties (ZECO directors, local leaders and owners) fill in and put signatures on the document for compensation payment procedures.
4. After the procedures 1-3 above, the Ministry of Finance will directly pay compensation into the bank account of the people who are resettled whose name is on the document for compensation payment procedures.

Thus, the compensation for the people who are subject to resettlement is paid only via the route between the Ministry of Finance and the people who are subject to resettlement.

Procedures for filing complaints:

Complaints are filed in the following procedures:

1. A committee consisting of 10 members is established in each community for smooth compensation payment. If any trouble related to the payment arises, the resident will file a complaint with the local leader and he/she will report it to the committee. The committee will play a central role in finding solutions.
2. If the committee fails to settle the dispute, the problem shall be solved through consultation with ZECO. ZECO will work in cooperation with the committee and evaluators to have discussions attended by the person who filed the complaint to clarify the procedures of the assessment of his/her property.
3. When the problem is not solved even through the discussions with ZECO, the decision will be made by the local representative (governor appointed by the government). The governor appointed by the government will listen to the claims of the plaintiff and ZECO in a fair manner and make a decision.
4. When the problem is not settled in any of the processes above, the plaintiff may file a suit with a court.

A joint committee consisting of the following organizations will be set up to prevent bribery:

- Ministry of Finance
- MLHWE (supervising agency)
- ZECO (executing body)
- Department of Environment (RAP expert)
- Judiciary branch (lawyer)

Issue 3:

Issues regarding changes in valuation between during planning and during implementation.

ZECO's policy:

ZECO will observe the agreed compensation plan. However, when the payment is delayed, changes of the compensation money will be considered to match the market price.

Issue 4:

Setting time lines for compensation and resettlement

ZECO's policy:

Based on the experience from the MCA-T project, the time frame for compensation shall be defined as three months, which will give the affected people sufficient time for resettlement.

Issue 5:

Provision of information regarding resettled areas and of assistance for the affected people.

ZECO's policy:

ZECO will utilize its past experiences in the MCA-T project and work closely with concerned organizations (DoE, governors' office and local leaders, etc.) for the proper resettlement of affected people.

Issue 6: Measures taken for those who resettle in areas far away from their current places. **ZECO's policy:** It is not difficult for people to find the location for resettlement in Zanzibar. Land conditions in Zanzibar are almost identical and people are likely to accept resettlement to places far from their current locations.
Issue 7: Measures taken for regional and rural common lands, which are situated within the buffer zone. **ZECO's policy:** There is no jointly owned community land in the buffer zone.
Issue 8: Assistance for people who cannot find land for relocation in the community in obtaining land and adopting to the new community. **ZECO's policy:** ZECO will provide sufficient assistance to those who have difficulty in finding the location of resettlement.
Issue 9: Explanation of RAP for illiterate residents. **ZECO's policy:** Explanations will be given in Swahili as needed for illiterate people to understand easily.
Issue 10: Measures taken for property rights that are regulated in customary terms. **ZECO's policy:** The land law in Zanzibar stipulates that land is the government's property. The people (residents) are given the occupancy right for various uses and land is leased to investors. The occupancy right can be transferred from a person to another and it may be inherited property based on traditional and religious perspectives. Land of existing projects is not treated based on traditional and custom-related rules. Such land can be handled based on RAP.

1-4 Other issues

The lifetime of the existing power facilities owned by ZECO has come to an end. Development and improvement of substations and distribution lines in the project will enable continued supply of power on Unguja Island and the problem of voltage drops will be improved, which will enable a stable power supply. Thus, the impact of power outage on hospitals and other public facilities and commercial facilities will be reduced and increase in power for tourism will promote employment and thus contribute to poverty reduction.

CHAPTER 2

CONTENTS OF THE PROJECT

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

In accordance with the principle to "supply reliable and inexpensive energy to customers", as stated in MKUZA, a poverty reduction plan created by the government of Zanzibar in 2007, the Project aims at the reinforcement of the power distribution system in Unguja Island. Based on the survey results concerning the condition of the existing equipment of ZECO, maintenance and management system, environmental and social considerations, etc., the Project will carry out the rehabilitation of the Mtoni Substation, the addition of two 33 kV distribution lines, the renewal of the Fumba Route, etc. The result of the environmental and social consideration survey that will be conducted in Tanzania will be reflected in the plan of distribution line routes and the like. When planning the scale of the equipment and other relevant matters, necessary facilities should be considered based on the demand forecast, etc. so that the quantity of the equipment will be minimized. The Project overview consists of the following seven components:

1) Expansion of 33 kV equipment for Mtoni Substation
2) Installation of 33/11 kV Mwanyanya Substation
3) Installation of 33/11 kV Welezo Substation
4) Installation of 33 kV distribution lines for the North route
5) Installation of 33 kV distribution lines for the South route
6) Replacement of 33 kV distribution lines for the Fumba route
7) Procurement of equipment and materials for distribution lines

Table 2-1.1 shows the contents of each component. Table 2-1.2 shows the changes of the distribution plan from the time of the project request to the time of the preparatory survey. Figure 2-1.1 shows the schematic drawing of 33 kV distribution lines.

Table 2-1.1 Project Overview

Item	Contents
1) Expansion of 33 kV equipment for Mtoni Substation	Mtoni Substation distributes electricity to the whole island of Unguja after stepping down the voltage of the power transmitted from the mainland of Tanzania from 132 kV to 33 kV. All the existing equipment will be renewed and two lines will be additionally installed. Whenever possible, existing equipment can be used as stand-by equipment in case of accidents and other emergencies in the future. If 33/11 kV transformers are not replaced, the failure of transformers might cause problems in supplying electricity to the city of Zanzibar. Therefore, 33/11 kV transformers should also be included in the scope of the cooperation. There are two possible rehabilitation methods: the conventional method to reconstruct existing transformation facilities of steel construction, and the method called the metal clad switchgear system to construct new facilities in the site of Mtoni Substation with indoor-type high-voltage switchgear cubicles. As the conventional method would involve complicated processes such as installation of additional lines in available space in the existing structure after all devices, including conductors, are removed once, it would require the prolonged interruption of the power supply. On the other hand, the metal clad method has many advantages; firstly, products assembled at the time of shipment from a factory will be installed in an area adjacent to the existing facilities of Mtoni Substation, allowing the construction to be conducted in a safe manner with the shortest power cut period. Moreover, many recent purchase records will ensure easy expansion in the future. As the costs of the two methods are not so very different, we have selected the metal clad method, which is now widely used.

Item	Contents
2) Installation of 33/11 kV Mwanyanya Substation 4) Installation of 33 kV distribution lines for the North Route	Installation of 33 kV distribution lines for the North Route (between Mtoni and Mahonda) and construction of Mwanyanya Substation on the route. Out of the three target routes, the North route runs through the area where electricity demand is increasing the most. The demand is expected to keep growing as a hotel is being constructed at the end of the route. To meet such increasing electricity demand, Mwanyanya Substation will be constructed and the load will be shared. New lines can also be used as a bypass that will be used in case of an accident or maintenance and therefore will contribute to reliability improvement of the distribution network. ABC cables will be used on part of the North route (4.4 km between Mwanyanya and Mbuzini) as buffer zones cannot be secured in this densely housed area.
3) Installation of 33/11 kV Welezo Substation 5) Installation of 33 kV distribution lines for the South route	Installation of additional 33 kV distribution lines for the South route (between Mtoni and Tunguu) and construction of Welezo Substation on the route. - The measures to assume influence a minimum of the resettlement of residents If, under the Project, the use of conventional open wires (ACSR) is planned for a 33 kV distribution route, there are some concerns. Firstly, there are many buildings alongside the streets and there is not much space left. Therefore, if the distribution route has to avoid these buildings, it will intrude on right-of-ways (ROW). Secondly, if the route is constructed away from the streets, new buffer zones for ACSR will be secured and therefore an increased number of houses might be affected. To eliminate the above-described concerns, we had a joint discussion with the Department of Environment, Department of Road, and ZECO about the possibility of using insulated cables (ABC cables, for which see the photo) for the Project and relaxing the regulations concerned. As a result, it was agreed that, in the zones where distribution lines have to be constructed in ROW, electric poles can be built in part of ROW as a utility space on condition that insulated materials such as ABC cables are used and the resettlement of residents is minimized. According to the agreement, the 33 kV distribution lines shall basically be constructed in the existing buffer zone parallel with the existing 33 kV distribution line.  ABC Cable However, in part of the South route (4.3 km from Mtoni Substation to the site of Welezo Substation), where the existing 33 kV distribution line runs over a densely housed area with almost no buffer zone, it is difficult to construct a line parallel with the distribution line. Therefore, ABC cables will be used in this area and a diverted route parallel to the Fumba route will connect to Welezo Substation.
6) Replacement of 33 kV distribution lines for the Fumba route	MCA-T plans to construct a 132 kV transmission line on the site of the existing Fumba line (former buffer zone) after it is relocated, and ZECO will carry out the relocation using temporary constructions by the end of 2010. The size of the electric cables used for the existing Fumba distribution line is 50 mm^2. Although the actual demand for electricity is small, it is an important distribution route as it provides electricity to undersea cable facilities and will also provide electricity to a planned new airport terminal. Although ACSR 150 mm^2 electric cable was originally requested for the Fumba line, it has been concluded that 100 mm^2 will be appropriate for such reasons as (1) calculation shows that a great effect (increase of distribution capacity) cannot be expected, (2) larger ABC cables with equivalent distribution capacity would be required, which would make the construction in a densely housed area difficult, and (3) 150 mm^2 is not a TANESCO standard size and is not used in Tanzania. ABC cables will be used on part of the Fumba route (13.7 km between Mtoni Substation and Maungani) as buffer zones cannot be secured in urban areas with many buildings and stores alongside the streets and as well as in densely housed areas.

Item	Contents
7) Procurement of equipment and materials for distribution lines	The Tanzanian side will carry out the construction of substations, 33 kV distribution lines, 11 kV distribution lines, low-voltage distribution lines, etc. for the Project. The Japanese side shall procure the following equipment and materials for distribution lines: • 33 kV Auto-recloser • Digger and pole erector truck • Truck with cranes

The land acquisition status for the above components is as follows:

1) Land for expansion of Mtoni Substation

Additional land does not have to be acquired as construction will be conducted on the existing site of Mtoni Substation.

2) Land for Welezo Substation and Mwanyanya Substation

The land is currently privately-owned and will be acquired with ZECO compensation before the implementation of the Project.

3) Land for construction and replacement of 33 kV distribution lines

As distribution lines will be constructed in principle in the buffer zones for the existing 33 kV distribution lines, additional land does not have to be acquired. Although lines will be constructed outside the buffer zone in part of the South route (about 1 km between Mtoni and Welezo), land acquisition is not necessary as ABC cables will be laid on the border of ROW.

Table 2-1.2 Changes of 33 kV Distribution Line Plan

Route	Section number	Section	At the time of request (July 2009)				Preparatory survey I (March 2010)				Preparatory survey II (December 2010)			
			Type of land	Electric cable	Distance (km)	No. of houses affected	Type of land	Electric cable	Distance (km)	No. of houses affected	Type of land	Electric cable	Distance (km)	No. of houses affected
North route (20.3km)	1	Mbuzini→ Mahonda	Agricultural land	ACSR	10.9	21	Same as at the time of request				Along existing distribution lines	ACSR	13.0	35
	2	Mwanyanya→ Mbuzini	Residential area	ACSR	5.9	250	Alongside ROW	ABC	6.5	0	Along existing distribution lines (densely housed area)	ABC	4.4	0
	3	Military Camp→ Mwanyanya	Agricultural land	ACSR	0.7	0	Same as at the time of request				Along existing distribution lines	ACSR	2.9	0
	4	Mtoni S/S→ Military Camp	Residential area	ACSR	0.65	30	Agricultural land	ACSR	0.65	0				
South route (22.0km)	5	Mtoni S/S→ Welezo S/S	Residential area	ACSR	1.92	110	Alongside ROW	ABC	3.15	0	Along existing distribution lines	ABC	4.3	0
	6	Welezo S/S→ Tunguu	Agricultural land	ACSR	15.7	27	Same as at the time of request				Along existing distribution lines	ACSR	17.7	20
Fumba route (38.5km)	7	Mtoni S/S→ Amani	Agricultural land	ACSR	6.65	0	Same as at the time of request				Along existing distribution lines (densely housed area)	ABC	13.7	0
	8	Amani→ Maungani	Residential area	ACSR	0.9	120	Residential area	ABC	0.9	60				
	9	Maungani→ Fumba	Agricultural land	ACSR	17.9	30	Same as at the time of request				Along existing distribution lines	ACSR	24.8	19
Total:			**ACSR: 61.2 km ABC: 0 km**			**588**	**ACSR: 51.9 km ABC: 11.2 km**			**138**	**ACSR: 58.4 km ABC: 22.4 km**			**74**

[Source] Survey team

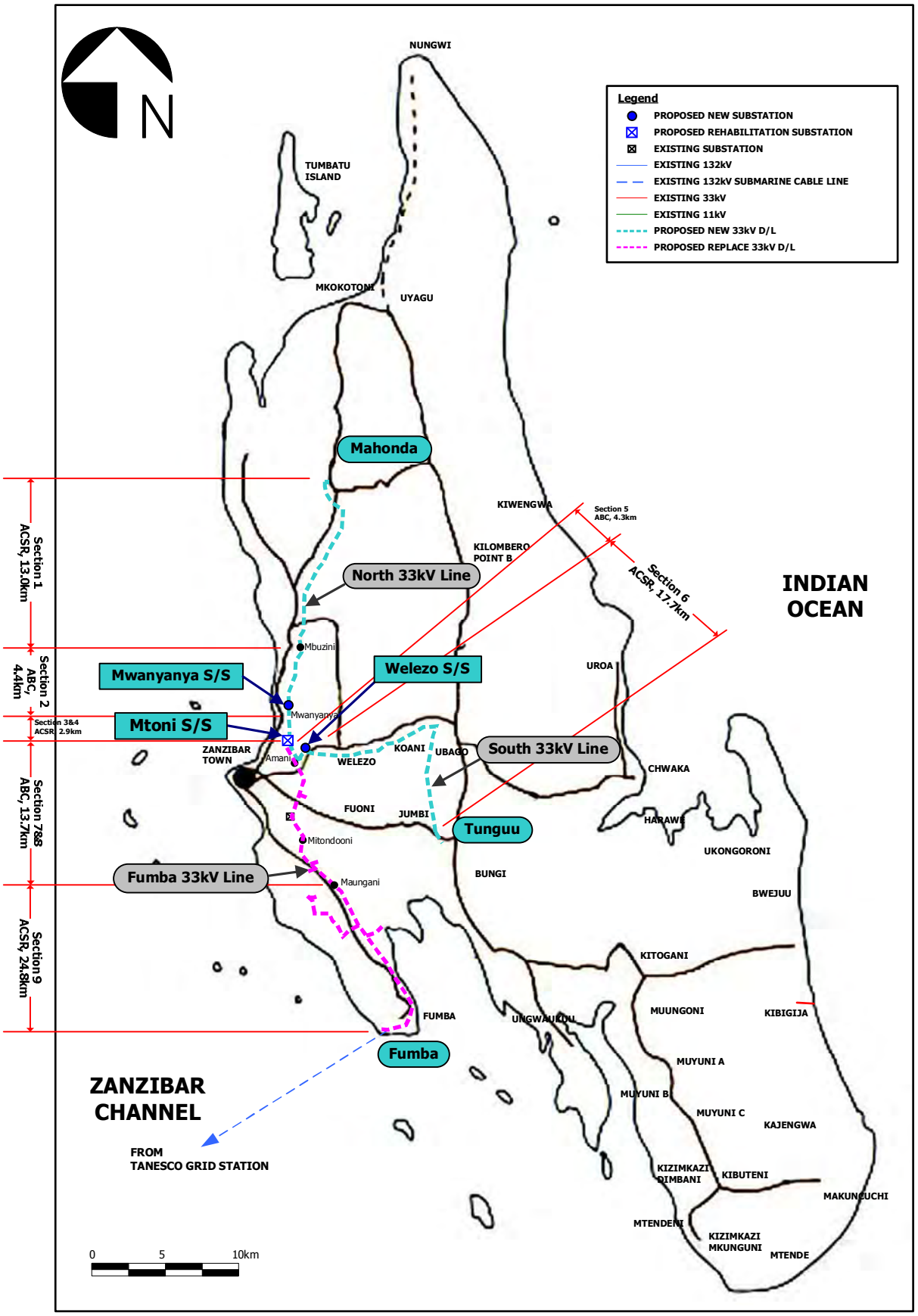


Figure 2-1.1 33 kV Distribution Line Schematic Drawing

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Basic Policy

Based on the principle described in the above 1-1, equipment and materials to reinforce 33 kV distribution lines will be procured and installed under the Project. To allow adequate time for the Tanzanian side to successfully utilize the equipment provided under the Project after the construction by the Japanese side was completed, the target year should be 2018, five years after delivery. The capacity of the 33 kV distribution lines procured under the Project should be of an appropriate scale that can meet the electricity demand estimate of the target year. As the statutory useful life of transformers is about 25 years in Tanzania, the capacity of transformers of which construction is requested shall be set to meet the demand in 2023, 10 years after the installation, as a minimum scope.

