Tanzania Electric Supply Company Ltd. (TANESCO)
Ministry of Energy (MOE)
The United Republic of Tanzania

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR
REINFORCEMENT OF SUPPLY
FROM
KINYEREZI POWER STATION
IN
THE UNITED REPUBLIC OF TANZANIA

NOVEMBER 2022

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

YACHIYO ENGINEERING CO., LTD.
WEST JAPAN ENGINEERING CONSULTANTS, INC.

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to the Consortium consist of Yachiyo Engineering Co., Ltd. and West Japan Engineering Consultants, Inc..

The survey team held a series of discussions with the officials concerned of the Government of Rwanda, 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 Tanzania for their close cooperation extended to the survey team.

November, 2022

Hiroo TANAKA

Director General,

Infrastructure Management Department

Japan International Cooperation Agency

SUMMARY

① Overview of the Country

The United Republic of Tanzania (hereinafter referred to as "Tanzania") is situated in the eastern part of the African continent and the largest country in East Africa. Tanzania has a total land area of approximately 945,000 km2 (roughly 2.5 times bigger than Japan) and a population of approx. 58.00 million. It is a unitary republic that was formed by the amalgamation of Tanganyika on the mainland and the island of Zanzibar in 1964.

Regarding the economy, the Government of Tanzania had promoted the socialism after independence. However, the Government of Tanzania have adopted market-oriented economic reforms under support from the World Bank and IMF since 1986. The gross domestic product (GDP) growth rate had recorded approx. 6.0～7.0% since 2002, and GDP growth rate is projected at approx. 6.0～7.0% annually until 2017 according to IMF economic outlook, also. Meanwhile, the gross national income (GNI) per capita is low at US$1,080 (2019, according to the World Bank), and the major challenge facing the Government of Tanzania concerns how to translate high economic growth into reduction of poverty.

To implement policies, the most important issue is that the Government of Tanzania has to secure the budget. In terms of fiscal management, Tanzania has a perennial fiscal deficit whereby expenditure exceeds revenue. And it depends on the support of bilateral or multilateral assistance to secure the necessary budget. Therefore, it is unable to independently finance the construction and upgrading of large-scale public facilities and has no choice but to depend on assistance from donors.

② Background, progress and outline of the Project

Dar es Salaam, the largest commercial city in Tanzania, has a population of approximately 10% of Tanzania's total, but accounts for nearly 50% of the country's electricity demand. Electricity demand in Dar es Salaam is expected to grow by approximately 10% per year until 2040, and the city needs a stable supply of electricity to meet this growing demand. In addition, Tanzania's national development plan, the "Second Five Year Development Plan 2016/17 - 2020/21," sets a target of reducing transmission and distribution losses to 14.0% by 2020 and 12.0% by 2025, and has specified plans to strengthen transmission and distribution facilities in Dar es Salaam in order to achieve this target. The plan also includes a plan to increase power transmission and distribution facilities in Dar es Salaam in order to achieve this goal.

Under these circumstances, JICA implemented a technical cooperation project consisting of development plans called the “Project for Formulation of Power System Master Plan in Dar es Salaam and Coast Regions and Review of Power System Master Plan 2012” (2014-2016), the “Review of Power System Master Plan 2012”(hereinafter to PSMP 2016 Update) and formulated the “Power System Master Plan in Dar es Salaam” (DSMP). Among the implementation plans for the transmission and distribution facilities, the "Reinforcement of Power Supply from Kinyerezi Power Plant to

Ubungo Substation" and the "Reinforcement of Ubungo Substation" in Dar es Salaam were identified as particularly urgent and important projects. In the Kinyerezi area of Dar es Salaam, there are the Kinyerezi I Power Plant (rated output 150 MW), Kinyerezi II Power Plant (rated output 240 MW), and Kinyerezi I Power Plant Expansion (rated output 185 MW), and there are plans to construct Kinyerezi III and IV. Thus, Kinyerezi is the largest thermal power plant in Tanzania, and in order to ensure a stable supply of electricity from the plant to Dar es Salaam, the city with the largest demand, it is essential to increase the transmission capacity from the plant to Dar es Salaam.

Based on the background, the Government of Tanzania has requested the Government of Japan on the Project for Reinforcement of Supply from Kinyerezi Power Station.

③ Outline of the study findings and Project contents

In response to the request, JICA dispatched the survey team to Tanzania (First field survey from March 12 to March 31, 2019, Second field survey from July 30 to August 15, 2019, Third field survey from October 26 to November 25, 2019, Fourth field survey from February 5 to February 19, 2020) in order to reconfirm the contents of the request from Tanzania and discuss the contents for implementation with related agencies on Tanzania side (responsible government agency: Ministry of Energy (MOE), and implementing agency: TANESCO), and survey the Project sites and gather related materials and data.

On returning to Japan, the survey team examined the necessity, social and economic impacts and validity of the Project based on the field survey materials and compiled the findings into the preparatory survey report.

The Project plan compiled based on the survey findings targets the procurement and installation for the equipment to reinforce and install substation facilities and transmission line facilities and the construction of related facilities. The outline of the basic plan is as follows;

Outline of the Project

	Major Components		Quantity/Capacity
Procurement/Installation	**1. 220/132 kV Mabibo Substation**		
	(1) Transformer		
	1) 220/132/33 kV transformer	(Outdoor)	200 MVA×2 units
	2) 33/0.4 kV earthing transformer	(Outdoor)	400 kVA×2 units
	(2) 220 kV Switchgear (GIS, double busbar system)		
	1) Transmission line bay	(Outdoor)	1 set
	2) Transformer bay	(Outdoor)	2 sets
	3) Busbar (Voltage transformers for busbar)	(Outdoor)	1 set
	4) Accessories for 220 kV outdoor switchyard	(Outdoor)	1 lot
	(3) 132 kV Switchgear (GIS, double busbar system)		
	1) Transmission line bay	(Outdoor)	4 sets
	2) Transformer bay	(Outdoor)	2 sets
	3) Busbar (Voltage transformers for busbar)	(Outdoor)	1 set
	4) Accessories for 132 kV outdoor switchyard	(Outdoor)	1 lot
	(4) 33 kV Switchgear (GIS, single busbar system)		
	1) 33 kV Feeder panels (1)	(Indoor)	2 panels
	2) 33/0.4 kV Transformer panels	(Indoor)	1 panel
	3) 33 kV Feeder panels (2)	(Indoor)	

	Major Components	Quantity/Capacity
	4) Cable connection panel (Indoor) (5) Control and protection (Indoor) (6) SCADA system (Indoor) (7) Communication system (Indoor) (8) Substation power supply system (Indoor)	1 panel 1 panel 1 lot 1 lot 1 lot 1 lot
	2. 220 kV Transmission Lines between Kinyerezi power station - Mabibo substation (1) Kinyerezi power station (T-off point) – Ubungo substation 220 kV Overhead lines (Bluejay 603 mm^2, double conductor and single conductor), triple circuit tower (2) Ubungo substation – Mabibo substation 220 kV Overhead lines (Bluejay 603 mm^2, double conductor), double circuit tower	Approx. 9.0 km Approx. 7.0 km Approx. 2.0 km
	3. 132 kV Transmission Lines between Mabibo substation – Existing Ubungo – Ilala line 132 kV Overhead lines (TACSR 240 mm^2, single conductor), double circuit tower	Approx. 0.5 km
	4. Reinforcement of switchgears at Kinyerezi power station Reinforcement of switchgears	1 lot
	5. Expansion of switchgear bay at Ubungo Substation Expansion of switchgears	1 lot
Procurement	**6. Maintenance tools for the Equipment of the Project** **7. Spare parts for the Equipment of the Project**	1 lot 1 lot
Construction Work	**8. Foundation for the Equipment of the Project (Switchgears,Transformers, Towers, etc.)** **9. Control building of Mabibo substation**	1 lot 1 building

Source: JICA preparatory survey team

④ Project implementation schedule and cost estimation

The total cost of the Project will be (*confidential*) until the verification of the Contractor/Supplier Contract is done. The implementation schedule for the Project will be approx. 42 months after Exchange of Notes of the Project.

(1) Relevance

The Project is deemed to be highly appropriate as an aid undertaking since it will aid realization of development plans and energy policy in Tanzania and impart benefits for the general public of Tanzania.

(2) Efficiency

1) Quantitative effects

Outcome Indicator	Base Value (2020 Current Value)	Target Value (2030) (3 years after the completion of the Project)	
		Without the Project	With the Project
1. 220/132 kV Transformer facility capacity (MVA)*1	770	840	1,240
2. Load factor of 220 kV transmission line between Kinyerezi power station and Ubungo substation (load flow / rated capacity) (%)*2	—	217 (Overloaded)	75 (Stable)
3. Transformer load factor in Ubungo substation (%)*3	—	209 (Overloaded)	113 (Overloaded)

*1 Indicate facility capacity of 220/132 kV substation in Dar es Salaam

*2 Based on 2-2-2-3 Power system analysis results. Ubungo substation is the exsiting substation powering to Dares Salaam city, and provide power from Kinyreizi power station. Also, it indicates the maximum value of the load factor of 220 kV transmission line between Kinyerezi power station and Ubungo substation.