For the smooth development of the effects of the Project, the Project shall cover from the 33/11 kV substation to the connection points to the existing distribution lines. (The final connection work at the existing distribution facilities shall be carried out at the expense of the recipient country.)

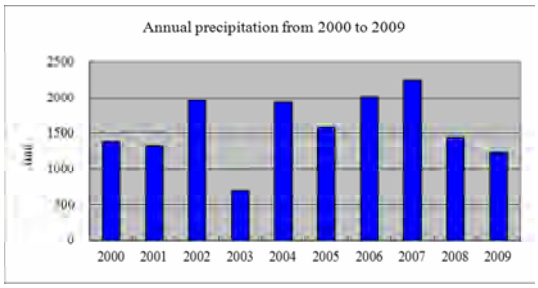
2-2-1-2 Policy on Natural Conditions

(1) Temperature and Humidity Conditions

According to the meteorological data of the last 10 years (2000 – 2009) of the target area of the Project, the area has a hot and humid climate, with a mean annual maximum temperature of 32.6 °C, a mean annual minimum temperature of 20.9 °C, and a mean maximum relative humidity of 96.6%. With regard to the distribution and transformation equipment to be employed for the Project, the above-mentioned temperature and relative humidity conditions should be considered. It should also be ensured that the equipment will operate correctly and there will be no operation failure when the temperature or humidity rises temporarily due to high external temperature or direct sunlight. Space heaters shall be installed in enclosed boards to prevent dew condensation caused by temperature difference.

(2) Precipitation and Lightning Strikes

As shown in Figure 2-2-1-2.1, the average annual precipitation of the last 10 years is 1,582.4 mm, although the precipitation varies from year to year. The number of rainy days in a month, shown in Figure 2-2-1-2.2, is the largest from March to May (heavy rainy season) and the second largest from November to December (lighter rainy season). Therefore, due consideration shall be given to civil engineering, construction and other outdoor work processes for equipment installation when the construction plan is made for the Project.



[Reference] Tanzania Meteorological Agency, Zanzibar Office

Figure 2-2-1-2.1 Annual Precipitation in the Target Area of the Project

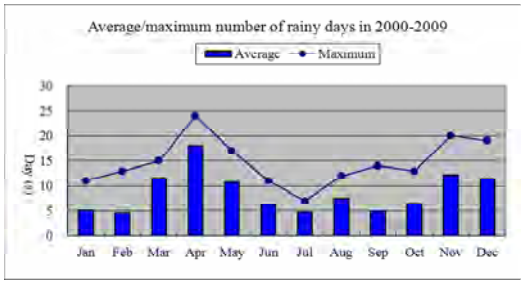


Figure 2-2-1-2.2 Annual Number of Rainy Days in the Target Area of the Project

As in the target area it may thunder in rainy seasons and lightning may strike electric poles and other objects, attention will have to be given to the weather conditions when construction work involves high-place work. In addition, proper protection equipment shall be installed on distribution lines and transformation facilities.

(3) Wind

According to the last ten years' wind speed records in the target area, the average speed was 10.8 knots (5.4 m/second) and the maximum speed was 34 knots (17 m/second). Therefore, the distribution lines should be designed in a way that they can resist strong winds.

(4) Salt Damage

As the planned construction sites of substations are on the coast, the transformation equipment needs to be used indoors so that they will be protected from salt damage. Corrosive-resistant materials and paints should also be used for distribution lines as they will be constructed near the coast.

2-2-1-3 Policy on Socioeconomic Conditions

As the switch-over to the existing transformation requires a power cut as part of the installation work of the transformation equipment, we will plan procedures in such a way as to minimize the impact on the customers who are supplied with electricity through the transformation facilities and will try to shorten the outage time. Although the installation of distribution lines will require relocation of houses and farm plots on the routes, tree cutting, improvement of access roads for construction vehicles, etc., we will plan the routes and construction works in existing buffer zones as much as possible. Moreover, at the time of the foundation works for substations, pole erection and excavation, considerable caution will be exercised not to damage buried objects related to telephone, water, sewage and other infrastructures. The safety distance from existing distribution lines, telephone lines and roads will also be secured in accordance with the applicable laws and regulations in Tanzania and design and construction will be conducted in such a way so as to avoid interference with existing infrastructures.

2-2-1-4 Policy on Circumstances of Construction

The circumstances are favorable in Tanzania, as the construction of many medium- to large-size

commercial facilities, office buildings, etc., has been carried out, especially in Dar es Salaam, and there are some general contractors who undertake such construction work, including electrical construction companies. On the other hand, in Zanzibar, the target area of the Project, there is no company that can undertake the construction of the power transformation and distribution facilities of the Project, although there are several construction companies that carry out small-scale works. Therefore, the contractor(s) for the installation works of the Project shall be selected from among those on the mainland of the country.

2-2-1-5 Policy on the Utilization of Local Vendors, Equipment and Materials

The result of the interviews with local contractors and documents about past orders for similar constructions, etc., indicate that the procurement of construction workers, vehicles, equipment, materials, etc., is very limited in Zanzibar but is relatively easy in the mainland, as stated earlier. As it is deemed that general workers for the construction of substations, civil engineering works, construction works and installation of distribution lines can be ordered from local companies, the construction of the Project will be planned based on the use of local vendors.

As wooden poles used for the installation of distribution lines, aggregate and steel rods used for civil engineering and construction works and such other items can be locally procured, equipment and materials for the Project will be locally procured whenever possible. However, considering the past record of introduction of existing equipment, the operation and maintenance capacity of the Tanzanian side and such other factors, transformation equipment of the scale required for the Project and part of the distribution equipment and materials that are not produced locally will be procured from Japan or third countries.

2-2-1-6 Policy on Maintenance and Management Capacity of the Executing Agency

The maintenance and management of the power transformation and distribution equipment improved by the Project will be conducted by the operation division of ZECO; the power transmission and distribution department and the power generation department of the division currently have 177 staff members. ZECO has supplied electric power to the Zanzibar Islands since 1964 as a state electric power company. Even after the 132 kV electric power network of TANESCO from the main island through a submarine cable became 45 MW, ZECO has provided a power supply for consumers. ZECO carries out bush cleaning in the buffer zone for existing facilities. Moreover, their operations and maintenance for the existing facilities of transforming electricity are sufficient, for example, troubled facilities are replaced to spare parts. Therefore, it is expected that the enforcement of the Project does not have serious problems. But it is necessary to review the maintenance system, such as increasing the number of staff, because distribution lines and power stations will be reinforced thought the Project. Although most of the staffs are Artisans except a few Engineers, there is a plan to provide training to the Artisans who have engaged in constructions of distribution lines in order to be a substation operator. For securing operators, ZECO will provide internal technical training and ZECO put big expectation of training from donors, especially the Japanese technical training conducting in TANESCO now. Through these training, ZECO will enable to maintain and operate the transmitting

and distributing facilities by the Project. For this reason, in the Project, Japanese engineers will carry out OJT concerning operation and maintenance of power transformation and distribution facilities during the construction works. The Project will also develop operation and maintenance manuals and make efforts to transfer appropriate operation and maintenance techniques. Moreover, for more effective and efficient operation and maintenance of the facilities, we will provide minimum backup supplies, test devices and maintenance tools.

Although the equipment for automation of operation records that are now currently produced manually is not covered by the Project, the expandability of distribution cubicles/boards and other equipment shall be taken into consideration for the design so that through independent efforts ZECO will be able to carry out development that is appropriate for its maintenance and management structure.

2-2-1-7 Policy on the Scope of Facilities and Equipment and Grade Setting

Considering the above-described conditions, the policy concerning equipment and materials to be procured, scope of installation works and technical level of the Project are defined as below.

(1) Policy on the Scope of Facilities and Equipment

Based on the electric demand estimation of the target year of 2018, the Project will improve electric power facilities for stable power supply to residents and community facilities in the target area. While the Japanese side will carry out procurement and installation of minimum equipment, the Tanzanian side will procure and install other equipment at its own expense when possible so that continuous operation and maintenance management by the Tanzanian side will be encouraged.

Moreover, in order to achieve economical design, international standard equipment and materials should be used whenever possible; compatibility with existing equipment and devices should be sought; and the makeup and specifications should be minimized.

(2) Policy on Grade Setting

When designing transformation and distribution equipment that will be procured and installed in the Project, caution should be exercised to ensure compliance with the makeup of the existing facilities and ZECO's technical standards and construction manuals and not to deviate from the technological level of ZECO, who will carry out operation and maintenance management after the provision.

2-2-1-8 Policy on Construction/Procurement Methods and Construction Period

In order to carry out the Project based on Japan's grant aid scheme, complete it within the planned construction period and generate the expected effects of electrification, the periods of construction by the Japanese and Tanzanian sides should be coordinated and the construction processes should be planned with consideration of inland transport routes and methods, periods, procedures, etc. The target sites of the Project are scattered and distribution lines of a total of approximately 80.8 km (ACSR of 58.4 km and ABC cables of 22.4 km) will be constructed at the same time. Therefore, construction

processes need to be planned with appropriate grouping to conduct construction in an efficient manner. It is also necessary to employ construction methods familiar to the local contractors and engineers and prepare a construction management structure for safe and prompt execution of the work.

The materials procured from Japan or third countries will be unloaded at Dar es Salaam Port on the Tanzanian mainland and then loaded on to another ship going to Zanzibar. After being unloaded at Zanzibar Port, they will be transported by land to the target areas of the Project. Therefore, curing and packaging of equipment and materials to be transported should be carried out with the utmost care, and great caution should be exercised for safe and secure procurement that will not affect surrounding traffic.

2-2-2 Basic Plan (Construction Plan/Equipment Plan)

2-2-2-1 Overall Plan

(1) Climate Conditions

Climate conditions to be applied to the design of transformation and distribution line equipment, buildings and foundations are shown in Table 2-2-2-1.1.

Table 2-2-2-1.1 Climate Conditions

Area		Unguja Island (Zanzibar)
Altitude		100 m or below
External temperature	Highest	40 °C
	Lowest	15 °C
	Average	27 °C
Max. humidity		96 %
Max. wind speed		32 knots (16 m/s)
Precipitation (max. monthly)		700 mm (Apr.)
Seismic force		Horizontal 0.1 G
Bearing capacity of soil		150 kN/m^2

(2) Conditions of Electric Modes

Conditions of electric modes to be applied to the design of power transformation and distribution line equipment are shown in Table 2-2-2-1.2.

Table 2-2-2-1.2 Conditions of Electric Modes

Item	Distribution system		Station power supply	
Nominal voltage	33 kV	11 kV	400-230 V AC	110 V DC
Maximum voltage	36 kV	12 kV	440-253 V AC	125 V DC
Frequency	50 Hz			N/A
Maximum short-circuit capacity	25 kA (1 sec.)	25 kA (1 sec.)	N/A	
Lightning impulse withstand voltage	170 kV	75 kV	N/A	
Earthing system	Effectively earthed system		N/A	
Creepage distance	25 mm/kV		N/A	
Minimum safe distance for conductors	(Note 1)		N/A	

Item	Distribution system		Station power supply
Relative distance (mm)	500	300	N/A
Correlation (mm)	900	600	N/A
Minimum safe distance from structures and occupation range	(Note 2)		N/A
Degree of protection (IP)	(Note 3)		

[Notes] 1. Minimum safe distances for distribution line conductors will comply with the relevant standards. However, the minimum safe distance for conductors in 33 kV and 11 kV switchgear cubicles will comply with the manufacturers' standards.

2. There are standards for minimum safe distances for conductors and supporters of distribution lines defined by ZECO, the Department of Roads and other organizations, as shown in Table 2-2-2-1.3. However, when these standards cannot be applied, ZECO will obtain approval from relevant organizations.

Table 2-2-2-1.3 Minimum Safe Distances for Conductors and Supporters of Distribution Lines

Item	33/11 kV distribution lines
Height of distribution line conductors	
General positions (m)	6
Road (m)	6
Minimum safe distance between a conductor and a house (m)	3
Minimum safe distance between a distribution line supporter and the center of a road	(Standard/compact)
Arterial road (m)	15/8
Branch road (m)	15/8
Local distribution road (m)	10/7
Daily service road (m)	10/7

3. The standard specifications of 33 kV switchgear cubicles, 11 kV switchgear cubicles, low-voltage boards and control and protection boards are as follows:
Outdoor: IP43, indoor: IP20

(3) Applicable Standards and Units

Considering the consistency with the existing equipment in Tanzania, IEC, ISO and other international standards as well as Japanese standards listed below should be observed for the design work of the Project. International system of Units (SI units) should be used.

(a)	Standards of International Electrotechnical Commission (IEC)	To be applied to major functions of general electrical products
(b)	Standards of International Organization for Standardization (ISO)	To be applied to performance evaluation of general electric products
(c)	Japanese Industrial Standards (JIS)	To be applied to general industrial products
(d)	Standards of Japanese Electrotechnical Committee (JEC), Institute of Electrical Engineers of Japan	To be applied to general electrical products
(e)	Standards of Japan Electrical Manufacturers' Association (JEM)	Same as above
(f)	Standards of Japanese Electric Wire & Cable	To be applied to electric wires and

	Makers' Association (JCS)	cables
(g)	Technical Standards Concerning Electric Works	To be applied to general electric works

2-2-2-2 Outline of the Basic Plan

Table 2-2-2-2.1 shows the outline of the basic plan of the cooperation project determined through discussion with the Tanzanian side in line with the aforementioned design policies (2-2-1).

Table 2-2-2-2.1 Outline of Basic Plan

Category	Outline
Plan of procurement and installation of equipment and materials	1. Expansion of 33 kV facilities for Mtoni Substation 2. Installation of 33/11 kV Mwanyanya Substation 3. Installation of 33/11 kV Welezo Substation 4. Installation of 33 kV distribution lines for the North route (20.3 km between Mtoni Substation and Mahonda) 5. Installation of 33 kV distribution lines for the South route (22.0 km between Mtoni Substation and Tunguu) 6. Replacement of 33 kV distribution lines for the Fumba route (38.5 km between Mtoni Substation and Fumba)
Equipment and materials procurement plan	1. Equipment and materials for distribution lines 2. Test devices and maintenance tools 3. Replacement parts 4. Emergency backup supply 5. Consumable goods

2-2-2-3 Plan of Equipment, Materials and Facilities

(1) Expansion of 33 kV facilities for Mtoni Substation

1) Basic Policy

For the replacement of the aging 33 kV switchgears of the existing Mtoni Substation, a control building (approximately 28 x 11 m) will be built in the ZECO premise adjacent to the existing Substation.

Two sets of 33/11 kV 25 MVA transformers and a set of station transformers will be installed in outdoor locations. 33 kV indoor-type switchgear cubicles, 33 kV control panels, a metering panel, a protection panel for transformers and a station power supply system will be installed in the control building (batteries in the battery room of the building).

There will be a total of 4 incoming lines; 2 lines (regular use) of a new 132/33 kV substation that will be constructed by MICA-T and 2 lines (backup) from the secondary side of the

existing 132/33 kV transformers. There will be a total of 5 outgoing lines for 33 kV power distribution, including those for the new North and South routes. A reclosing system will be employed for the outgoing lines for 33 kV power distribution, so that the reliability of power distribution will be improved by automatically reclosing the circuit breakers even in the case of a slight ground fault.

33 kV and 11 kV cables will be armored-type cables directly buried under the ground. They will be buried about 0.6 meters below ground.

Low-voltage and control cables will be laid inside cable trenches and conduit lines.

The earth resistance of the substation to be used for the design should be 10 ohms or below.

2) Plan Details

Details of power transformation and distribution equipment for the expansion of 33 kV facilities for Mtoni Substation are as shown in Table 2-2-2-3.1.

Table 2-2-2-3.1 Details of Transmission and Distribution Equipment for the Expansion of 33 kV Facilities for Mtoni Substation

No.	Equipment	Details
1	33/11 kV transformer	As the capacity of the existing transformers is 15 MVA (2 sets) and 20 MVA (1 set), the capacity of new transformers will be 25 MVA (2 sets) to keep the same total capacity as the existing ones. Voltage on-load tap changers will be installed.
2	Station transformer	Install 2 transformers for transformation equipment and for power source for the control building.
3	33 kV switchgear cubicle	A total of 18 cubicles; incoming feeders (4 cubicles), bus couplers (2 cubicles), instrument transformers (2 cubicles), 33/11 kV transformer feeders (2 cubicles), station transformer feeders (2 cubicles) and outgoing feeders for distribution (6 cubicles). Considering the capacity of transformers (25 MVA), the rated current of breakers for outgoing feeders should be 630 A.
4	33 kV control panel	Will have control and status display functions necessary for monitoring and control of 33 kV indoor-type switchgear cubicles.
5	33 kV metering panel	The 33 kV metering panel will include a watt-hour meter for feeders.
6	33/11 kV transformer control and protection panel	Will have control and status display functions necessary for monitoring and controls of 33/11 kV transformers. Will also include tap operation and protection functions for transformers.
7	Low voltage distribution board	Install a low-voltage distribution board (1 cubicle) in the control building as a low-voltage power source for transformers and for power source for the control building.
8	DC supply system	Install a battery charger and batteries (1 set) in the control building as a DC power source for transformers.
9	33 kV, 11 kV cables	33 kV cables will be connected from the 33 kV side of the 132/33 kV substation to all equipment and devices via a 33 kV indoor-type switchgear cubicle and then another. 11 kV cables will be connected from the transformer side (11 kV side) to 11 kV switchgear cubicles.

3) Mtoni Substation Rehabilitation Steps

The Mtoni Substation rehabilitation steps are planned as follows. The procedures are shown in Figure 2-2-2-3.1.

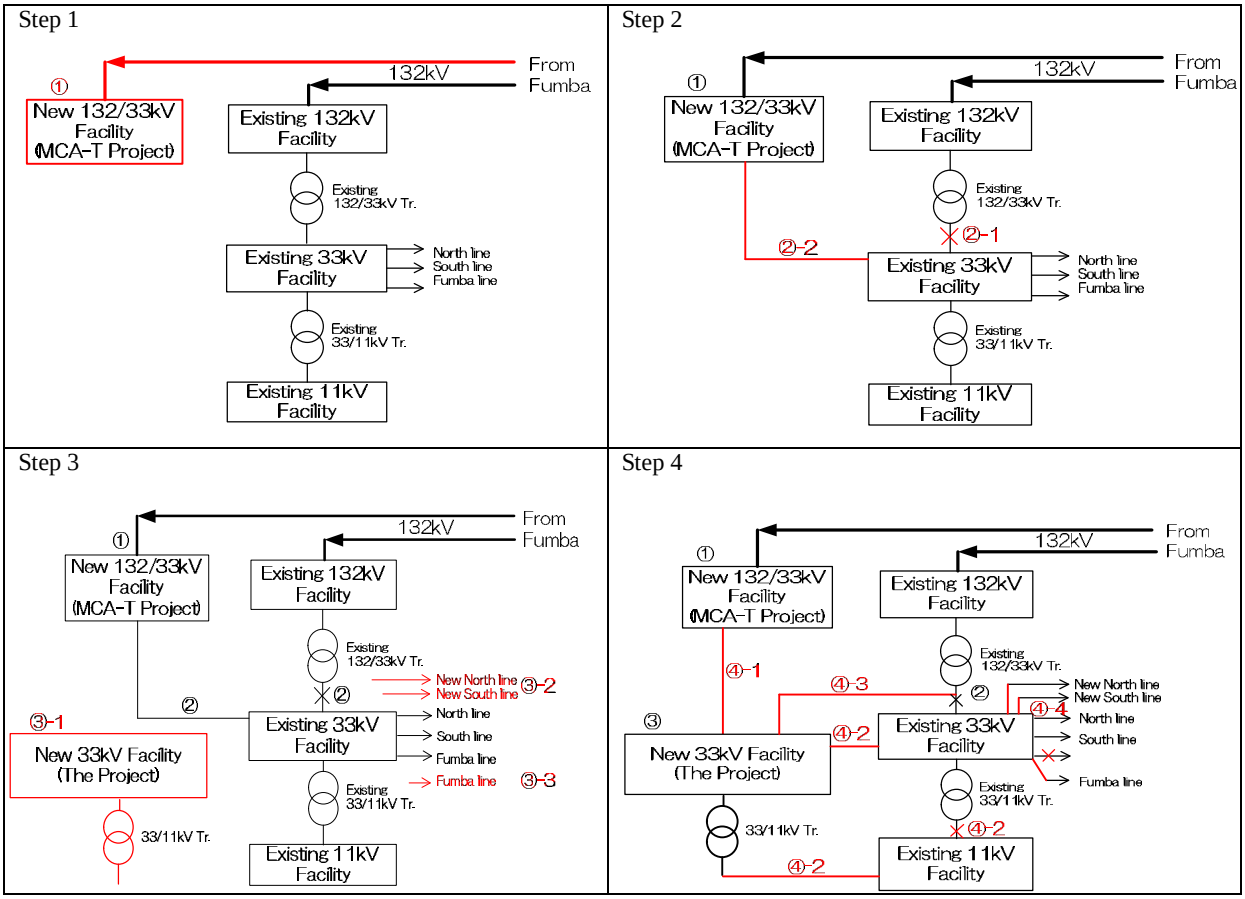
Step 1: MCA-T will construct a new 132/33 kV substation.

Step 2: In the above-mentioned project, 33 kV cables will be connected to existing 33 kV bus. Then breakers on the secondary side of the existing 132/33 kV transformers will be opened.

Step 3: In this Project a new 33 kV control building with 33 kV switchgears and 33 kV

transformers will be constructed. 33 kV distribution lines (3 routes) will be built at the same time.

Step 4: In the Project new 132/33 kV and 33 kV switchgear cubicles will be connected with cables, and existing 33 kV bus, existing 11 kV switchgear cubicles and the secondary side of the existing 132/33 kV transformers will be connected with cables. At the same time the existing breakers will be opened. Finally, 33 kV distribution lines will be connected.



[Source] Survey team

Figure 2-2-2-3.1 Mtoni Substation Rehabilitation Steps

4) General Specifications of Major Equipment and Materials

Table 2-2-2-3.2 General Specifications of Major Equipment and Materials for the Expansion of 33 kV Facilities for Mtoni Substation

No.	Item / Equipment	Specifications	Quantity
1	33/11 kV transformer 1) Type 2) Rated primary voltage 3) Rated secondary voltage 4) Rated capacity 5) Cooling type 6) Number of phases 7) Frequency 8) Tap voltage 9) Number of taps 10) Step voltage 11) Winding connection 12) Impedance	 Outdoor, oil immersed, with on-load tap changer 33 kV 11 kV 25MVA ONAN 3 50 Hz 33 kV +10% to -10% 17 taps 1.25% Primary: Star with neutral brought out Secondary: Star with neutral brought out Third: Delta About 7%	2 Sets
2	Station transformer 1) Type 2) Rated primary voltage 3) Rated secondary voltage 4) Rated capacity 5) Cooling type 6) Number of phases 7) Frequency 8) Tap voltage 9) Winding connection	 Outdoor, oil immersed, with no-voltage tap selector 33 kV 400 – 230 V 100 kVA ONAN 3 50 Hz 33 kV ±2.5% and ±5.0% Primary: Delta Secondary: Star with neutral brought out	2 sets
3	33 kV switchgear cubicle 1) Type 2) Number of cubicles 3) Type of circuit breaker 4) Rated current 5) Rated short-time withstand current	 Indoor cubicle, enclosed Incoming feeder: 4 cubicles Outgoing feeder: 6 cubicles 33/11kV Tr feeder: 2 cubicles PT cubicle: 2 cubicles Station transformer cubicle: 2 cubicles Bus coupler: 2 cubicles VCB 1600 A (Bus), 630 A (feeder) 25 kA (1 sec.)	18 Cubicles
4	33 kV control panel 1) Type 2) Control & supervision (annunciation), measurement	 Indoor cubicle, enclosed 33kV feeders, Voltage, Ampere, Watt, Var	3 panels
5	33 kV metering panel 1) Type 2) Measurement	 Indoor cubicle, enclosed Energy Meter	1 panel
6	33/11 kV Tr control and protection panel 1) Type 2) Measurement, annunciation 3) Protection	 Indoor cubicle, enclosed On-load tap changer control, alarm display window Inside of cubicles	1 panel
7	Low voltage distribution board 1) Type 2) Voltage 3) Breaker, measurement	 Indoor cubicle 3-phase 4-line, 400/230 V MCCB, Voltage, Ampere	1 panel

No.	Item / Equipment	Specifications	Quantity
8	DC supply system 1) Charger type 2) Charger rating 3) Battery type 4) Battery rating	 Indoor, thyristor type DC 110 V, 20A Sealed Lead-acid battery 100 Ah/10 hr	1 set
9	33 kV and 11 kV cables 1) Type 2) Conductor and insulation	 Triplex Cross-linked Polyethylene Insulated vinyl sheath cables directly buried under the ground Copper conductor and XLPE insulation	1 set
Modification of the Existing Gantry Structure			
10	Additional steel	Hot-dipped galvanized steel	1 set
11	33kV line switch	For 33 kV	1 set
12	33kV lightning arrester	For 33 kV, 10 kA	1 set
13	Equipment and materials for 33 kV distribution lines	Tension insulator, clamp	1 set
14	Equipment and materials for 33 kV connections	Mount for insulator-type cable terminal	1 set

5) General Specifications of Substation Building

For the purpose of monitoring operations of the substation, a one-story control building (approximately 28 x 11 m) will be constructed with reinforced concrete frames and blocks on the site of the existing Mtoni Substation. The outline of the control building is as follows:

(a) Control Room (free access system floor)

33 kV control panels, a 33 kV metering panel, a 33/11 kV transformer control and protection panel and a low-voltage distribution board will be installed in this room. The area will be about 32 m^2.

(b) Electric Room

33 kV switchgear cubicles, 196 m^2

(c) Battery Room

Batteries (lead batteries, 100 Ah/10 Hr) will be installed in this room. The area will be about 16 m^2.

(d) Stock Room

Documents/drawings, backup supplies and tools will be stored in this room. The area will be about 16 m^2.

(e) Sanitary Equipment

Flush toilets, a wastewater treatment tank and a subsurface pit will be installed. The area will be about 18.4 m^2.

(2) Installation of 33/11 kV Mwanyanya Substation

1) Basic Policy

Two sets of 33/11 kV 5 MVA transformers, 33 kV indoor-type switchgear cubicles, 11 kV

indoor-type switchgear cubicles, a 33/11 kV control panel, a 33/11 kV metering panel and a station power supply system will be installed in the new control building (batteries in the battery room of the building). Two sets of 33 kV terminal poles for receiving power will also be installed.

A reclosing system will be employed for the outgoing lines for 11 kV overhead distribution lines so that the reliability of power distribution will be improved by automatically reclosing the circuit breakers even in case of a slight ground fault.

33 kV and 11 kV cables will be armored-type cables directly buried under the ground. They will be buried about 0.6 meters (on the premises) or 1.2 meters (outside the premise) below ground.

Low-voltage and control cables will be laid inside cable trenches and conduit lines.

The earth resistance of the substation to be used for the design should be 10 ohms or below.

2) Plan Details

Details of power transformation and distribution equipment for the new installation of Mwanyanya Substation are as shown in Table 2-2-2-3.3.

Table 2-2-2-3.3 Details of Transformation and Distribution Equipment Concerning Installation of 33/11 kV Mwanyanya Substation

No.	Equipment	Details
1	33/11 kV transformer	Considering the electricity demand forecast in 2023, the capacity and number of transformers should be 5 MVA and two. Voltage on-load tap changers will be installed.
2	Station transformer	Install 1 transformer for transformation equipment and power source for the control building.
3	33 kV switchgear cubicle	A total of 8 cubicles; incoming feeders (2 cubicles), bus couplers (2 cubicles), instrument transformer (1 cubicle), 33/11 kV transformer feeders (2 cubicles) and station transformer feeder (1 cubicle). Considering the capacity of transformers (5 MVA), the rated current of breakers for transformer feeders should be 630 A.
4	11 kV switchgear cubicle	A total of 5 cubicles; incoming feeders (2 cubicles), bus coupler (1 cubicle) and outgoing feeders for distribution (2 cubicles). Considering the capacity of distribution lines, the rated current of breakers for outgoing feeders should be 630 A.
5	33/11 kV control panel	Will have control and status display functions necessary for monitoring and control of 33/11 kV indoor-type switchgear cubicles.
6	33/11 kV metering panel	The 33/11 kV metering panel will include a watt-hour meter for feeders.
7	33/11 kV transformer control and protection panel	Will have control and status display functions necessary for monitoring and controls of 33/11 kV transformers. Will also include tap operation and protection functions for transformers.
8	Low voltage distribution board	Install a low-voltage distribution board (1 cubicle) in the control building as a low-voltage power source for transformers and for power source for the control building.
9	DC supply system	Install a battery charger and batteries (1 set) in the control building as a DC power source for transformers.
10	33 kV and 11 kV cables	33 kV cables will be connected from 33 kV terminal poles to transformers (33 kV side) via 33 kV switchgear cubicles. 11 kV cables will connect transformers (11 kV side) with 11 kV switchgear cubicles, and then with the T-off poles (2 sets) of the existing 11 kV distribution lines underground.