*3 Described as an indicator after distribution load allocated. (Maximum demand / Facility capacity)

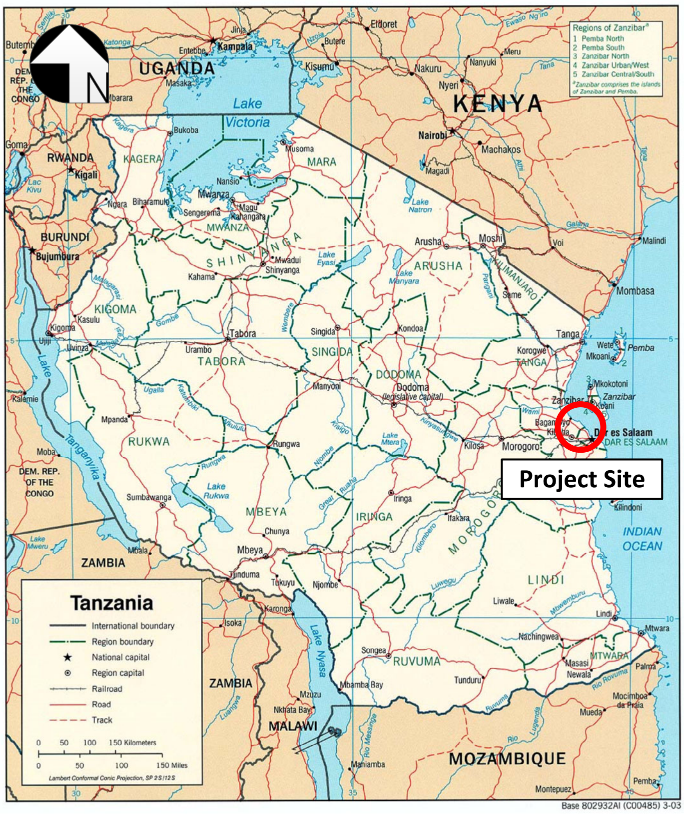
2) Qualitative effects

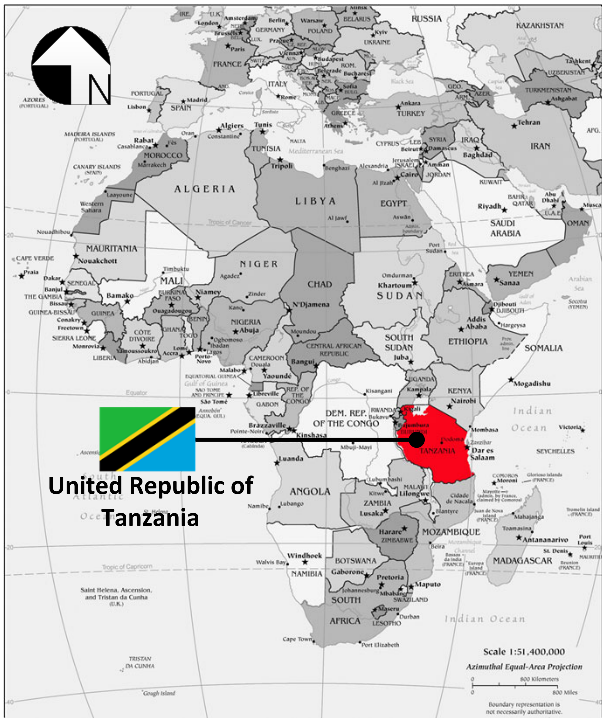
Present Status and Problems	Project Countermeasures (Grant Aid Project)	Extent of Project Effects and Improvement
1. With frequent power outage and voltage drops caused by aging equipment for transmission, distribution and substation system and overload operation, Dar es Salaam has the following issues. 1-1 Hindered industrial and economic development. 1-2 Operation of public welfare facilities, especially healthcare facilities, is affected.	Procurement and installation of the following equipment in Dar es Salaam city: - 220/132/33 kV substation 400 MVA＝200 MVA×2 banks - 220 kV tranmission equipment ・ Overhead line (Approx. 9.0 km) and steel towers (22) - 132 kV tranmission equipment ・ Overhead line (Approx. 0.5 km) and steel towers (2)	Stable power supply will revitalize industries and economic activities in Dar es Salaam, improve stable operation of public welfare facilities and healthcare services and the living environment of local residents in Dar es Salaam (Approx. 7.40 million people)
2. The power demand in Dar es Salaam has been rapidly increasing. However, there are frequent power interruptions and power losses caused by the deterioration and overload of the transmission and distribution facilities.	Same as the above	With 220/132/33 kV substation and 220 kV transmission line, the project reduces dependence on the Ubungo substation for power supply. Also, the project alleviates the risk of unstable power supply and power loss.
3. Dar es Salaam has serious problems such as unstable power supply and power shortages, which interferes with economic activity. Also, the 220/132 kV substation is not easy to construct due to the land limitations.	A Gas Insulated Switchgear is introduced.	Introduction of Gas Insulated Switchgear helps minimize required installation space for construction.

To sum up, since Project implementation can be expected to have major effects, it is confirmed to be relevant for implementation under the Grant Aid scheme of the Government of Japan. Moreover, the Tanzania side is deemed to possess adequate personnel and budget for implementing the Project and conducting operation and maintenance after implementation.

However, the total cost of the Project exceeded significantly the initial estimate for the Project as a result of the cost estimation based on the survey findings. Therefore, the Government of Japan decided not to implement the Project for a grant aid. Thus, the work for design and cost estimation is not carried out in this preparatory survey.