3) General Specifications of Major Equipment and Materials

Table 2-2-2-3.4 General Specifications of Major Equipment and Materials Concerning Installation of 33/11 kV Mwanyanya Substation

No.	Item / Equipment	Specifications	Quantity
1	33/11 kV transformer 1) Type 2) Rated primary voltage 3) Rated secondary voltage 4) Rated capacity 5) Cooling type 6) Number of phases 7) Frequency 8) Tap voltage 9) Number of taps 10) Step voltage 11) Winding connection 12) Impedance	 Outdoor, oil immersed, with on-load tap changer 33 kV 11 kV 5MVA ONAN 3 50 Hz 33kV +10% to -10% 17 taps 1.25% Primary: Star with neutral brought out Secondary: Star with neutral brought out Third: Delta About 7%	2 sets
2	Station transformer 1) Type 2) Rated primary voltage 3) Rated secondary voltage 4) Rated capacity 5) Cooling type 6) Number of phases 7) Frequency 8) Tap voltage 9) Number of taps 10) Winding connection	 Outdoor, oil immersed, with no-voltage tap selector 33 kV 400 – 230V 50 kVA ONAN 3 50 Hz 33kV ±2.5% and ±5.0% 5 taps Primary: Delta Secondary: Star with neutral brought out	1 set
3	33 kV switchgear cubicle 1) Type 2) Number of cubicles 3) Type of circuit breaker 4) Rated current 5) Rated short-time to withstand current	 Indoor cubicle, enclosed Incoming feeder: 2 cubicles 33/11 kV transformer cubicle: 2 cubicles PT cubicle: 1 cubicle Station transformer cubicle: 1 cubicle Bus coupler: 2 cubicles VCB 1250 A(bus), 630 A (feeder) 25 kA (1 sec.)	8 cubicles
4	11 kV switchgear cubicle 1) Type 2) Number of cubicles 3) Type of circuit breaker 4) Rated current 5) Rated short-time to withstand current	 Indoor cubicle, enclosed Incoming feeder: 2 cubicles Outgoing feeder: 2 cubicles Bus coupler: 1 cubicle VCB 1250 A(bus), 630 A (feeder) 25 kA (1 sec.)	5 cubicles
5	33/11 kV control panel 1) Type 2) Control & supervision (annunciation)	 Indoor cubicle, enclosed 33/11 kV feeders, Ampere, Voltage, Watt, Var	2 panels
6	33/11 kV metering panel 1) Type 2) Measurement	 Indoor cubicle, enclosed Energy meter	1 panel
7	33/11 kV Tr control and protection panel 1) Type 2) Measurement & annunciation 3) Protection	 Indoor cubicle, enclosed On-load tap changer control, alarm display window Inside of cubicle	1 panel

No.	Item / Equipment	Specifications	Quantity
8	Low voltage distribution board 1) Type 2) Voltage 3) Breaker	 Indoor cubicle 3-phase 4-line, 400/230 V MCCB, Voltage, Ampere	1 panel
9	DC Supply system 1) Charger type 2) Charger rating 3) Battery type 4) Battery rating	 Indoor, thyristor type DC 110 V, 20 A Sealed Lead-acid battery 100 Ah/10 Hr	1 set
10	33 kV terminal pole 1) Type 2) Equipment mounted on pole	 H pole type 33kV Lightning arrester and line switch	2 sets
11	33 kV and 11 kV Cables 1) Type 2) Conductor and insulation	 CVT or Armored-type cables directly buried under the ground Copper conductor and XLPE insulation	1 set

4) General Specifications of Substation Building

For the purpose of monitoring operations of the Mwanyanya Substation, a one-story control building (approximately 15.7 x 15.0 m) will be constructed with reinforced concrete frames and blocks. The outline of the control building is as follows:

(a) Control Room

33/11 kV control panels, a 33/11 kV metering panel, a 33/11 kV transformer control and protection panel and a low-voltage distribution board will be installed in this room. The area will be about 18.3 m^2.

(b) Electric Room

33 kV switchgear cubicles, 11 kV switchgear cubicles, 162.5 m^2

(c) Battery Room

Batteries (lead batteries, 100 Ah/10 Hr) will be installed in this room. The area will be about 18.3 m^2.

(d) Stock Room

Documents/drawings, backup supplies and tools will be stored in this room. The area will be about 18.3 m^2.

(e) Sanitary Equipment

Flush toilets, a wastewater treatment tank and a subsurface pit will be installed. A water tank (made of polyvinyl chloride, 2 m^3) will be installed outside. The area will be about 10 m^2.

(3) Installation of 33/11 kV Welezo Substation

1) Basic Policy

Two sets of 33/11 kV 5 MVA transformers, 33 KV indoor-type switchgear cubicles, 11 kV indoor-type switchgear cubicles, 33/11 kV control panels, a 33/11 kV metering panel and a

station power supply system will be installed in the control building (batteries in the battery room of the building). 2 sets of terminal poles for receiving 33 kV power and 2 sets for distributing 11 kV power will also be installed.

A reclosing system will be employed for the outgoing lines for 11 kV overhead distribution lines so that the reliability of power distribution will be improved by automatically reclosing the circuit breakers even in case of a slight ground fault.

33 kV and 11 kV cables will be armored-type cables directly buried under the ground. They will be buried about 0.6 meters below ground.

Low-voltage and control cables will be laid inside cable trenches and conduit lines.

The earth resistance of the substation to be used for the design should be 10 ohms or below.

2) Plan Details

Details of power transformation and distribution equipment for the new installation of Welezo Substation are as shown in Table 2-2-2-3.5.

Table 2-2-2-3.5 Details of Transformation and Distribution Equipment Concerning Installation of 33/11 kV Welezo Substation

No.	Equipment	Details
1	33/11 kV transformer	Considering the electricity demand forecast in 2023, the capacity and number of transformers should be 5 MVA and two. Voltage on-load tap changers will be installed.
2	Station transformer	Install 1 transformer for transformation equipment and power source for the control building.
3	33 kV switchgear cubicle	A total of 8 cubicles; incoming feeders (2 cubicles), bus couplers (2 cubicles), instrument transformers (1 cubicle), 33/11 kV transformer feeders (2 cubicles) and station transformer feeders (1 cubicle). Considering the capacity of transformers (5 MVA), the rated current of breakers for outgoing feeders should be 630 A.
4	11 kV switchgear cubicle	A total of 5 cubicles; incoming feeders (2 cubicles), bus coupler (1 cubicle) and outgoing feeders for distribution (2 cubicles). Considering the capacity of distribution lines, the rated current of breakers for outgoing feeders should be 630 A.
5	33/11 kV control panel	Will have control and status display functions necessary for monitoring and control of 33/11 kV indoor-type switchgear cubicles.
6	33/11 kV metering panel	The 33/11 kV metering panel will include a watt-hour meter for feeders.
7	33/11 kV transformer control and protection panel	Will have control and status display functions necessary for monitoring and controls of 33/11 kV transformers. Will also include tap operation and protection functions for transformers.
8	Low voltage distribution board	Install a low-voltage distribution board (1 cubicle) in the control building as a low-voltage power source for transformers and for power source for the control building.
9	DC supply system	Install a battery charger and batteries (1 set) in the control building as a DC power source for transformers.
10	33 kV, 11 kV cables	33 kV cables will be connected from 33 kV terminal poles to transformers (33 kV side) via 33 kV switchgear cubicles. 11 kV cables will connect transformers (11 kV side) with 11 kV switchgear cubicles, and then with the 11 kV Terminal poles (2 sets) of the existing 11 kV distribution lines underground.

3) General Specifications of Major Equipment and Materials

Table 2-2-2-3.6 General Specifications of Major Equipment and Materials Concerning Installation of 33/11 kV Welezo Substation

No.	Item / Equipment	Specifications	Quantity
1	33/11kV transformer		2 sets
	1) Type	Outdoor, oil immersed, with on-load tap changer	
	2) Rated primary voltage	33 kV	
	3) Rated secondary voltage	11 kV	
	4) Rated capacity	5MVA	
	5) Cooling type	ONAN	
	6) Number of phases	3	
	7) Frequency	50 Hz	
	8) Tap voltage	33kV +10% to -10%	
	9) Number of taps	17 taps	
	10) Step voltage	1.25%	
	11) Winding connection	Primary: Star with neutral brought out Secondary: Star with neutral brought out Third: Delta	
	12) Impedance	About 7%	
2	Station transformer		1 set
	1) Type	Outdoor, oil immersed, with no-voltage tap selector	
	2) Rated primary voltage	33 kV	
	3) Rated secondary voltage	400 – 230V	
	4) Rated capacity	50 kVA	
	5) Cooling type	ONAN	
	6) Number of phases	3	
	7) Frequency	50 Hz	
	8) Tap voltage	33kV ±2.5% and ±5.0%	
	9) Number of taps	5 taps	
	10) Winding connection	Primary: Delta Secondary: Star with neutral brought out	

No.	Item / Equipment	Specifications	Quantity
3	33 kV switchgear cubicle		8 cubicles
	1) Type	Indoor cubicle, enclosed	
	2) Number of cubicles	Incoming feeder: 2 cubicles	
		33/11 kV transformer cubicle: 2 cubicles	
		PT cubicle: 1 cubicle	
		Station transformer cubicle: 1 cubicle	
		Bus coupler: 2 cubicles	
	3) Type of circuit breaker	VCB	
	4) Rated current	1250 A(bus), 630 A (feeder)	
	5) Rated short-time to withstand current	25 kA (1 sec.)	
4	11 kV switchgear cubicle		5 cubicles
	1) Type	Indoor cubicle, enclosed	
	2) Number of cubicles	Incoming feeder: 2 cubicles	
		Outgoing feeder: 2 cubicles	
		Bus coupler: 1 cubicle	
	3) Type of circuit breaker	VCB	
	4) Rated current	1250 A(bus), 630 A (feeder)	
	5) Rated short-time to withstand current	25 kA (1 sec.)	
5	33/11 kV control panel		2 panels
	1) Type	Indoor cubicle, enclosed	
	2) Control & supervision (annunciation)	33kV feeders, Ampere, Voltage, Watt, Var	
6	33/11 kV metering panel		1 panel
	1) Type	Indoor cubicle, enclosed	
	2) Measurement	Energy meter	
7	33/11 kV Tr control and protection panel		1 panel
	1) Type	Indoor cubicle, enclosed	
	2) Measurement and annunciation	On-load tap changer control, alarm display window	
	3) Protection	Inside of cubicle	
8	Low voltage distribution board		1 panel
	1) Type	Indoor cubicle	
	2) Voltage	3-phase 4-line, 400/230 V	
	3) Breaker, measurement	MCCB, Voltage, Ampere	
9	DC supply system		1 set
	1) Charger type	Indoor, thyristor type	
	2) Charger rating	DC 110 V, 20 A	
	3) Battery type	Sealed Lead-acid battery	
	4) Battery rating	100 Ah/10 Hr	
10	33 kV terminal pole		2 sets
	1) Type	H pole type	
	2) Equipment mounted on pole	33 kV lightning arrester and line switch	
11	11 kV terminal pole		2 sets
	1) Type	H pole type	
	2) Equipment mounted on pole	11 kV lightning arresters and line switch	
12	33 kV and 11 kV cables		1 set
	1) Type	Triplex Cross-linked Polyethylene Insulated vinyl sheath cable or Armored-type cables directly buried under the ground	
	2) Conductor and insulation	Copper conductor and XLPE insulation	

4) General Specifications of Substation Building

For the purpose of monitoring operations of the Welezo Substation, a one-story control building (approx. 15.7 x 15.0 m) will be constructed with reinforced concrete frames and blocks. The outline of the control building is as follows.

(a) Control Room

33/11 kV control panels, a 33/11 kV metering panel, a 33/11 kV transformer control and protection panel, a low-voltage distribution board will be installed in this room.

The area will be about 18.3 m^2.

(b) Electric Room

33 kV switchgear cubicles, 11 kV switchgear cubicles, 162.5 m^2

(c) Battery Room

Batteries (lead batteries, 100 Ah/10 Hr) will be installed in this room. The area will be about 18.3 m^2.

(d) Stock Room

Documents/drawings, backup supplies and tools will be stored in this room. The area will be about 18.3 m^2.

(e) Sanitary Equipment

Flush toilets, a wastewater treatment tank and a subsurface pit will be installed. A water tank (made of polyvinyl chloride, 2 m^3) will be installed outside. The area will be about 10 m^2.

(4) Installation and Replacement of 33 kV Distribution Lines

1) Basic Policy

The purpose of the installation and replacement of 33 kV distribution lines of the Project is to reinforce the 33 kV distribution network that supplies electricity throughout Unguja Island with three routes (North, South and Fumba routes) from the Mtoni Substation and improve the quality of electricity supply to the local regions that have plants, large hotels, sightseeing facilities, etc., and therefore has a large demand for electricity. The outline of the 33 kV distribution lines to be installed or replaced is shown in Figure 2-2-2-3.2.

33 kV distribution lines to be installed on the North and South routes will be constructed in parallel with the existing 33 kV distribution lines. They will go through Mwanyanya and Welezo Substations located on these routes and reach the existing 33 kV branch points (Mahonda and Tunguu) in the suburbs. The load on the existing 33 kV distribution lines can be reduced and the end voltage can be improved by separating each of the branch points into two and supplying power from existing and new 33 kV distribution lines to separate systems. For the Fumba route, existing cables will be replaced with thicker ones and the power distribution capacity will be increased to prepare for any future demand increase with the construction of Mpendae Substation on the route (to be completed in 2011 with the support of Belgium, 2 sets x 7.5 MVA), the expansion of an airport (in 2015), etc. However, as the existing electric poles are not strong enough to support the weight and tension of the size of the electric cables that will be newly installed, both cables and poles need to be replaced.

Figure 2-2-2-3.2 Outline of New 33 kV Distribution Lines

As for the procurement and installation of 33 kV distribution equipment and materials of the Project that will be carried out by the Japanese side, design work should be conducted in accordance with the following basic policy and outlines of equipment and materials. Electric cables, electric poles, metal fittings and devices should be designed according to the technical and design standards of ZECO and TANESCO and be as compatible as possible with the existing devices in Tanzania so that management can be centralized. As the technical and design standards of ZECO are only applicable to a small portion of power distribution equipment and materials (such as wooden poles, low-voltage cables and metal fittings), the technical and design standards of TANESCO should be applied to other major distribution equipment and materials.

On the Fumba route, existing transformers and other devices will be moved from the existing route to a new one at the expense of Tanzania. During these switch works, customers may experience prolonged power cut and people's lives and public facilities may be affected. Therefore, out of the 33 kV switchgear cubicles that will be additionally installed in the Mtoni Substation (see Figure 2-2-3.1), a backup feeder will be used as a temporary feeder for the switch works and connected to the first pole of the existing Fumba route with a temporary cable. Thus, power cuts can be avoided during the construction on the existing Fumba Route and the impact on customers will be minimized.

2) Outline of 33 kV Distribution Network Plan

(a) Route Selection

We finalized the distribution line route of each area after creating drawings of the distribution route based on a satellite image; conducting a field survey with ZECO engineers; and checking obstacles, landmark objects, particularities of the natural environment of the region, etc. The major works to be conducted by the Japanese side in the Project will be the installation of 33 kV distribution lines, but will also perform the installation of the 11 kV distribution line from the secondary side of Welezo Substation located on the South route to the connection points to the existing 11 kV distribution line (about 370 m).

(b) Span Selection

Considering such factors as the size and tensile strength of electric cables and strength of electric poles, the spans should comply with the TANESCO standards. However, as TANESCO does not have design standards for the span of electric poles for ABC cables, it should be set based on international standards and the case of ABC cables (3 x 50 mm^2, made in South Africa) that were recently constructed in part of the Wete area of Pemba Island (about 1.5 km, see a photo in the beginning).

- Standard span of 33 kV distribution poles

ACSR: 100 m (70 m in densely populated areas such as urban areas)
ABC cables: 50 m

- Standard span of section poles

ACSR: every 10 spans
ABC cables: every 5 spans

(c) Types of Electric Cables for Overhead Distribution Lines

Electric cables to be used for overhead distribution lines of the Project should be ZECO standard aluminum cables steel reinforced (ACSR). As for the size of the ABC cables, it should have the same allowable current as the size of the ACSR. The messenger wires should be coated to prevent salt damage. Considering these conditions, the sizes of electric cables should be as follows:

- ACSR 100 mm^2
- ABC 3 x 150 mm^2 and (coated) messenger wire 50 mm^2

For the calculation of the quantity of electric cables for overhead distribution lines, the distance of branch lines from main lines and the distance of jumper processing at terminal poles should be added to the plane distance measured on the drawing (design quantity). For the calculation of the quantity for the equipment and material procurement plan, the quantity should be multiplied by 1.03 (1.05 in case of ABC cables) for the slack of electric cables and by 1.1 as a construction supply rate.

For the installation plan, the quantity of the cables for 33 kV distribution lines to be constructed by the Japanese side should be the design quantity multiplied by the allowance rate of 1.03. Therefore, the quantity of electric cables for overhead distribution lines to be procured and installed in the Project should be as shown in Table 2-2-2-3.7.

Table 2-2-2-3.7 Quantity of Electric Cables for 33/11 kV Overhead Distribution Lines

Item		North Route (Mtoni Substation – Mahonda)	South Route (Mtoni Substation – Tunguu)	Fumba Route (Mtoni Substation – Fumba)	Total
ACSR 100 mm^2	(1) Distance of distribution lines	15.9 km	17.7 km	24.8 km	58.4 km
	(2) Design quantity (3 phases, (1) x 3)	47.7 km	53.1 km	74.4 km	175.2 km
	(3) Quantity for procurement plan ((2) x 1.10 x 1.03)	54.0 km	60.2 km	84.3 km	198.5 km
	(4) Quantity for installation plan ((2) x 1.03)	49.1 km	54.7 km	76.6 km	180.4 km
ABC 3x150 mm^2 + 50 mm^2	(1) Distance of distribution lines	4.4 km	4.3 km	13.7 km	22.4 km
	(2) Design quantity (3 phases, same as (1))	4.4 km	4.3 km	13.7 km	22.4 km
	(3) Quantity for procurement plan ((2) x 1.07 x 1.05)	4.9 km	4.8 km	15.4 km	25.1 km
	(4) Quantity for installation works ((2) x 1.05)	4.6 km	4.5 km	14.4 km	23.5 km

Note: Standard 2 km drums should be used (0.25 km in case of ABC cables). The distance of distribution lines of the South Route includes the distance from the new Welezo Substation to the connection points to the existing 11 kV distribution lines.

(d) Types and Dimensions of Electric Poles

TANESCO standard wooden poles (12 m long) should be used. However, where ABC cables are used, steel poles that have enough strength to support the load of ABC cables should be used. The distance between these steel poles and nearby structures should be as large as possible and the height of the poles should be 15 meters so that they will be higher than the existing distribution lines that run parallel.

The creepage distance of pin insulators and suspension insulators for 33 kV distribution lines should be 25 mm/kV. The cross arms for mounting insulators should be hot-dipped galvanized steel.

The types, uses and quantity of electric poles are as shown in Table 2-2-2-3.8. The quantity of electric poles should be the design quantity calculated based on the drawing multiplied by the construction supply rate (1.05).

Table 2-2-2-3.8 Quantity of Each Type of Electric Poles for 33/11 kV Distribution Lines

Type of poles	Use	Pole	Pole length (m)	Number of poles per set	North route			South route			Fumba route			Total set quantity Number of electric poles in parentheses	
					(8) Design quantity	(9) Supply quantity ((8) x 0.05)	Subtotal (set) (8) + (9)	(8) Design quantity	(9) Supply quantity ((8) x 0.05)	Subtotal (set) (8) + (9)	(8) Design quantity	(9) Supply quantity ((8) x 0.05)	Subtotal (set) (8) + (9)		
3A	33 kV intermediate pole (line angle 0º) for ACSR	Wooden	12	1	122	6	128	140	7	147	191	10	201	453	476
3B	33 kV light angle pole (line angle up to 30º) for ACSR	Wooden	12	1	9	1	10	5	1	6	3	1	4	17	20
3C	33 kV section pole for ACSR	Wooden	12	2	9	1	10	13	1	14	6	1	7	28	31
3D	33 kV section pole with LBS for ACSR	Wooden	12	2	1	1	2	1	1	2	0	0	0	2	4
3E	33 kV Heavy Angle Pole (Line Angle 60°-90°) for ACSR	Wooden	12	2	11	1	12	7	1	8	15	1	16	33	36
3F	33 kV terminal pole for ACSR	Wooden	12	2	1	1	2	1	1	2	0	0	0	2	4
3G	33 kV terminal pole (with disconnecting switch) for ACSR	Wooden	12	2	3	1	4	2	1	3	2	1	3	7	10
3H	33 kV T-off pole for ACSR	Wooden	12	2	2	1	3	2	1	3	5	1	6	9	12
3J	33 kV transformer pole (section type) for ACSR	Wooden	12	2	0	0	0	0	0	0	15	1	16	15	16
3K	33 kV transformer pole (terminal type) for ACSR	Wooden	12	2	0	0	0	0	0	0	6	1	7	6	7
3L	33 kV intermediate pole (line angle up to 45°) for ABC	Steel	15	1	65	3	68	64	3	67	197	10	207	326	342
3M	33 kV section pole for ABC	Steel	15	1	14	1	15	13	1	14	34	2	36	61	65
3N	33 kV Heavy Angle Pole (Line Angle 45°-90°) for ABC	Steel	15	1	2	1	3	3	1	4	15	1	16	20	23
3P	33 kV section pole with Line SW for ABC	Steel	15	1	0	0	0	1	1	2	3	1	4	4	6
3Q	33 kV T-off pole for ABC	Steel	15	1	0	0	0	0	0	0	6	1	7	6	7
3R	33 kV transformer pole (section type) for ABC	Steel	15	1	0	0	0	0	0	0	10	1	11	10	11
3S	33 kV transformer pole (terminal type) for ABC	Steel	15	1	0	0	0	0	0	0	5	1	6	5	6
3T	33 kV ABC/ACSR convert pole	Steel	15	1	4	1	5	1	1	2	1	1	2	6	9
1A	11 kV intermediate pole (line angle 0º) for ACSR	Wooden	12	1	0	0	0	4	1	5	0	0	0	4	5
1E	11 kV Heavy Angle Pole (Line Angle 60°-90°) for ACSR	Wooden	12	2	0	0	0	6	1	7	0	0	0	6	7
1F	11 kV terminal pole for ACSR	Wooden	12	2	0	0	0	2	1	3	0	0	0	2	3
1G	11 kV terminal pole (with disconnecting switch) for ACSR	Wooden	12	2	2	1	3	1	1	2	0	0	0	3	5

Note: The numbers of devices (such as load break switches and lightning arresters) should be the actual numbers and are not included in the supply quantity.

(e) Installation of Load Break Switches

For the purpose of maintenance and inspection of 33 kV distribution lines in the target areas of the Project, load break switches that can open and close the load current on electric lines will be installed at the connection points with the existing 33 kV distribution lines.

(f) Installation of Lightning Arresters

Lightning arresters will be installed on the 33 kV side to protect load break switches and distribution equipment from lightning damage.

3) General Specifications of Equipment and Materials

Table 2-2-2-3.9 Details of Plan for Installation of 33/11 kV Distribution Lines

No.	Item / Equipment	Specifications	Quantity
1	33 kV overhead electric pole		Refer to main text (Table 2-2-2-3.8)
	1) Material and length	Wooden pole (12 m) or steel pole (15 m)	
	2) Type (for ACSR lines)		
	(1) Intermediate pole	Wooden pole, line angle: 0 deg.	
	(2) Light angle pole	〃 : Up to 30 deg.	
	(3) Section pole	Installation: every 10 spans, Wooden, H-type	
	(4) Section pole with LBS	Wooden pole, H-type	
	(5) Heavy angle pole	〃 Line angle: 60 to 90 deg. H-type	
	(6) Terminal pole	Wooden pole, H-type	
	(7) Terminal pole with line switch	Wooden pole, H-type	
	(8) T-off pole	Wooden pole, H-type	
	(9) Transformer pole (section type)	Wooden pole, H-type	
	(10) Transformer pole (terminal type)	Wooden pole, H-type	
	3) Type (for ABC lines)		
	(1) Intermediate pole	Steel pole	
	(2) Section pole	Steel pole	
	(3) Heavy angle pole	Steel pole	
	(4) Terminal pole with line switch	Steel pole	
	(5) T-off pole	Steel pole	
	(6) Transformer pole (section type)	Steel pole	
	(7) Transformer pole (terminal type)	Steel pole	
	(8) Convert pole (ABC/ACSR)	Steel pole	
	4) Accessories	Pole cap, nail, etc.	
2	11 kV overhead electric pole		Refer to main text (Table 2-2-2-3.8)
	1) Material and length	Wooden pole (12 m)	
	2) Type (for ACSR lines)		
	(1) Intermediate pole	Line angle: 0 deg.	
	(2) Light angle pole	〃 : Up to 30 deg.	
	(3) Section pole with LBS	H-type	
	(4) Heavy angle pole	〃 : 60 to 90 deg. H-type	
	(5) Terminal pole	H-type	
	(6) Terminal pole with line switch	H-type	
	3) Accessories	Pole cap, nail, etc.	
3	33 kV overhead distribution line		Refer to main text (Table 2-2-2-3.8)
	1) Applicable standard	IEC or equivalent	
	2) Type and nominal section size	ACSR 100 mm^2 ABC 3 x 150mm^2 + 50mm^2	

No.	Item / Equipment	Specifications	Quantity
4	11k V overhead distribution line		Refer to main text (Table 2-2-2-3.8)
	1) Applicable standard	IEC or equivalent	
	2) Type and nominal section size	ACSR 100 mm^2	
	3) Purpose of use	For connection between the secondary side of main transformer at Mwanyanya and Welezo Substations and the existing 11 kV distribution lines.	
5	33 kV insulator		
	1) Pin insulator		
	(1) Applicable standard	IEC or equivalent	1 set
	(2) Type	Porcelain glazed, color: brown	
	(3) Nominal voltage	33 kV	
	(4) Basic impulse insulation level	170 kV	
	2) Suspension insulator		
	(1) Applicable standard	IEC or equivalent	1 set
	(2) Type	Porcelain glazed, color: brown, disc type	
	(3) Nominal voltage	33 kV	
	(4) Minimum creepage distance	25 mm/kV	
	(5) Basic Impulse Insulation Level	170 kV	
6	11 kV insulator		
	1) Pin insulator		
	(1) Applicable standard	IEC or equivalent	1 set
	(2) Type	Porcelain glazed, color: brown	
	(3) Nominal voltage	11 kV	
	(4) Basic impulse insulation level	75 kV	
	2) Suspension insulator		
	(1) Applicable standard	IEC or equivalent	1 set
	(2) Type	Porcelain glazed, color: brown, disc type	
	(3) Nominal voltage	11 kV	
	(4) Minimum creepage distance	25 mm / kV	
	(5) Basic impulse insulation level	75 kV	
7	Pole assembly material		
	1) Cross arm		1 set
	(1) Material	Mild steel	
	(2) Finish	Hot-dipped galvanized	
	(3) Section shape	L, C shape	
	2) Anchor shackle		1 set
	(1) Type	Bolt clamping type	
	(2) Material	Steel	
	3) Ball clevis & socket eye		1 set
	(1) Material	Ductile iron or steel	
	(2) Finish	Hot-dipped galvanized	
	4) Suspension clamp		1 set
	(1) Material	Main body: Nodular graphite cast iron Holder: Aluminum alloy casting	
	5) Branch line		1 set
	(1) Material	Zinc-coated steel wire	
	(2) Size	45 mm^2 (2.90 mm x 7) or equivalent	
	6) Stay insulator		1 set
	(1) Line voltage	33 kV or 11 kV	
	(2) Material	Porcelain glazed, color: brown	
	7) Stay anchor		1 set
	(1) Material	Steel plates	
	(2) Tensile load	6 tons	
	8) Turnbuckle		1 set
	(1) Material	Mild steel	
	(2) Finish	Hot-dipped galvanized	
	9) Anti-climbing (ivy protection)	PVC	1 set
	10) Nail	Low carbon steel	1 set
	11) Staple	Low carbon steel	1 set
	12) Display board	Japanese flag mark, pole number, danger plate	1 set
	13) Barbed wire for anti- climbing		1 set

No.	Item / Equipment	Specifications	Quantity
8	33 kV load breaker switch 1) Applicable standard 2) Type 3) Nominal voltage 4) Rated voltage 5) Short-time current	 IEC or equivalent 3 phase, outdoor type, manual operation 33 kV 36 kV 25 kA or more	1 set
9	11 kV load breaker switch 1) Applicable standard 2) Type 3) Nominal voltage 4) Rated voltage 5) Short-time current	 IEC or equivalent 3 phase, outdoor type, manual operation 11 kV 12 kV 25 kA or more	1 set
10	33 kV lightning arrester 1) Applicable standard 2) Type 3) Nominal voltage 4) Rated voltage 5) Discharge current	 IEC or equivalent Outdoor type, gapless type 33 kV 36 kV 10 kA	1 set (1 unit/phase)
11	11 kV lightning arrester 1) Applicable standard 2) Type 3) Nominal voltage 4) Rated voltage 5) Discharge current	 IEC or equivalent Outdoor type, gapless type 11 kV 12 kV 10 kA	1 set (1 unit/phase)
12	Earthing materials for devices (1) Earthing wire (2) Earthing rod	 14 mm^2 Copper open wire or the equivalent Copper clad steel rod with lead terminal, D14 x L 1,500 mm Or the equivalent	 1 set 1 set
13	Connector for overhead lines (1) Type (2) Material	 Bolt clamping type Aluminum alloy casting	1 set

(5) Procurement of Power Distribution Equipment and Materials

1) Basic Policy

The following items will be procured for the purposes of the improvement and expansion of the 11 kV distribution network in the center of Unguja Island, the expansion of the 33 kV distribution network in rural areas. As for the specifications of the components, based on the specifications requested by the Tanzanian side and with great caution to secure competitiveness in bidding, grades should be set at the level that is not too far from the ability of the ZECO engineers who will carry out the installation.

2) Outline of Procurement of Equipment and Materials for Distribution Lines

Table 2-2-2-3.10 Details of Equipment and Materials for Distribution Lines

No.	Name	Specifications and use	Quantity
1	33 kV Auto-recloser	For improvement of reliability for supplying electricity to big consumers in the rural area	4 sets
2	Digger and pole erector truck	For replacement of existing vehicles of ZECO	1 vehicles
3	Truck with cranes	For replacement of existing vehicles of ZECO	1 vehicles

2-2-3 Schematic Design Drawings

The schematic design drawings for the Project are as follows:

Single Line Diagrams

Figure Number	Name of Drawing
Figure 2-2-3.1	Single Line Diagram of New 33 kV SWGR (Mtoni Substation)
Figure 2-2-3.2	Single Line Diagram of Mwanyanya Substation
Figure 2-2-3.3	Single Line Diagram of Welezo Substation
Figure 2-2-3.4	Connection Plan for Existing 33 kV Gantry

Layout Plans

Figure Number	Name of Drawing	Figure Number	Name of Drawing
Figure 2-2-3.5	Layout Plan of New Substation (Mtoni)	Figure 2-2-3.13	Elevation Plan of Mwanyanya Substation Control Building (South and East)
Figure 2-2-3.6	Layout Plan of Mwanyanya Substation	Figure 2-2-3.14	Elevation Plan of Mwanyanya Substation Control Building (North and West)
Figure 2-2-3.7	Layout Plan of Welezo Substation	Figure 2-2-3.15	Sectional Plan of Mwanyanya Substation Control Building
Figure 2-2-3.8	Floor Plan of Mtoni Substation Control Building	Figure 2-2-3.16	Floor Plan of Welezo Substation Control Building
Figure 2-2-3.9	Elevation Plan of Mtoni Substation Control Building (South and East)	Figure 2-2-3.17	Elevation Plan of Welezo Substation Control Building (North and West)
Figure 2-2-3.10	Elevation Plan of Mtoni Substation Control Building (North and West)	Figure 2-2-3.18	Elevation Plan of Welezo Substation Control Building (South and East)
Figure 2-2-3.11	Sectional Plan of Mtoni Substation Control Building	Figure 2-2-3.19	Sectional Plan of Welezo Substation Control Building
Figure 2-2-3.12	Floor Plan of Mwanyanya Substation Control Building		

Distribution Line Route Maps and Accessory Drawings

Figure Number	Name of Drawing
Figure 2-2-3.20	33 kV Distribution Route Map (North route)
Figure 2-2-3.21	33 kV Distribution Route Map (South and Fumba routes)
Figure 2-2-3.22	33/11 kV Intermediate Pole (Line angle 0º) for ACSR
Figure 2-2-3.23	33 kV Light Angle Pole (line angle up to 30º) for ACSR
Figure 2-2-3.24	33 kV Section Pole for ACSR
Figure 2-2-3.25	33 kV Section Pole with LBS for ACSR
Figure 2-2-3.26	33/11 kV Heavy Angle Pole (Line Angle 60º to 90º)
Figure 2-2-3.27	33/11 kV Terminal Pole for ACSR
Figure 2-2-3.28	33/11 kV Terminal Pole with Line Switch for ACSR
Figure 2-2-3.29	33 kV T-Off Pole for ACSR
Figure 2-2-3.30	33 kV Transformer Pole (Section Type) for ACSR
Figure 2-2-3.31	33 kV Transformer Pole (Terminal Type) for ACSR
Figure 2-2-3.32	33 kV ABC Cable Distribution Line Fitting Drawings