Contents





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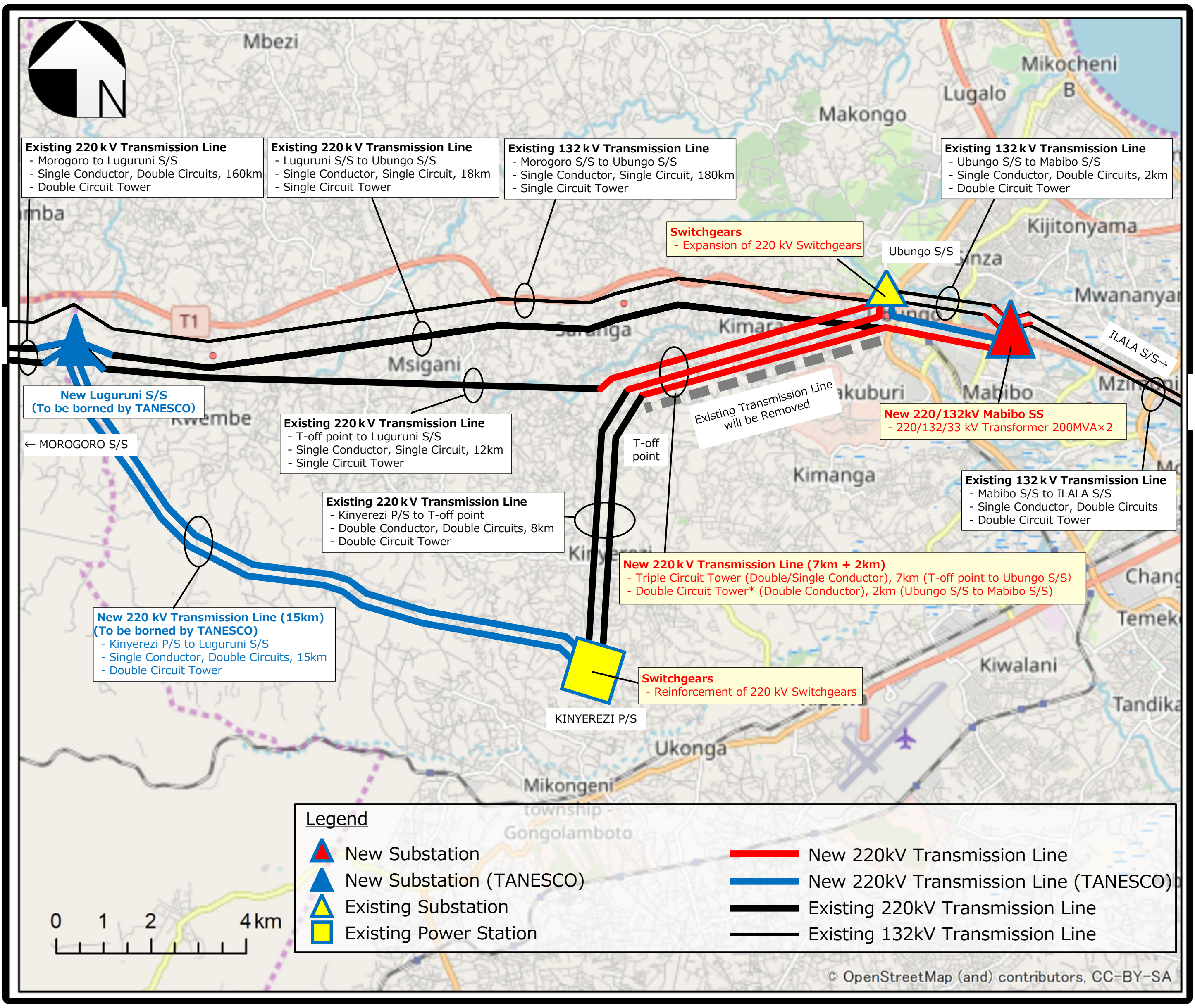
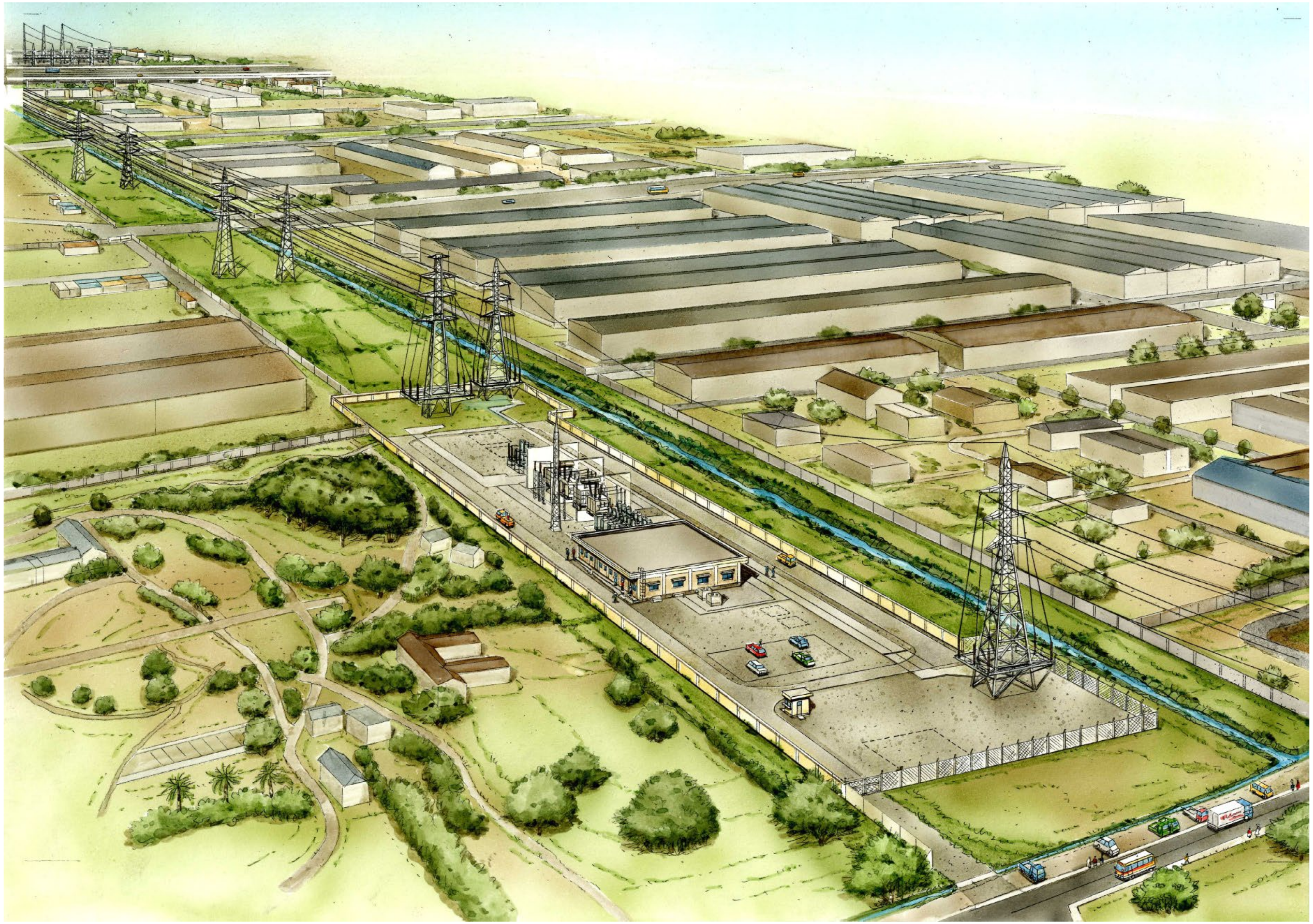


Location of Project Site



The Project for Reinforcement of Supply from Kinyerezi Power Station
(Architectural Redering of Mabibo substation)

List of Figures and Tables

Chapter 1

Chapter 2

Chapter 3

Abbreviations

AC	Alternate Current
ADSS	All Dielectric Self-supporting Cable
AfDB	African Development Bank
AIDS	Acquired Immunodeficiency Syndrome
ARAP	Abbreviated Resettlement Action Plan
ASEAN	Association of South East Asian Nations
ACSR	Aluminium Conductors Steel Reinforced
BCU	Bay Control Unit
COD	Chemical Oxygen Demand
COVID-19	Coronavirus disease 2019
Cl	Chloride
CT	Current Transformer
CRB	Contractor Resitration Board
DAC	Development Assistance Committee
DC	Direct Current
DGRC	District Grievance Redress Committee
DAWASA	Dar es Salaam Water and Sewerage Authority
DOE	Division of Environment
EC	Electrical conductivity
EMA	Environmental Management Act
EHS	Environment Health and Safety
E/N	Exchange of Notes
EIA	Environmental Impact Assessment
ERB	Engineers Registration Board
ESMP	Environmental and Social Management Plan
ESIA	Environmental and Social Impact
G/A	Grant Agreement
GCC	Grid Control Center
GDP	Gross Domestic Product
GL	Ground Level
GPS	Global Positioning System
GIS	Gas Insulation System
HIV	Human Immunodeficiency Virus
IEC	International Electrotechnical Commission
IEE	Initial Environmental Examination
IEEE	Institute of Electrical and Electronics Engineers
IFC	International Finance Corporation
IMF	International Monetary Fund
IWGIA	International Work Group for Indigenous Affairs
JEC	Japanese Electrotechnical Committee

JEM	Japan Engineering Management Inc.
JICA	Japan International Cooperation Agency
JIS	Japan Industrial Standards
LARAP	Land Acquisition and Resettlement Action Plan
MCCB	Molded Case Circuit Breaker
MEM	Ministry of Energy and Minerals
MGRC	Mtaa Grievance Redress Committee
NEAC	National Environmental Advisory Committee
NEMC	National Environmental Management Council
NGO	Non-governmental Organization
NIT	National Institute of Transport
NOx	Nitrogen Oxides
NO3-	Nitrate
NSSF	National Social Security Fund
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration
OHS	Occupational Health and Safety
OJT	On the Job Training
OPGW	Optical Ground Wire
PAP	Project Affected People
PCB	Polychlorinated Biphenyl
PLC	Power Line Communication
PPE	Personal protective equipment
PSMP	Power System Master Plan
REA	Rural Energy Agency
REME	Regional Environmental Management Expert
RTU	Remote Terminal Units
ROW	Right of Way
SEA	Strategic Environment Assessment
SF6	Sulfur hexafluoride
SCADA	Supervisory Control and Data Acquisition System
SOx	Sulfur oxide
SO2	Sulfur dioxide
SO4+	Sulfate
S/S	Electrical Substation
SSC	Social Services Committee
STD’s	Sexually Transmitted Diseases
TACSR	Thermo-Resistant Aluminium alloy Conductor SteelReinforced
TANESCO	Tanzania Electric Supply Company Ltd.
TBS	Tanzania Bureau of Standards
TDS	Total Dissolved Solids

TMA	Tanzania Meteorological Authority
TOR	Term of Reference
TSH	Tanzanian Shillings
UPS	Uninterruptible Power System
USD	United States dollar
VPO	Vice President's Office
WB	World Bank

Chapter 1 Background of the Project

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1-1 Background of the Project

Dar es Salaam, the largest commercial city in the United Republic of Tanzania (hereinafter referred to as "Tanzania"), has a population of approximately 10% of Tanzania's total, but accounts for nearly 50% of the country's electricity demand. Electricity demand in Dar es Salaam is expected to grow by approximately 10% per year until 2040, and the city needs a stable supply of electricity to meet this growing demand. In addition, Tanzania's national development plan, the "Second Five Year Development Plan 2016/17 - 2020/21," sets a target of reducing transmission and distribution losses to 14.0% by 2020 and 12.0% by 2025, and has specified plans to strengthen transmission and distribution facilities in Dar es Salaam in order to achieve this target. The plan also includes a plan to increase power transmission and distribution facilities in Dar es Salaam in order to achieve this goal.

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However, the power system in Dar es Salaam and the Coastal region is centered on the 220/132 kV Ubungo substation, from which 132 kV power lines are laid radially to Dar es Salaam and surrounding areas. Thus, the power supply in the region is heavily dependent on Ubungo substation, and an accident at the substation could affect the entire region. Ubungo substation is equipped with two 150 MVA 220/132 kV transformers, but since these transformers have been in operation for more than 40 years and are aging, the transformer load is limited to 110 MVA/unit or less. On the other hand, the electricity demand in Dar es Salaam and the Coastal region is increasing steadily, forcing load shedding at Ubungo substation.

Under these circumstances, Tanzania requested Japan's grant aid for the construction of a new Mabibo substation and a new transmission line from Kinyerezi power station to the new substation, in order to partially replace the functions of Ubungo substation and to meet the increasing demand for electricity.

Initially, the requested proposal (see Figure 1-1.2) was to construct a transmission line to Mburahati substation by replacing the two existing 220 kV transmission lines from Kinyerezi power station to

Morogoro/Ubungo substation in the current power system configuration (see Figure 1-1.1). However, while the acquisition of a new right-of-way (ROW) is minimal, the 220 kV transmission line from Kinyerezi power station to Ubungo substation is eliminated, and the power supply from Kinyerezi power station is stepped down from 220 kV to 132 kV at Mburahati substation before being fed to Ubungo substation. This increases the capacity of the 220/132 kV transformer at Mubrahati substation. Furthermore, the 220 kV transmission line from Kinyerezi power station to Morogoro substation is lost. Therefore, the power supply from Kinyerezi power station to Morogoro substation is inefficient and irregular due to a step-down from 220 kV to 132 kV at Mubrahati substation and a step-up from 132 kV to 220 kV again at Ubungo Substation.

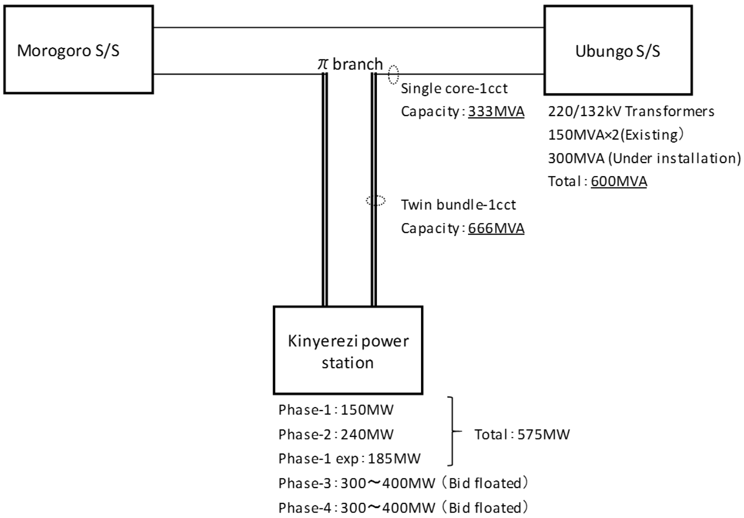


Figure 1-1.1 Current power system configuration

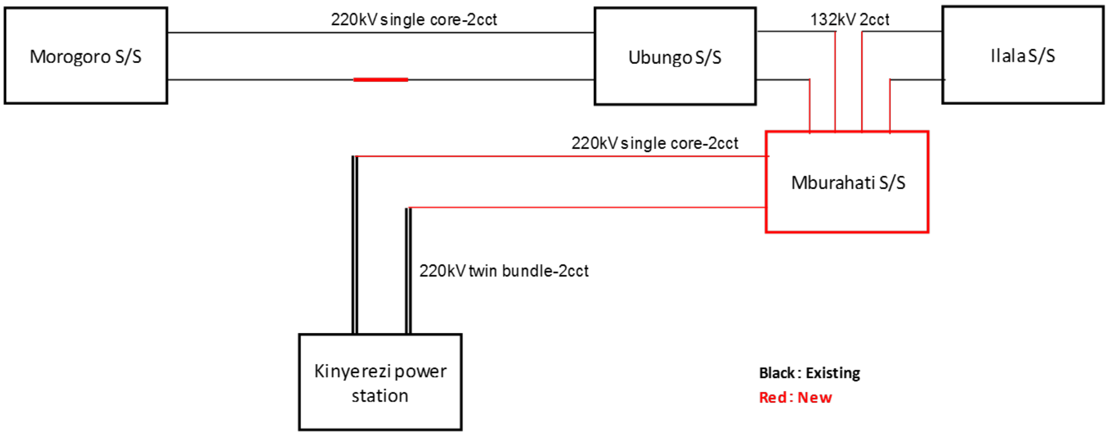


Figure 1-1.2 Power system configuration proposed by Tanzania side

Therefore, Tanzania side conducted a transmission line route survey to build new 220 kV double circuit transmission lines from Kinyerezi power station to Mubrahati substation as shown in Figure 1-1.3, and proposed Alternative 1 to JICA preparatory survey team.

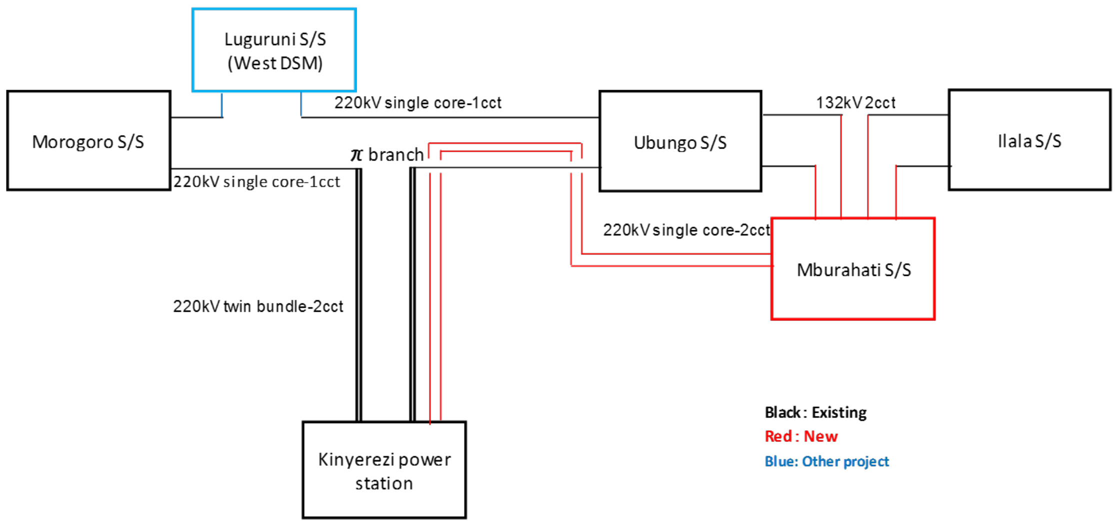


Figure 1-1.3 Power system configuration for Alternative 1

However, when the survey team conducted the first field survey of the route, a large number of houses were observed in the ROW of the new transmission line. As a result, the number of houses to be relocated was estimated to be 120, and it was determined that it would be difficult to proceed with this project as an Environmental Category B project. Therefore, the survey team examined alternatives for the optimal system configuration for the transmission network between Kinyerezi power station and substations. The characteristics of each alternative are described below.

① Alternative 2

Of the two existing 220 kV transmission lines from Kinyerezi power station to Morogoro/Ubungo substation, one line to Ubungo is removed and the ROW of the same line would be used to construct one line to Mburahati substation. This proposal lacks feasibility in terms of reliability because the transmission line from Kinyerezi power station to Ubungo substation is eliminated and only one transmission line from Kinyerezi power station to Mburahati substation is used.

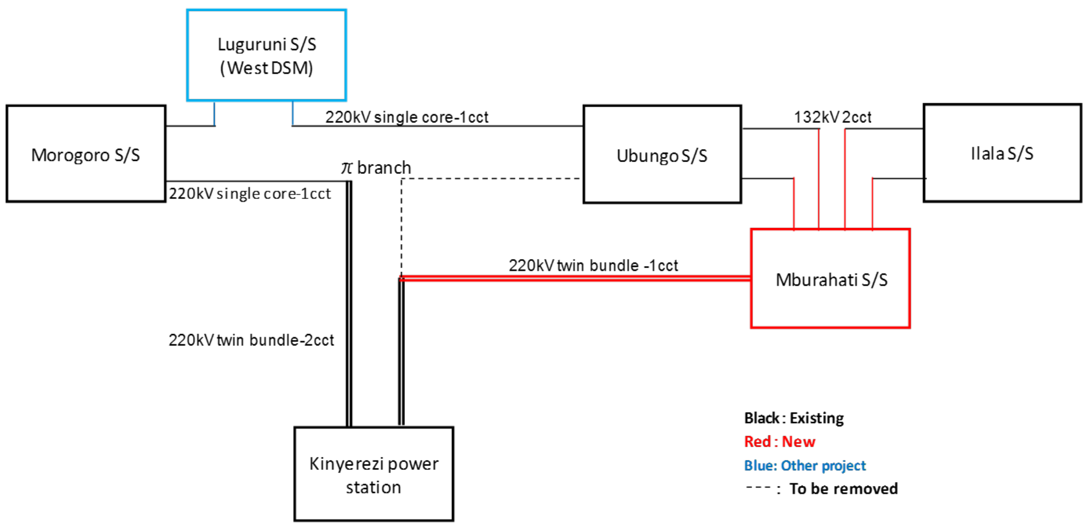


Figure 1-1.4 Power system configuration for Alternative 2

② Alternative 3

The proposal is to construct a transmission line to Mburahati substation by replacing the existing 220 kV double circuit transmission lines from Kinyerezi power station to Morogoro/Ubungo substation. However, it differs from Alternative 1 in that one line to Mburahati substation is interconnected to Ubungo substation and a new single line from Kinyerezi power station to Morogoro substation would be constructed. This proposal provides a transmission line from Kinyerezi power station to Ubungo/Morogoro substation and there is no need to supply power through other substations, allowing for a more efficient system configuration. On the other hand, there are some issues with Ubungo substation, such as the lack of space for an additional 220 kV switchyard bay, and the difficulty of securing new ROW due to a gas pipeline buried in the west of the existing 220 kV transmission line from Kinyerezi power station to Morogoro/Ubungo substation.