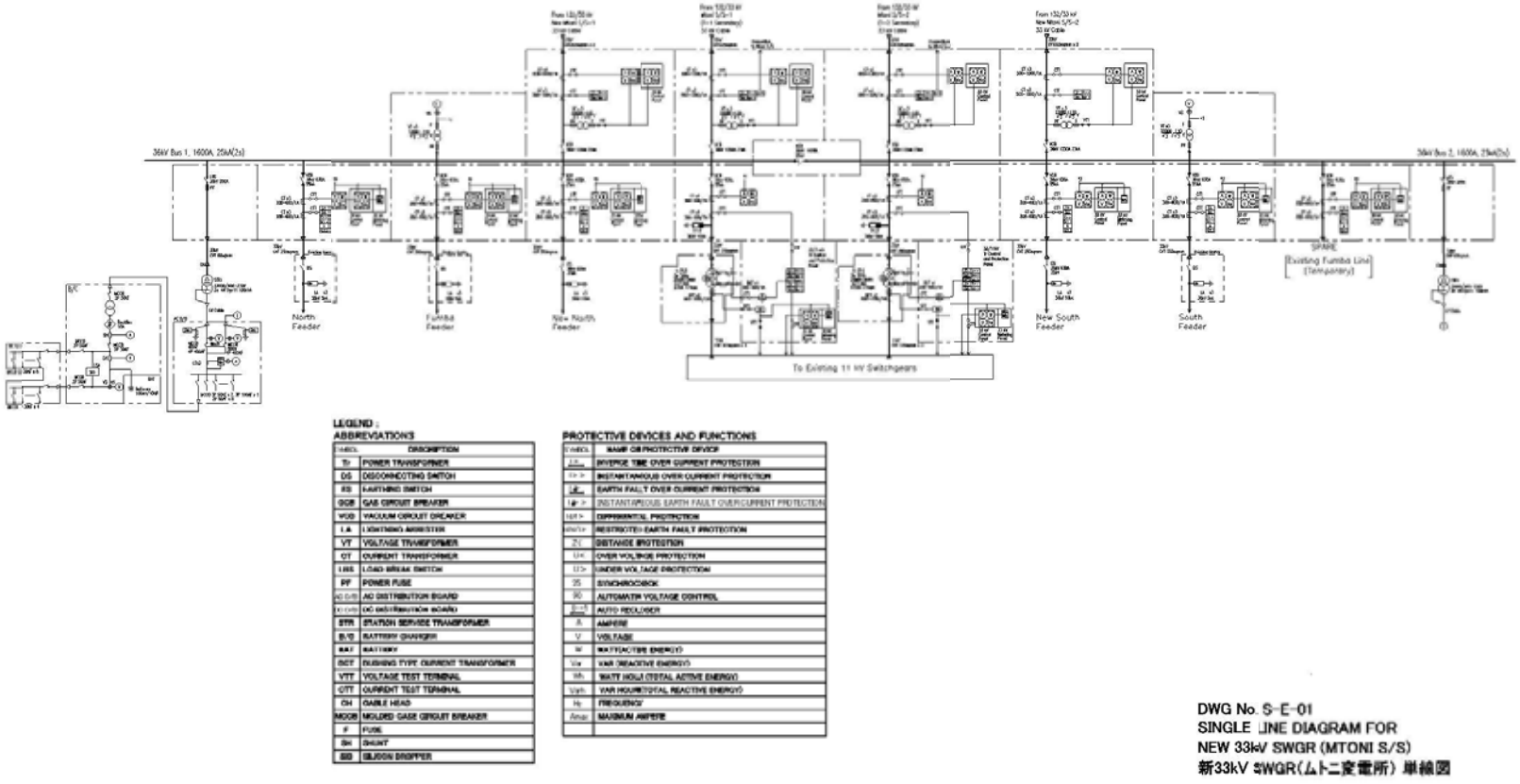


Figure 2-2-3.1 Single Line Diagram for New 33 kV SWGR (Mtoni Substation)

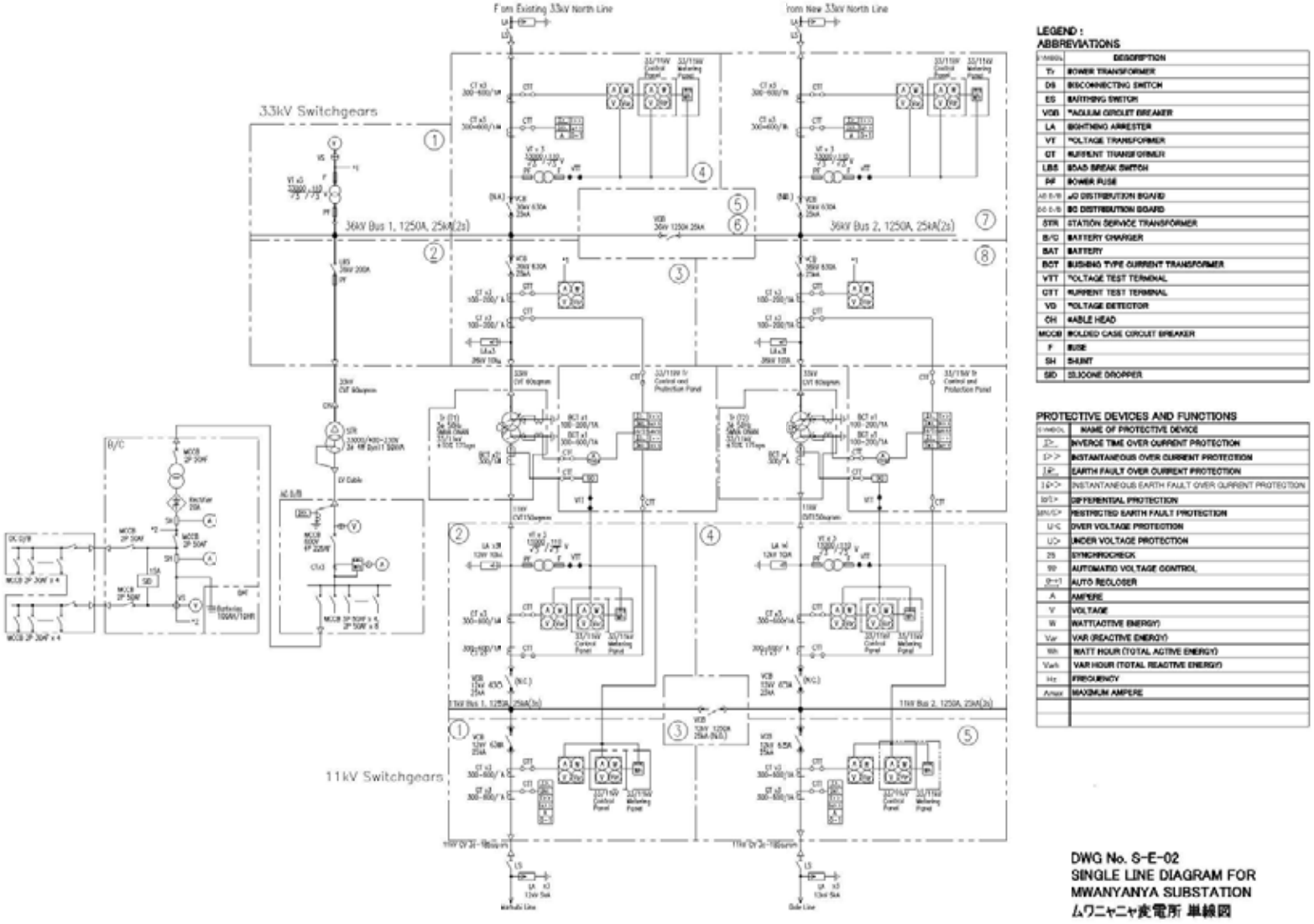
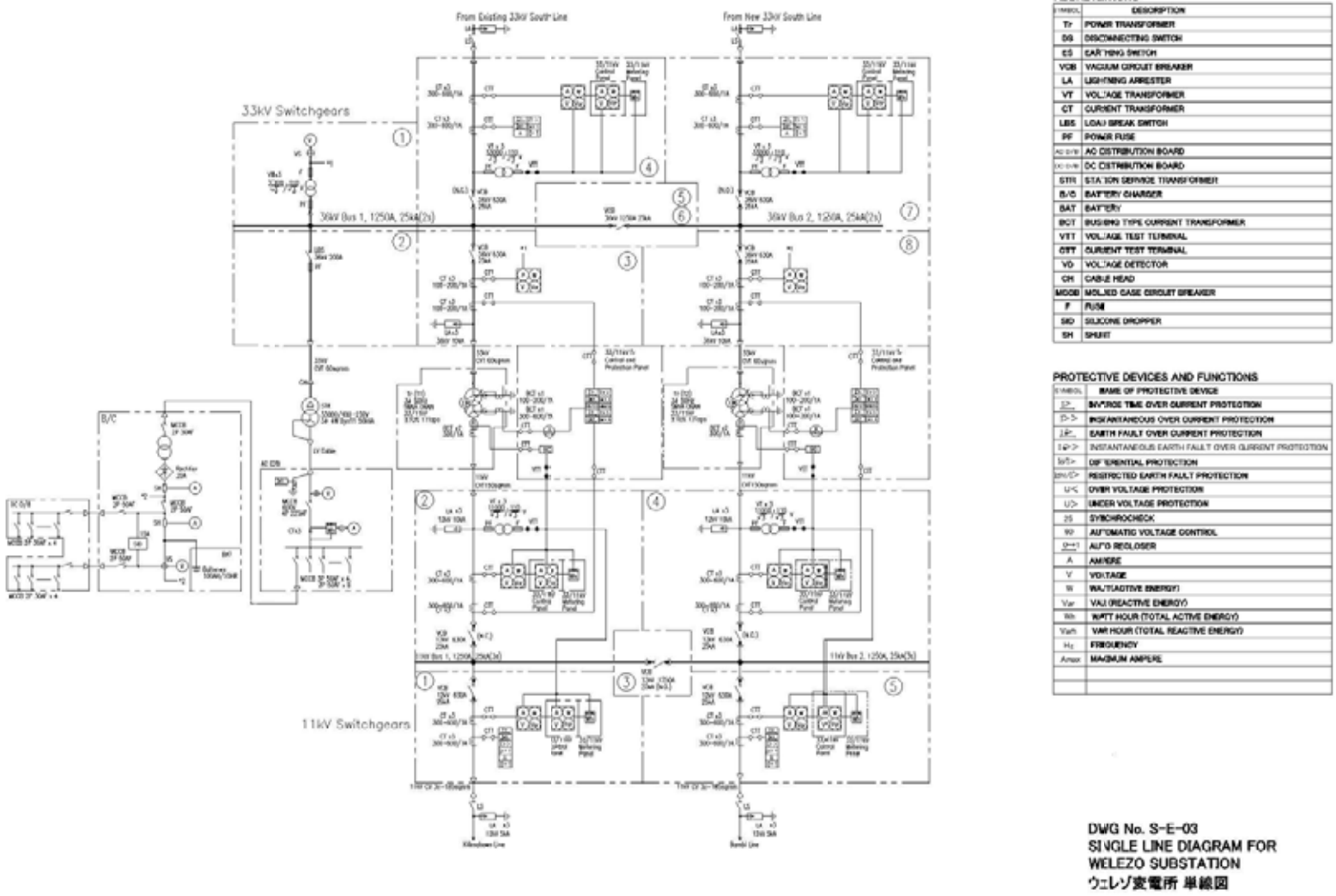


Figure 2-2-3.2 Single Line Diagram for Mwanyanya Substation



LEGEND :
ABBREVIATIONS

SYMBOL	DESCRIPTION
Tr	POWER TRANSFORMER
DS	DISCONNECTING SWITCH
ES	EARTHING SWITCH
VCB	VACUUM CIRCUIT BREAKER
LA	LIGHTNING ARRESTER
VT	VOLTAGE TRANSFORMER
CT	CURRENT TRANSFORMER
LBS	LOAD BREAK SWITCH
PF	POWER FUSE
AC D/B	AC DISTRIBUTION BOARD
DC D/B	DC DISTRIBUTION BOARD
STR	STATION SERVICE TRANSFORMER
B/C	BATTERY CHARGER
BAT	BATTERY
BCT	BUSHING TYPE CURRENT TRANSFORMER
VTT	VOLTAGE TEST TERMINAL
CTT	CURRENT TEST TERMINAL
VD	VOLTAGE DETECTOR
CH	CABLE HEAD
MCCB	MOLDED CASE CIRCUIT BREAKER
F	FUSE
SID	SILICONE DROPPER
SH	SHUNT

PROTECTIVE DEVICES AND FUNCTIONS

SYMBOL	NAME OF PROTECTIVE DEVICE
I>t	INVERSE TIME OVER CURRENT PROTECTION
I>>	INSTANTANEOUS OVER CURRENT PROTECTION
Ie>	EARTH FAULT OVER CURRENT PROTECTION
Ie>>	INSTANTANEOUS EARTH FAULT OVER CURRENT PROTECTION
Δ/Δ>	DIFFERENTIAL PROTECTION
64/G>	RESTRICTED EARTH FAULT PROTECTION
U<	OVER VOLTAGE PROTECTION
U>	UNDER VOLTAGE PROTECTION
25	SYNCHROCHECK
90	AUTOMATIC VOLTAGE CONTROL
0→1	AUTO RECLOSER
A	AMMERE
V	VOLTAGE
W	WATT(ACTIVE ENERGY)
Var	VAR (REACTIVE ENERGY)
Wh	WATT HOUR (TOTAL ACTIVE ENERGY)
Varh	VAR HOUR (TOTAL REACTIVE ENERGY)
Hz	FREQUENCY
Amax	MAGNUM AMPERE