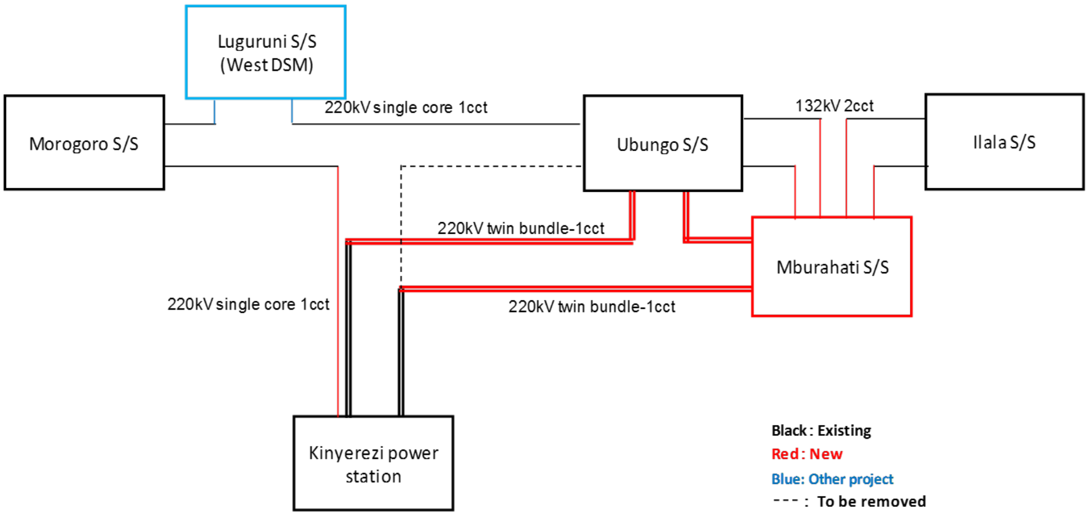


Figure 1-1.5 Power system configuration for Alternative 3

③ Alternative 4

The proposal is to reconnect the existing 220 kV double circuit transmission lines from Kinyerezi power station to Morogoro/Ubungo substation to Mburahati substation at T-off point, remove the existing 220 kV single circuit transmission line from T-off point to Ubungo substation, and construct a new 220 kV three circuit transmission line. The three circuit transmission line is co-located with two lines for Kinyerezi power station to Mburahati substation and one line for Ubungo substation to Morogoro substation. By constructing the transmission line from Kinyerezi power station to Luguruni substation first and then securing the transmission network from Kinyerezi power station to Ubungo /Morogoro substation, a temporary transmission line that is necessary for the existing 220 kV single circuit transmission line between T-off point and Ubungo substation to be removed would be no longer needed.

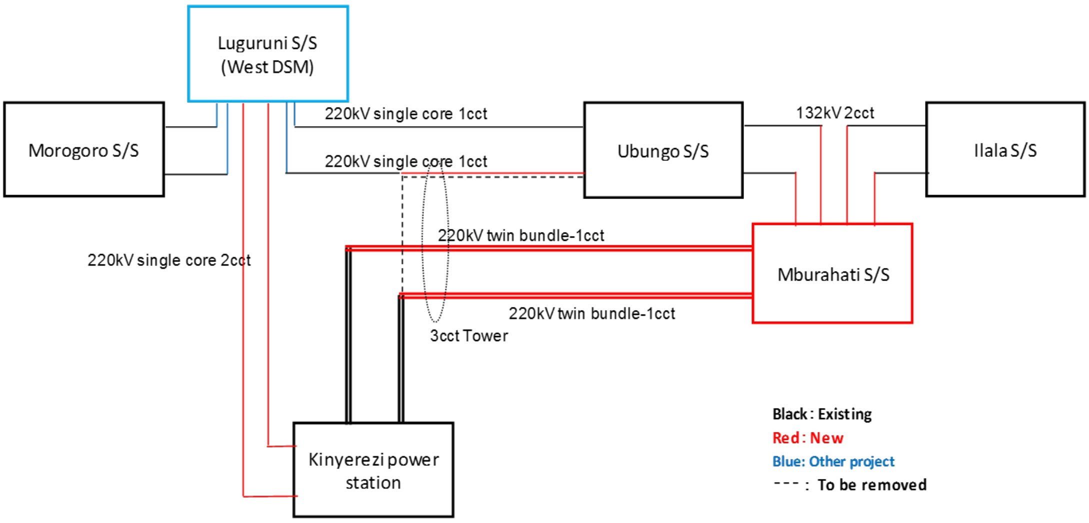


Figure 1-1.6 Power system configuration for Alternative 4

④ Alternative 5

The proposal is to reconnect the existing 220 kV double circuit transmission lines from Kinyerezi power station to Morogoro/Ubungo substation to Mburahati substation at T-off point, remove the existing 220 kV single circuit transmission line from T-off point to Ubungo substation, and construct a new double circuit transmission line. One of the two lines from Kinyerezi power station to Mburahati substation is interconnected to Ubungo substation. Since there is no space available at Ubungo substation for 220 kV switchgears, one of the two existing 220/132 kV, 150 MVA transformers should be replaced with a 300 MVA transformer and the other transformer should be removed so that the space in the transformer bay can be used for interconnecting the 220 kV transmission line. The project cost is unreasonable due to the additional transformers at Ubungo substation.

It is the same to Alternative 4 in terms of that a temporary transmission line that is necessary for the existing 220 kV single circuit transmission line between T-off point and Ubungo substation to be removed would be no longer required by constructing the transmission line from Kinyerezi power station to Luguruni substation first and then the transmission system from Kinyerezi power station to the Ubungo and Morogoro substations.

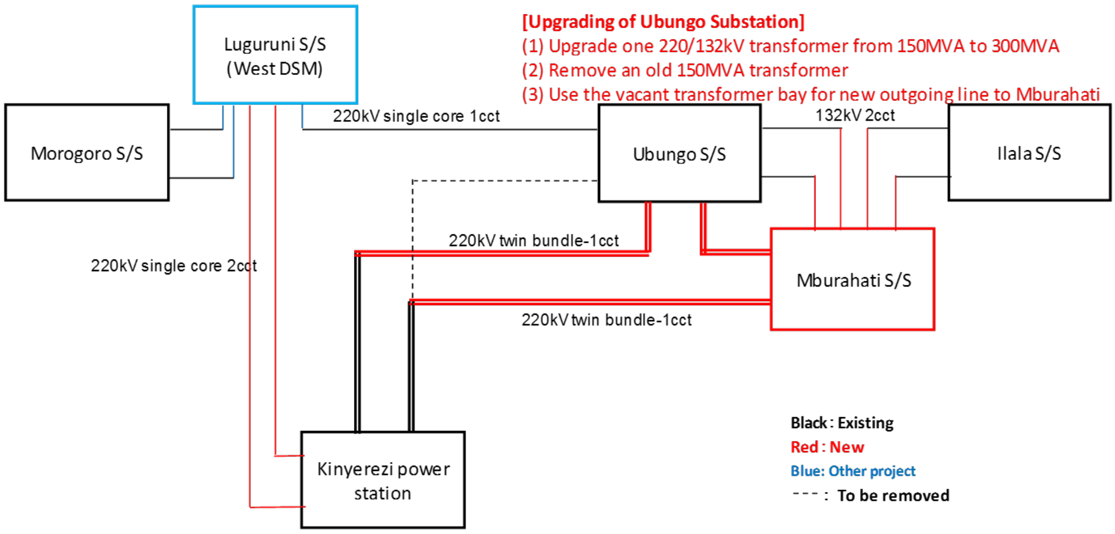


Figure 1-1.7 Power system configuration for Alternative 5

⑤ Alternative 5’

Regarding Alternative 5’, the 220 kV transmission line between Ubungo substation and Mburahati substation with less power flow is omitted and there is no need to replace the 220/132 kV transformer at Ubungo substation, it is better than Alternative 5 in terms of cost.

It is the same to Alternative 4 and 5 in terms of that a temporary transmission line that is necessary for the existing 220 kV single circuit transmission line between T-off point and Ubungo substation to be removed would be no longer required by constructing the transmission line from Kinyerezi power station to Luguruni substation first and then the transmission system from Kinyerezi power station to the Ubungo and Morogoro substations.