DWG No. S-E-03
SINGLE LINE DIAGRAM FOR
WELEZO SUBSTATION
ウェレゾ変電所 単線図

Figure 2-2-3.3 Single Line Diagram for Welezo Substation

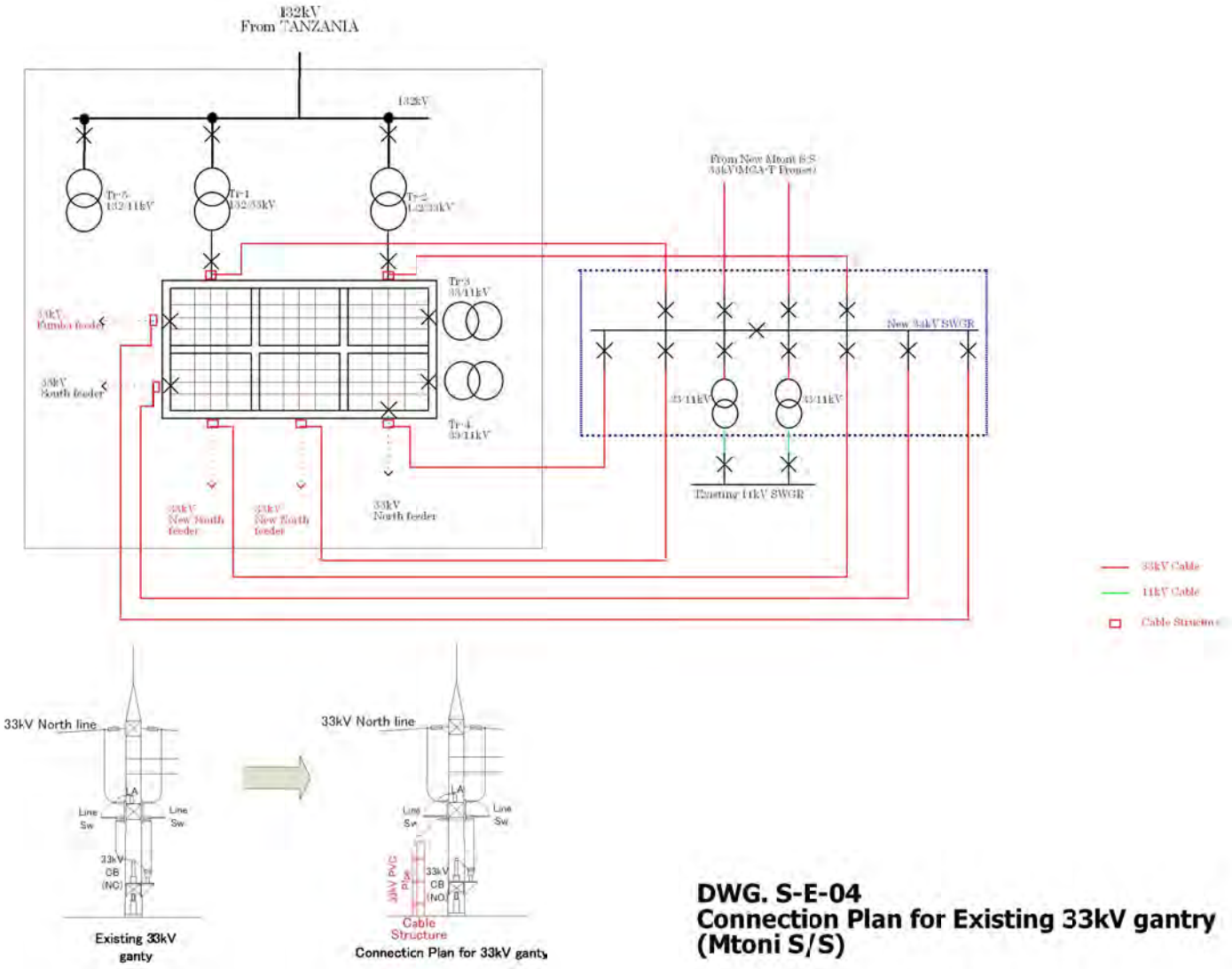


Figure 2-2-3.4 Connection Plan for Existing 33 kV Gantry

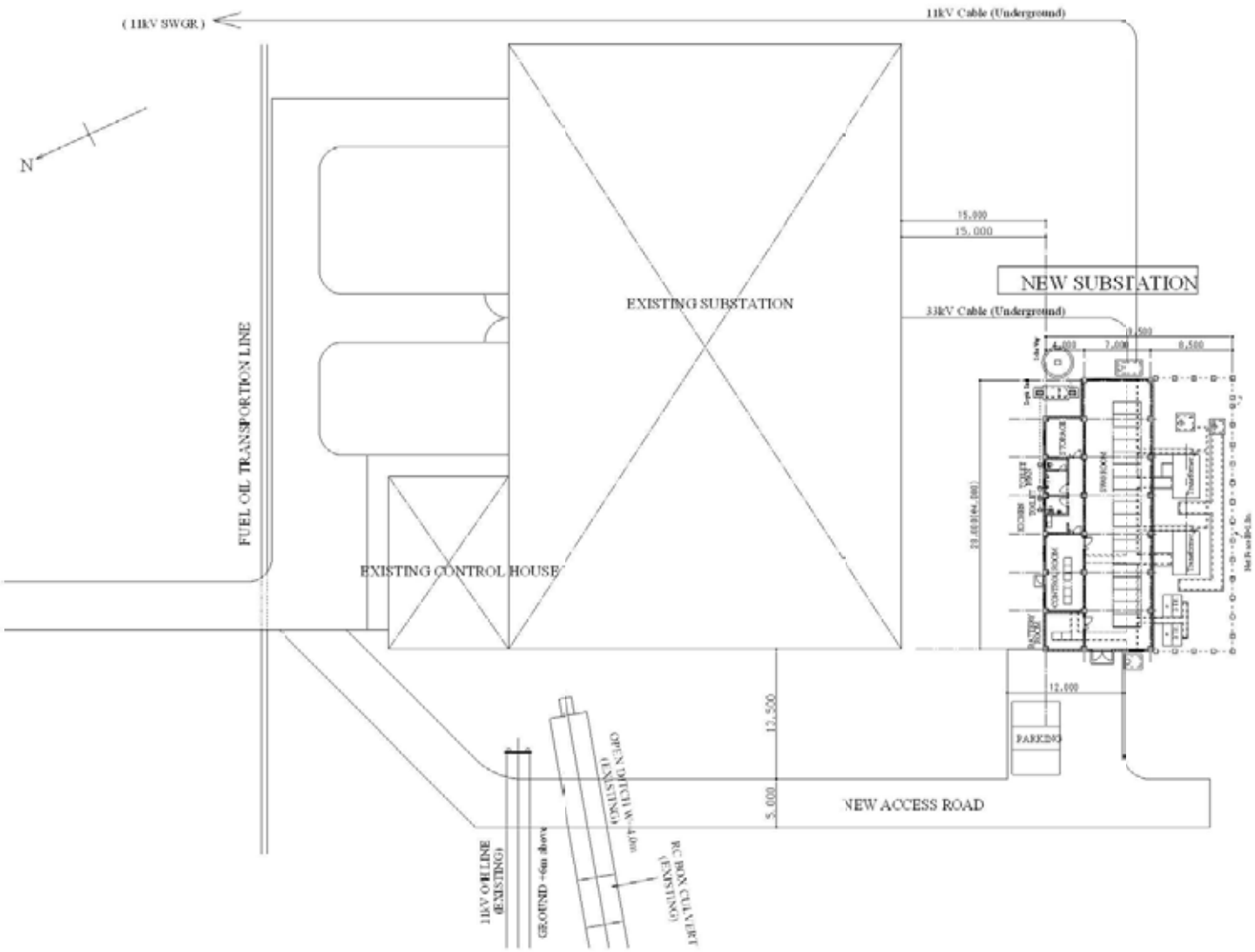


Figure 2-2-3.5 Layout Plan of New Substation (Mtoni)