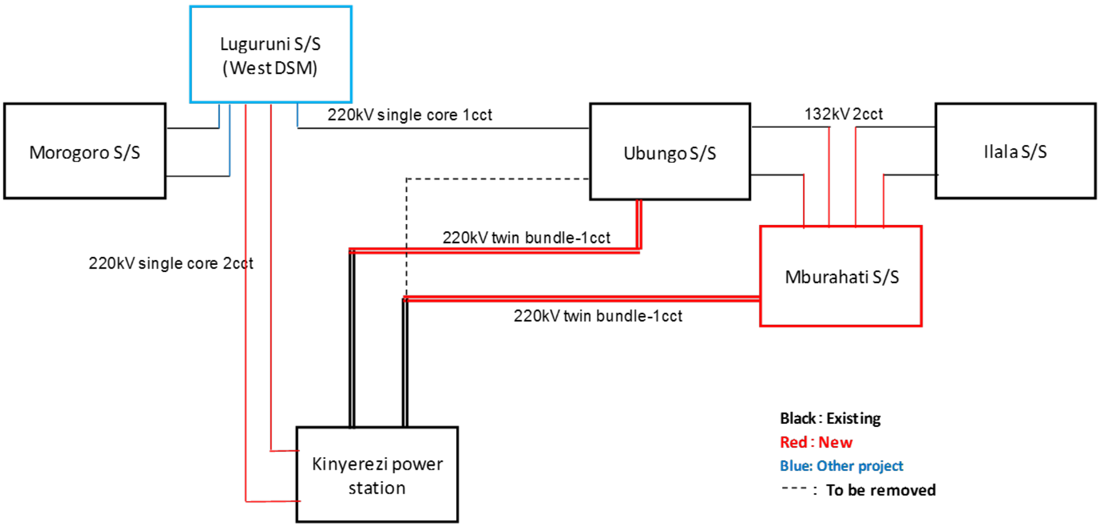


Figure 1-1.8 Power system configuration for Alternative 5'

The system configuration above were evaluated in terms of cost, local constraints of existing substations, ease of ROW acquisition, securing transmission lines during construction, ease of operation and maintenance, and reliability. The result of discussions with Tanzania side is shown in Table 1-1.1.

Table 1-1.1 Comparison of gains and losses of proposed power system configurations

Evaluation Item	Draft request	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5 (5' included)
Transformer cost	C	A	B	A	A	C
Transmission line costs	B	B-	A	B-	C	C
Site constraints of existing substations	A	A	A	C	A	A
Ease of ROW acquisition	B	**C-**	A	C	B	B
Securing transmission lines during construction	B	A	B	B	A	A
Ease of operation and maintenance	A	A	A	A	B	A
Reliability	B	A	**C-**	A	A	A
Overall evaluation (total points)	23	-	-	20	27 **1st**	25 **2nd**

【Remarks】The ratings and scores are as follows: A: Excellent (5 points), B: Good (3 points), B-: Good (2 points), C: Acceptable (1 point), C-: Not acceptable. Since C- is considered a determinant score, proposals with a C- rating are excluded from the comparison study.

Based on the above, the survey team confirmed with Tanzania side that this project proceed with the schematic design study using Alternative 4 in the third field survey. However, at the end of that survey, Ag. Senior Manager Transmission of TANESCO requested to proceed with a system configuration which is different from Alternative 4, and Alternative 6 was proposed as shown in Figure 1-2.9. Alternative 6 requires the additional 220 kV switchyard for a 220 kV transmission line at Ubungo substation. Since there is currently no space, TANESCO and the survey team conducted a site survey to confirm whether or not the space could be expanded. As a conclusion, the survey team decided to expand the 220 kV switchyard under the following conditions: (1) the tower (UB-FZIII TW1) around Ubungo substation should be removed and connected to the next tower by underground cables, and (2) the fence on the south side of Ubungo substation should be partially extended to the outside.

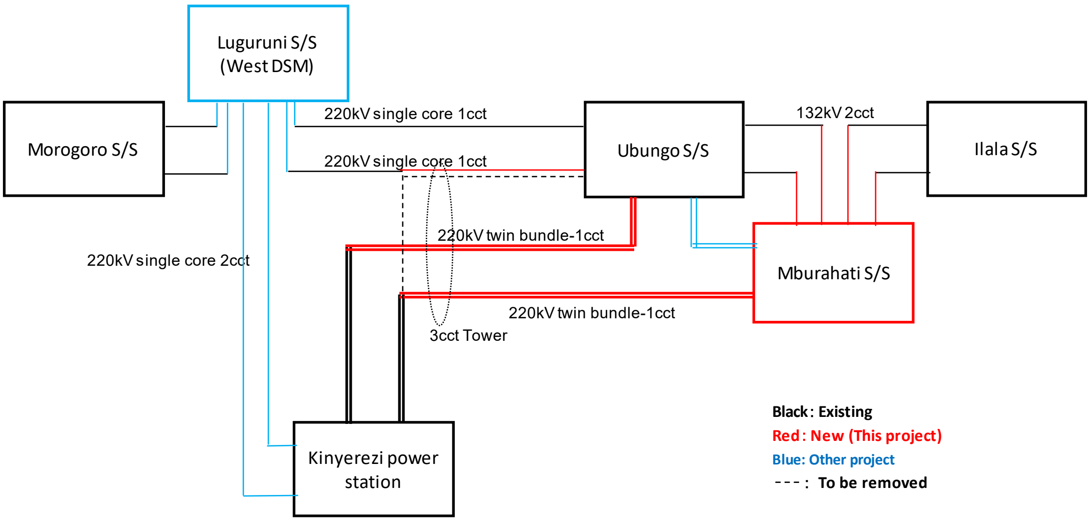


Figure 1-1.9 Power system configuration for Alternative 6

Based on the above results, it was decided that Alternative 6 should be adopted for future outline design studies. The reason why Tanzania side chose Alternative 6 over Alternative 4 is that it is less dependent on the 220 kV transmission line between Kinyerezi power station and Luguruni substation, which was to be implemented under the responsibility of Tanzania side (Refer to Annex-1 of Appendix 5). Due to budgetary constraints of the grant aid project, it was necessary to implement the 220 kV line between Kinyerezi power station and Luguruni substation, which is included in Alternatives 4 and 6, as one of undertakings of Tanzania side (see below). However, Tanzania side was concerned that the transmission line might not be completed in time for the completion of the Project because they have to raise funds for the transmission line from now.

Additional major undertakings to be done by Tanzania side due to budgetary constraints of the Project (undertakings to be covered by Tanzania side)

- 220 kV transmission line between Kinyerezi power station and Luguruni substation
- 220 kV transmission line between Ubungo substation and Mburahati substation
- 220/132 kV transformers (200 MVA)×2 units and 132/33 kV transformers (100 MVA)×2 units to be installed at Mburahati substation

Based on the above, it was concluded that Alternative 6, which has less power flow on the 220 kV transmission line between Kinyerezi power station and Luguruni substation, has less impact due to the delay of the completion of the 220 kV transmission line. Therefore, Alternative 6 is the final request as the system configuration of the Project.

The site for Mburahati substation proposed by Tanzania was expensive due to the large difference in elevation and a lot of houses. As a result, a site near National Institute of Transport (NIT) in Mabibo district was proposed to Tanzania side as an alternative site and agreed upon. Mabibo site is located approx. 2.4 km to the west of Mburahati site (closer to Ubungo substation) and has a 50m x 500m area, so there are no problems with the installation of substation equipment.

1-2 Natural Conditions

1-2-1 Location, geology and topography of the proposed site

Location of the surveys

- Proposed Mabibo Substation site and surroundings (approx. 35,000 m^2)
- 220 kV Transmission line route (from Kinyerezi power station (T-off point) to Mabibo Substation, approx. 9.0 km)
- 132 kV Transmission line route (from Ubungo substation to Ilala Substation, approx. 0.1km)

1-2-2 Topographic survey

(1) Construction site for Mabibo Substation

The construction site for Mabibo substation is planned to be on the RoW (approximately 70 m wide) of the existing transmission line connecting the Ubungo S/S and Mbrahati S/S. The site is located between the market and textile factory in the north and the National Institute of Transport (NIT) in the south. There is a factory drainage channel in the north of the site. A gradual gradient is also observed, with the eastern side being lower than the western side. Although the gradient is gentle at around 1%, the site is long and narrow (45-49m x 350m), so there is a height difference of around 3-4m in the longitudinal direction. As it is important that the foundations of substation equipment are supported on stable ground, sectional planning shall be made according to the results of the topographical survey and the layout plan.

(2) Transmission line route

As the construction of the transmission line will include the installation of electric lines and the installation of new towers with foundations, topographic surveys were carried out for entire route of the transmission line and geological surveys were carried out for the tower construction locations.

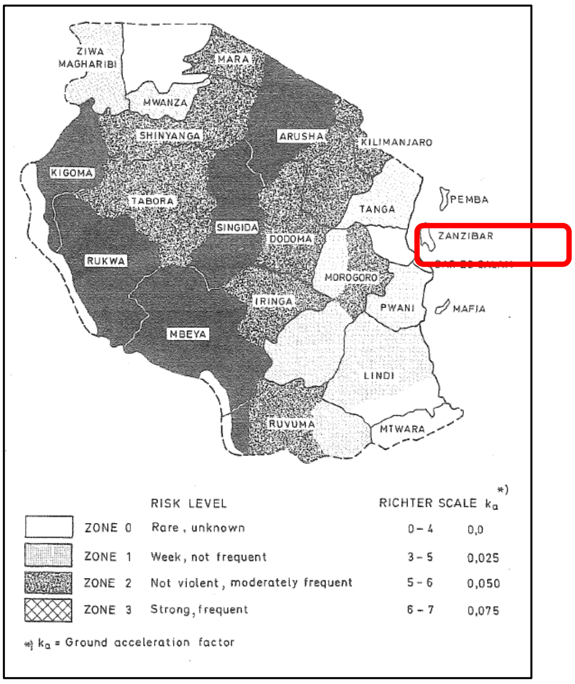
1-2-3 Geological Survey

According to the results of the geological survey, the sub-surface layer is 1-1.2m of clayey sand and sandy clay in Mabibo Substation area. The direct foundation shall have the sufficient dimensions in order to support the single-storey structure. In addition, as the groundwater level on Mabibo substation site is as high as GL-0.3m~1.44m, the cable tunnel should be watertight to prevent groundwater inflow and equipped with drainage pit with water pump for rainwater drainage.