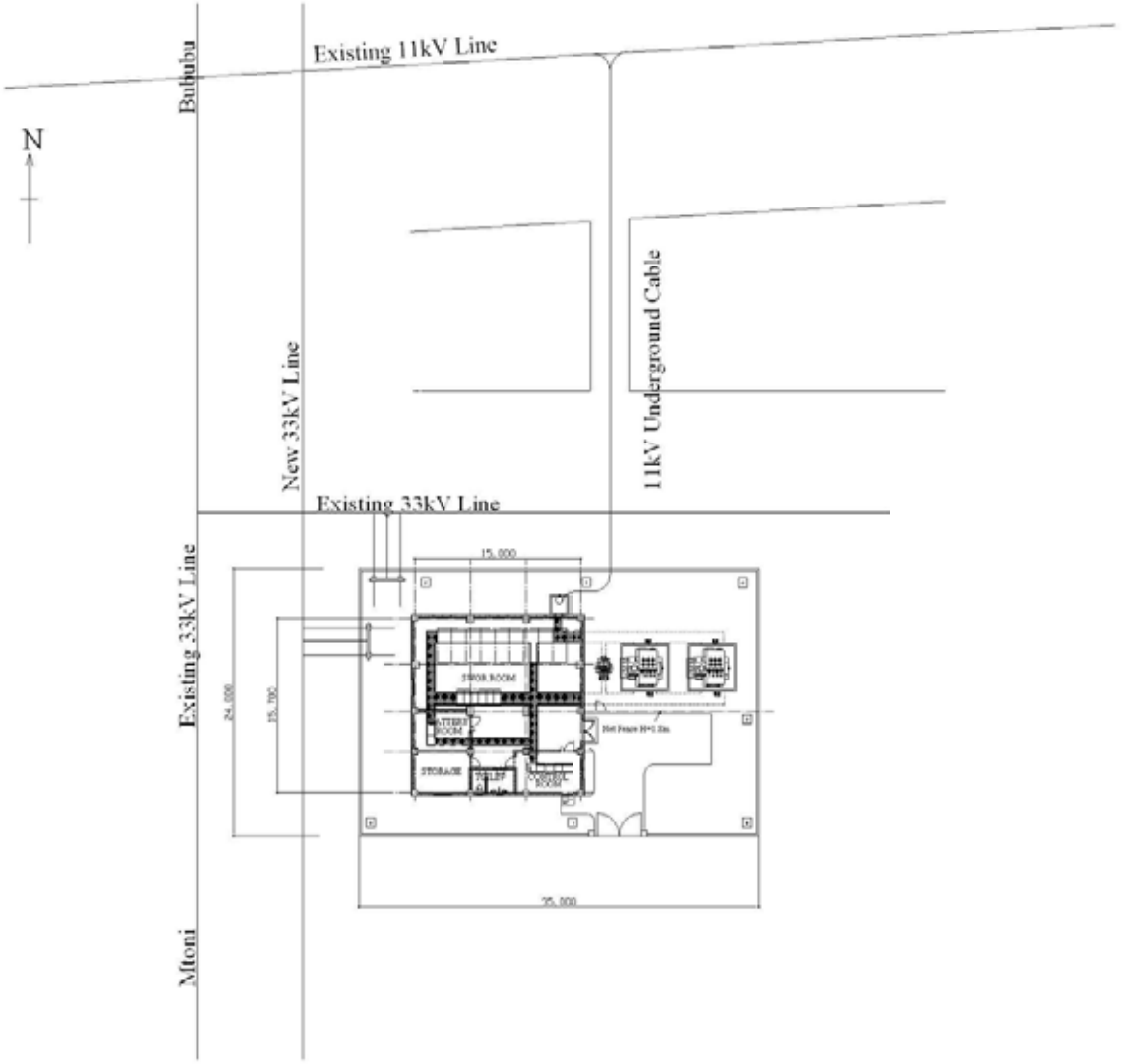


Figure 2-2-3.6 Layout Plan of Mwanyanya Substation

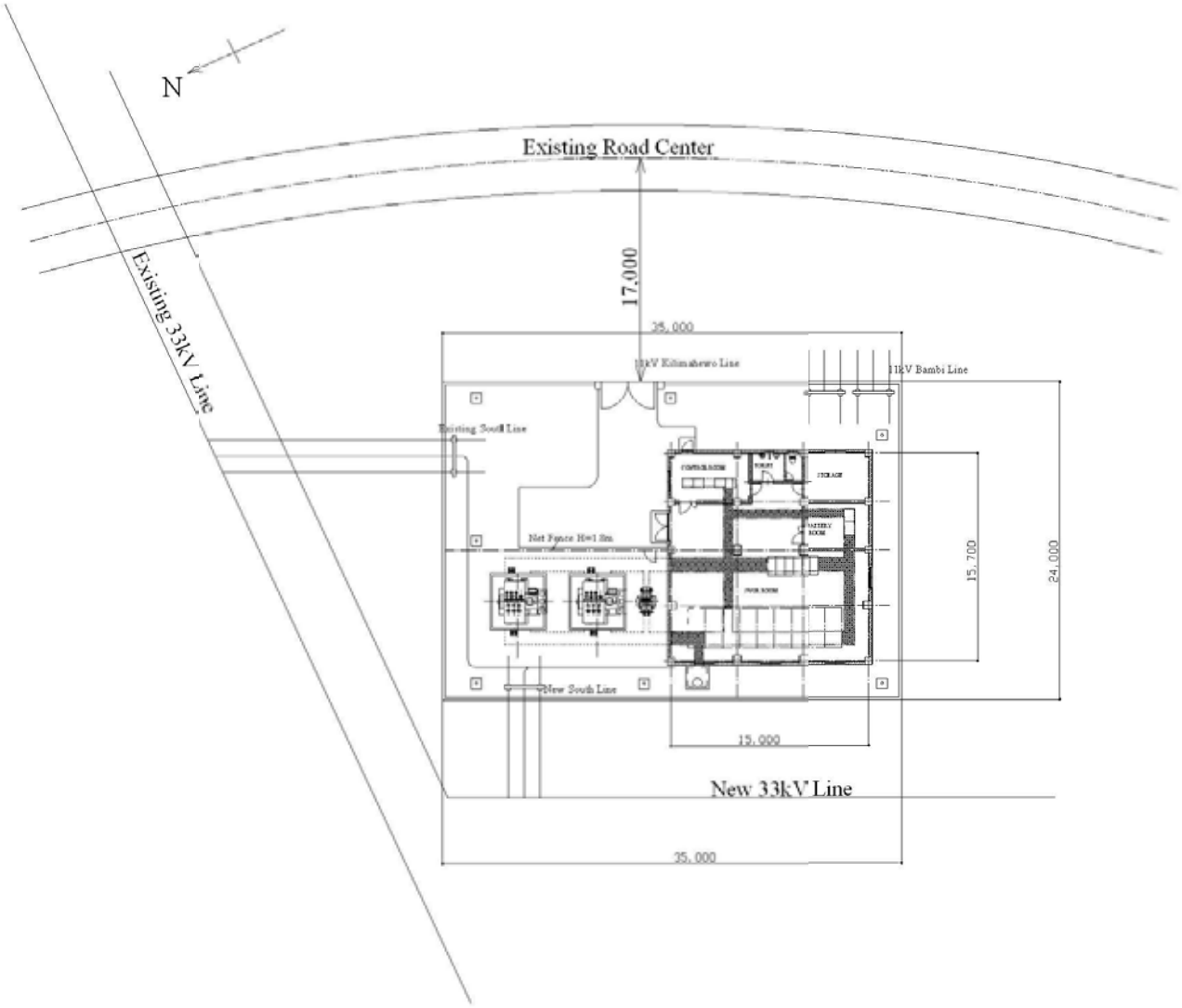


Figure 2-2-3.7 Layout Plan of Welezo Substation

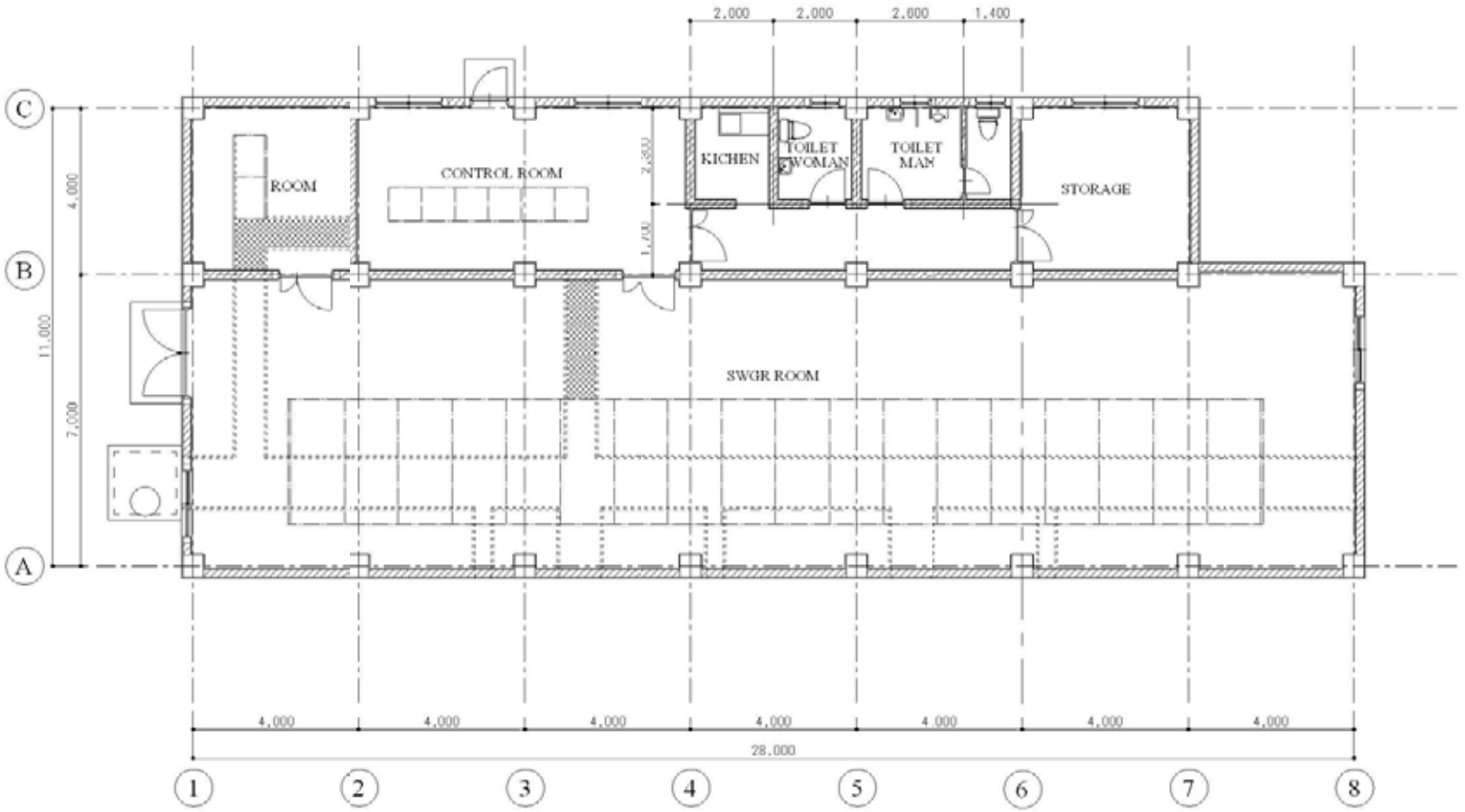
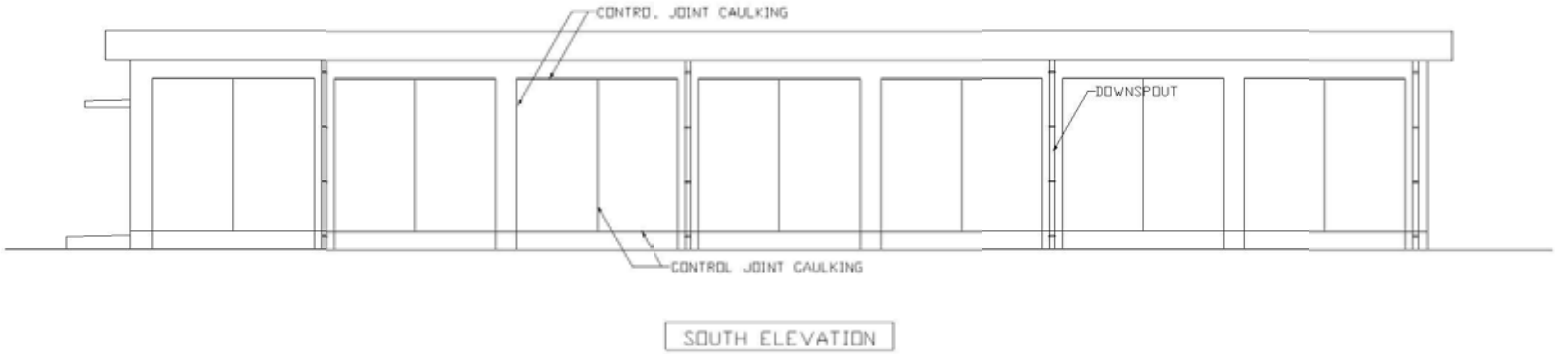


Figure 2-2-3.8 Floor Plan of Mtoni Substation Control Building



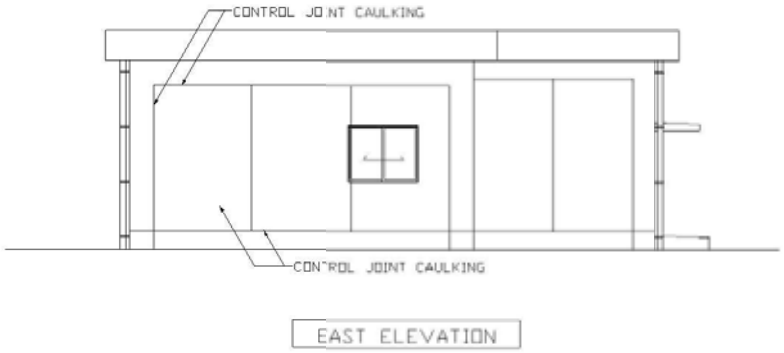


Figure 2-2-3.9 Elevation Plan of Mtoni Substation Control Building (South and East)

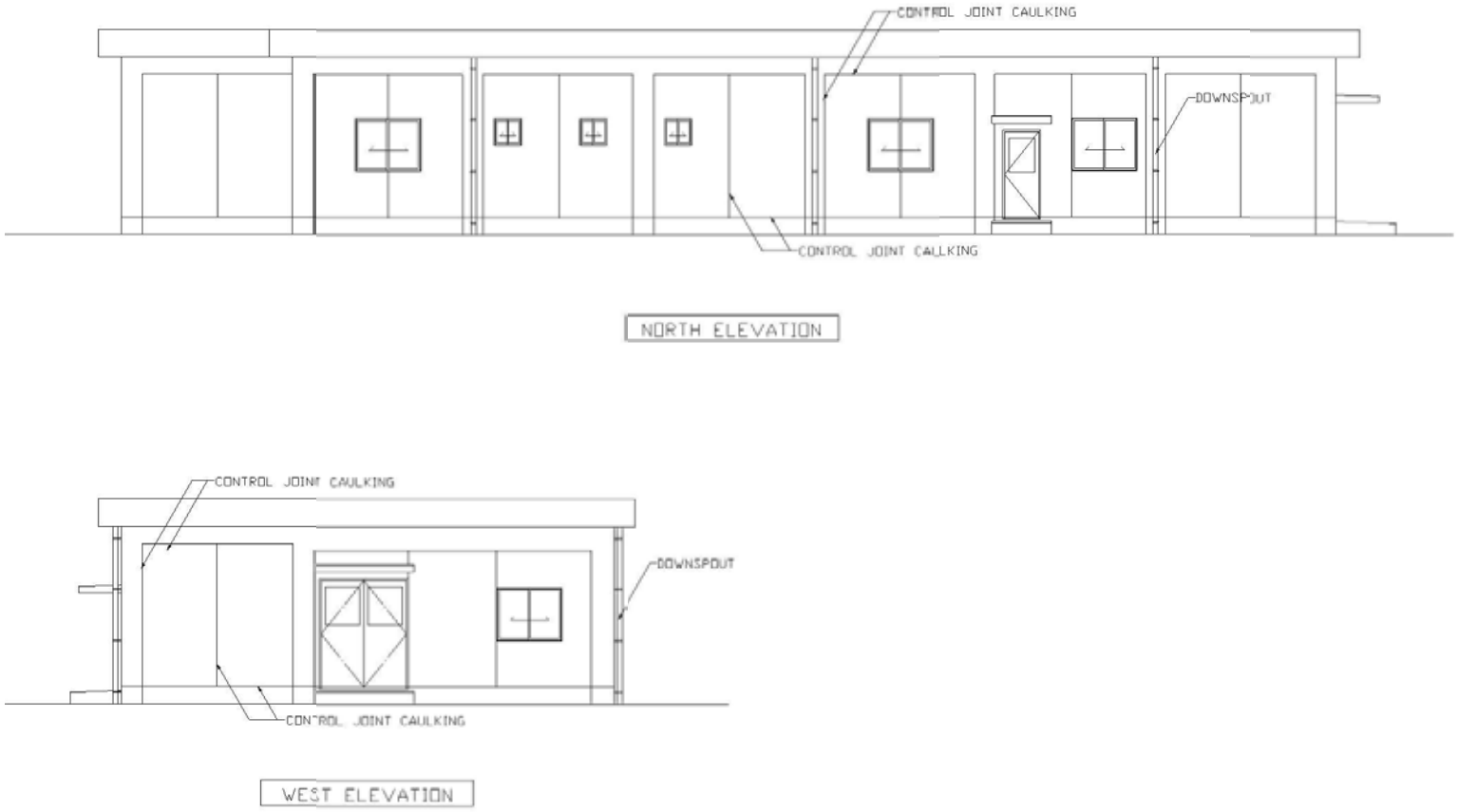


Figure 2-2-3.10 Elevation Plan of Mtoni Substation Control Building (North and West)

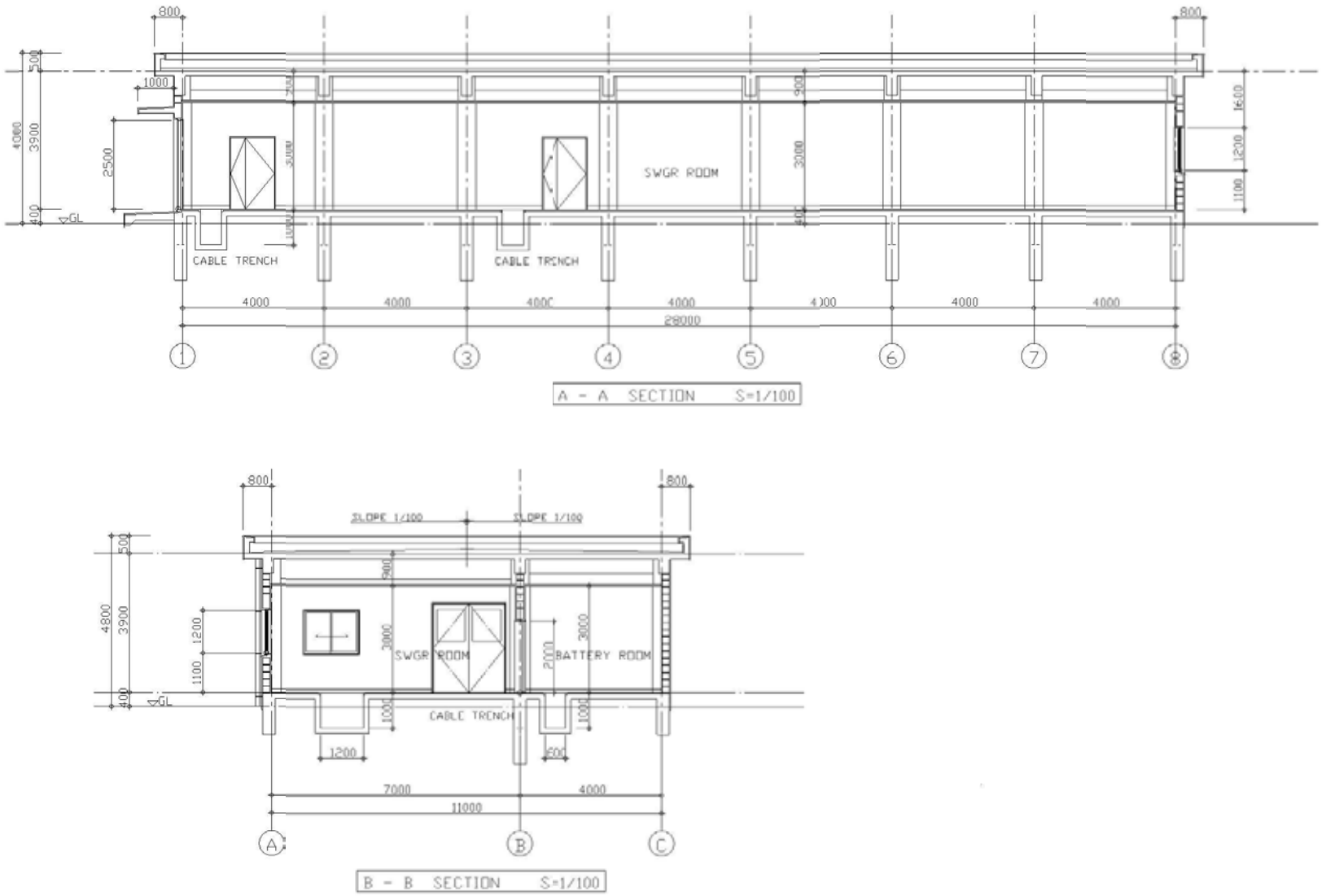


Figure 2-2-3.11 Sectional Plan of Mtoni Substation Control Building

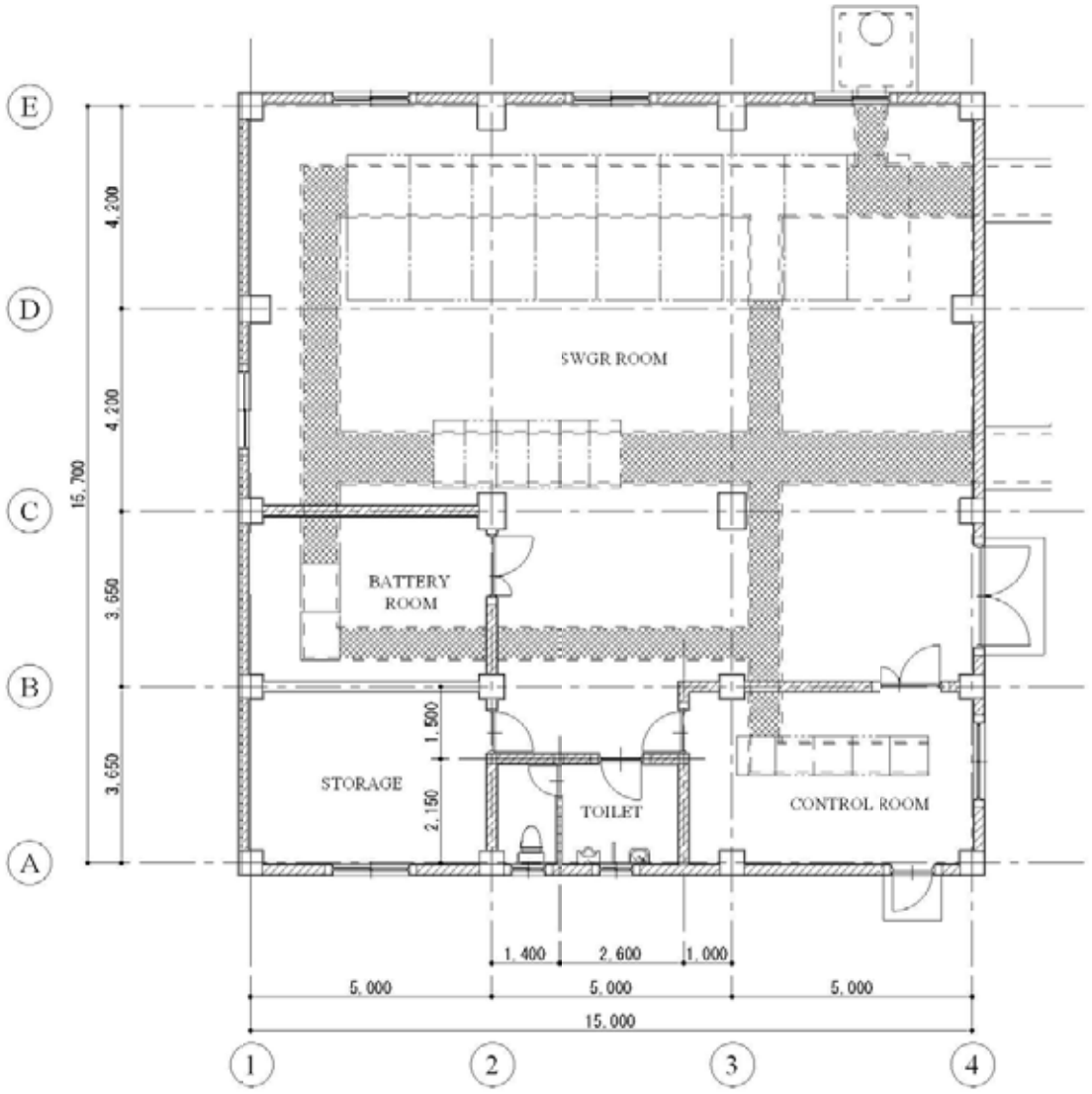


Figure 2-2-3.12 Floor Plan of Mwanyanya Substation Control Building