1-2-4 Earthquake

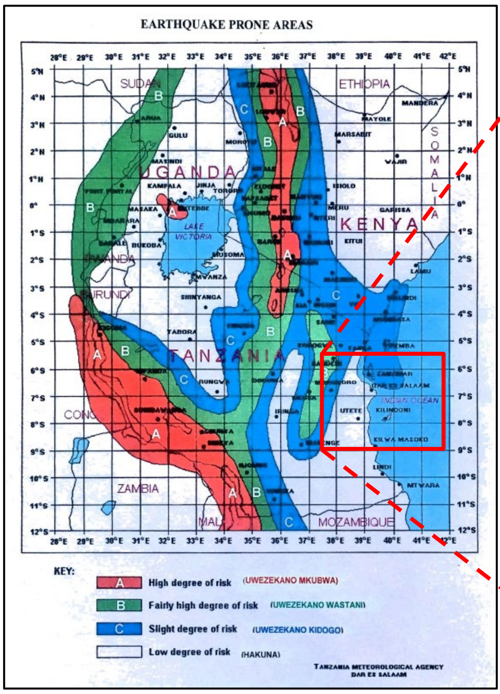
Interviews with the Tanzania Meteorological Authority (TMA: Tanzania Meteorological Authority) indicate that no earthquakes have been recorded in Dar es Salaam and the earthquake risk maps which TMA has indicate no risk in the area. In addition, the structural design guidelines prepared by Building Research Unit do not assume any seismic risk. However, as earthquakes have been confirmed in

Tanzania, a seismic horizontal load factor of 0.1 will be considered in the design of the substation.



Source: Building Research Unit

Figure 1-2-4.1 Earthquake risk map



Source: TMA

Figure 1-2-4.2 Earthquake risk map

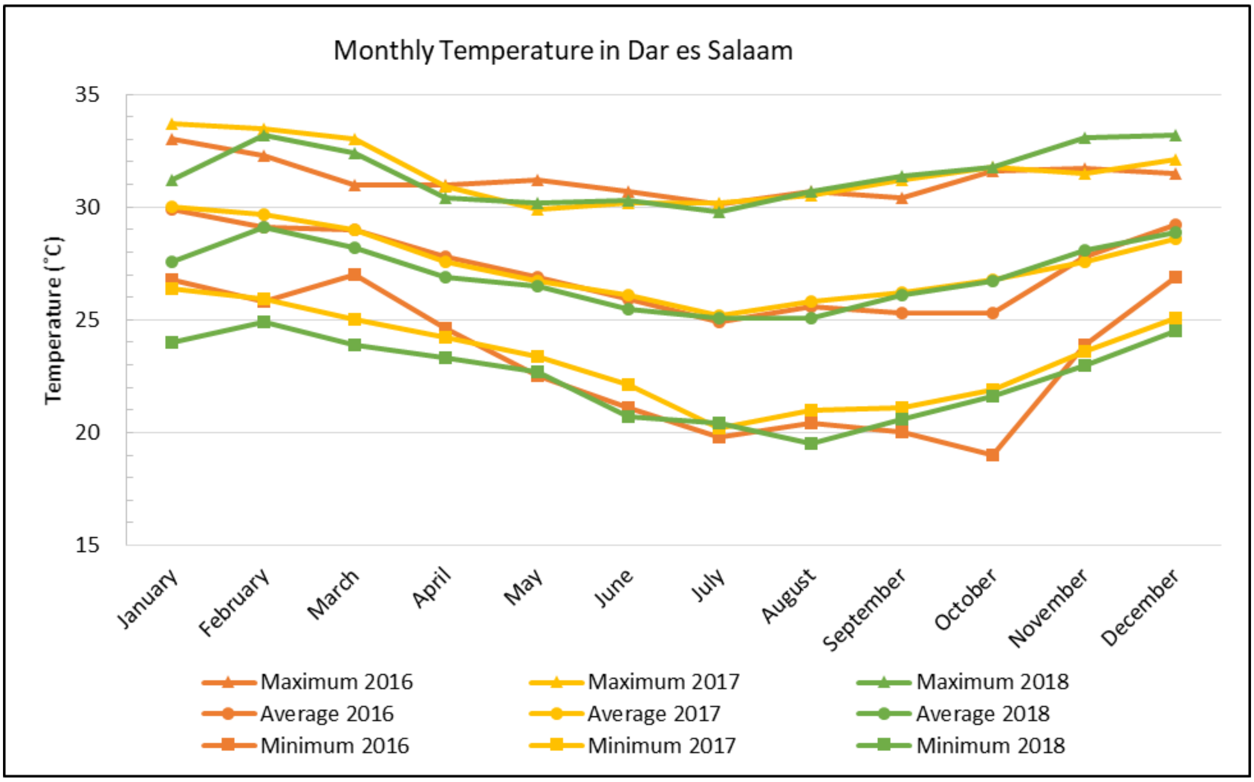
1-2-5 Climate conditions

The data received from the TMA and published by the TMA are summarized in the table and figures below.

Table 1-2-5.1 Climate conditions (2018)

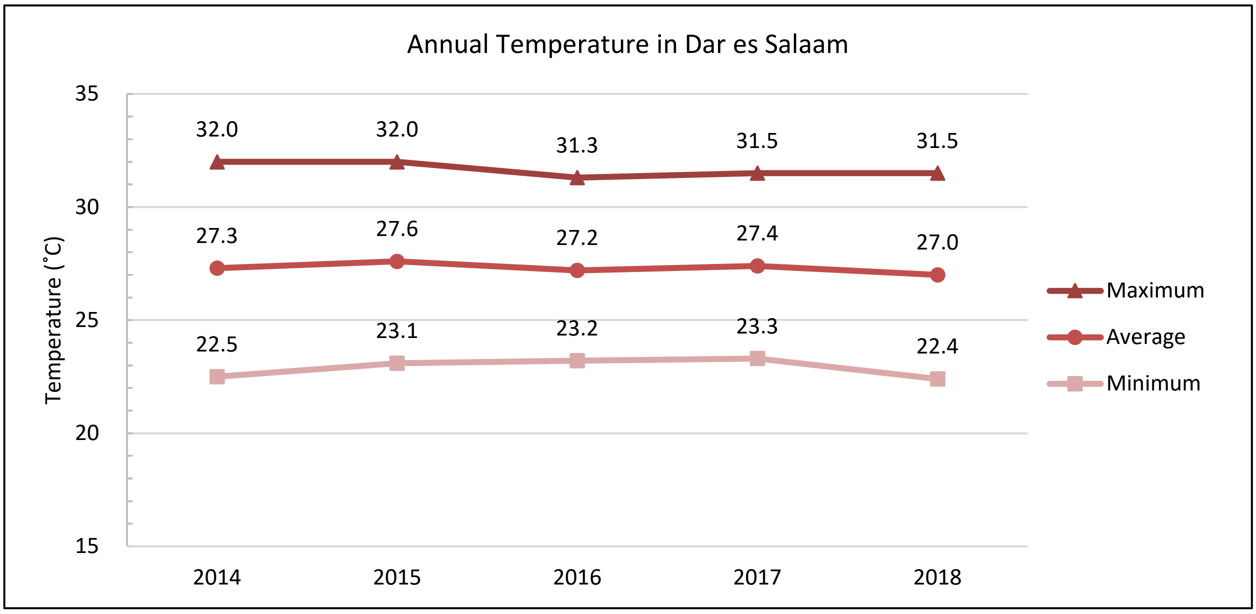
Location		Dar-es-salaam
Altitude (Observatory)		53 m
Temperature	Max.	33.2 ºC
	Min.	19.5 ºC
	Ave.	27.0 ºC
Humidity		76～91 %
Max. Wind Velocity		9.8 m/s
Max. Monthly Rainfall		417.6 mm
Seismic load factor		holizontal factor 0.10
Bearing Capacity		100kN/m^2 (long-term)

Source: JICA preparatory survey team according to the data from TMA



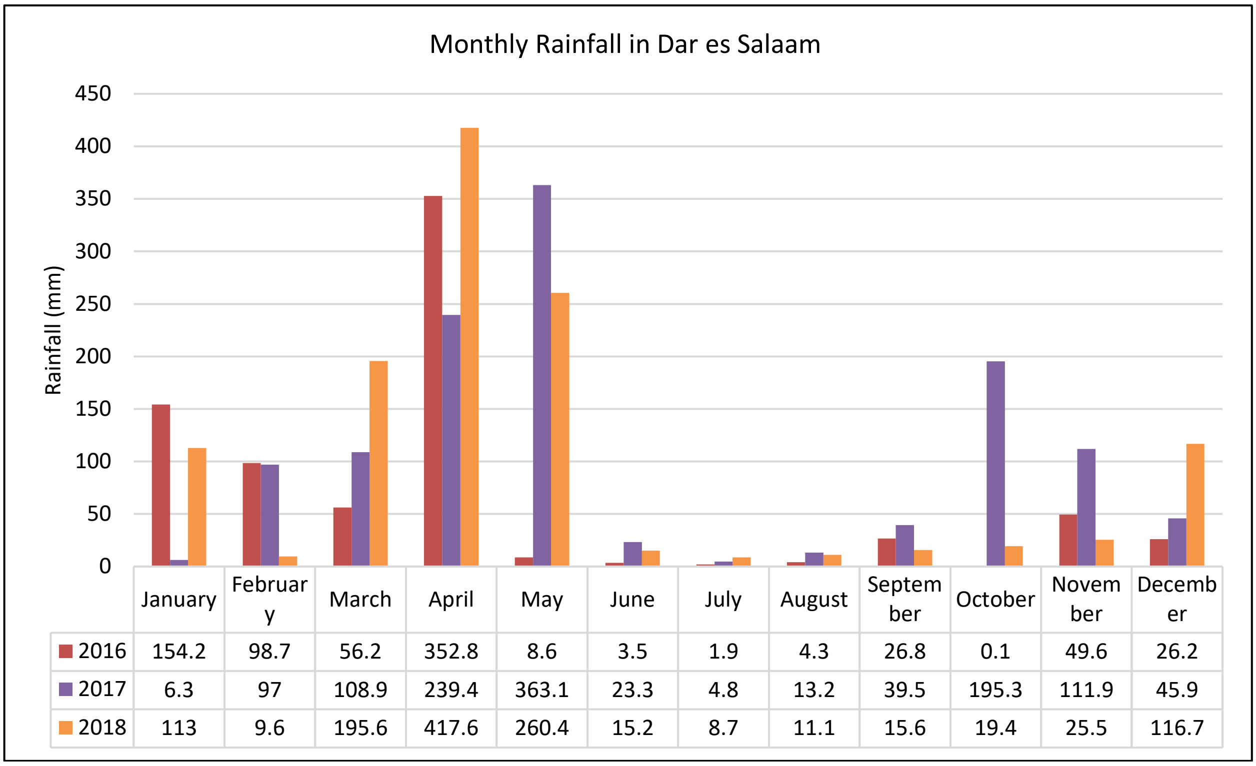
Source: JICA preparatory survey team according to the data from TMA

Figure 1-2-5.1 Monthly Temperature (Max., Ave. and Min.) in Dar es Salaam



Source: JICA preparatory survey team according to the data from TMA

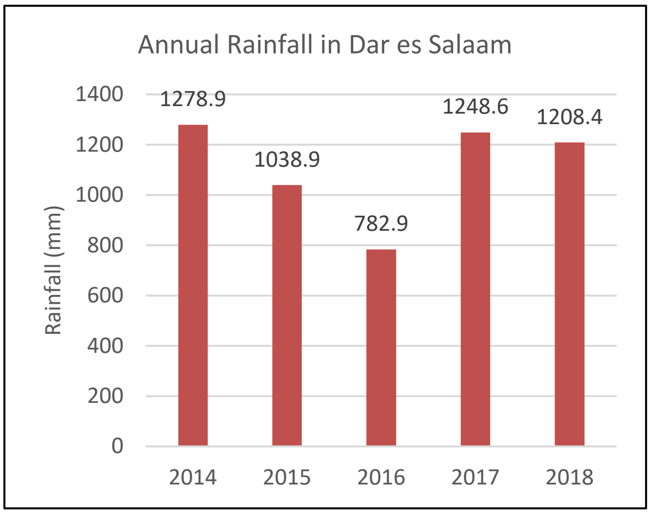
Figure 1-2-5.2 Annual Temperature (Max., Ave. and Min.) in Dar es Salaam



	January	February	March	April	May	June	July	August	September	October	November	December
2016	154.2	98.7	56.2	352.8	8.6	3.5	1.9	4.3	26.8	0.1	49.6	26.2
2017	6.3	97	108.9	239.4	363.1	23.3	4.8	13.2	39.5	195.3	111.9	45.9
2018	113	9.6	195.6	417.6	260.4	15.2	8.7	11.1	15.6	19.4	25.5	116.7

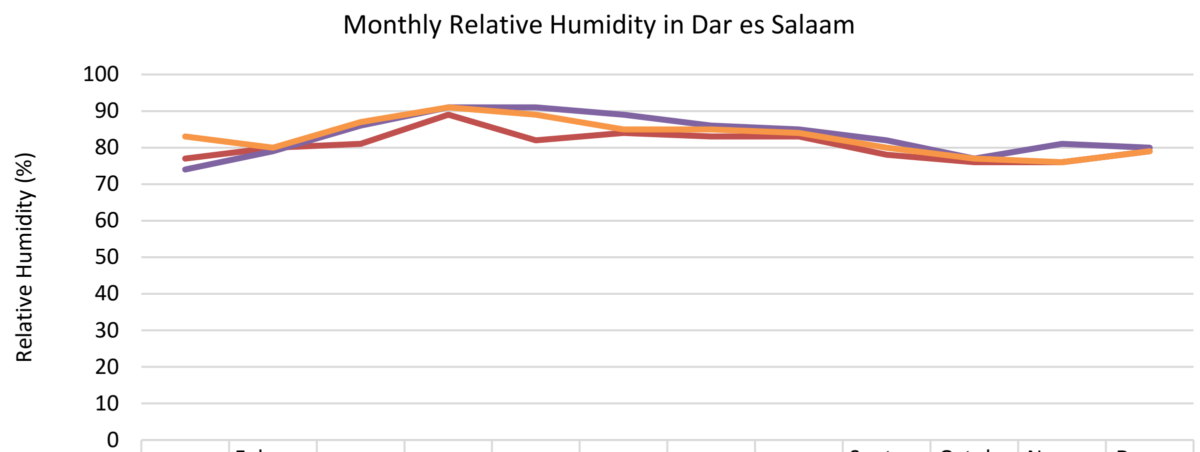
Source: JICA preparatory survey team according to the data from TMA

Figure 1-2-5.3 Monthly Rainfall in Dar es Salaam



Source: JICA preparatory survey team according to the data from TMA

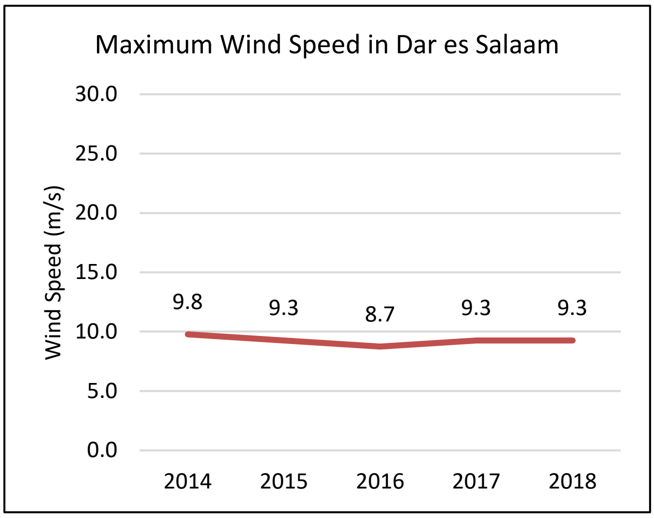
Figure 1-2-5.4　Annual rainfall in Dar es Salaam



	January	February	March	April	May	June	July	August	September	October	November	December
2016	77	80	81	89	82	84	83	83	78	76	76	79
2017	74	79	86	91	91	89	86	85	82	77	81	80
2018	83	80	87	91	89	85	85	84	80	77	76	79

Source: JICA preparatory survey team according to the data from TMA

Figure 1-2-5.5　Monthly Average relative humidity in Dar es Salaam



Source: JICA preparatory survey team according to the data from TMA

Figure 1-2-5.6 Annual record of Maximum wind Velocity in Dar es Salaam

1-3 Environmental and Social Considerations

1-3-1 Environmental Impact Assessment

1-3-1-1 Summary of Business Components with Environmental and Social Impacts

Table 1-3-1-1.1 and Figure 1-3-1-1.1 show the main project components to be provided by this grant aid project.

Table 1-3-1-1.1 Main project components to be provided by the Project

	Component	Scale	Location	Remarks
1.	Construction of a new substation with gas insulated switchgears (GIS) (220/132 kV, 2 ×200 MVA transformers). The main equipment is transformers and switchgear, and a parking lot is also provided. Note that non-PCB oil is used for the transformers.	It is constructed within an existing site (ROW) of approximately 50m×500m.	Mabibo	TANESCO fronting on the Mabibo Market and the National Transportation Institute site of the existing substation. No new land acquisition is anticipated.
2.	There are 220/132 kV transmission lines (3 circuits) planned for approximately 7 km from Kinyerezi (T-off point) to Ubungo substation, and 220/132 kV transmission lines (2 circuits) from Ubungo substation to Mabibo area.	220/132kV transmission line (approx. 7km + approx. 2km, total approx. 9km)	Kinyerezi, Ubungo, Mabibo	Removal of existing transmission line and construction of a new transmission line within the ROW of the existing line. No new land acquisition is required since the existing 40m wide ROW is applied.

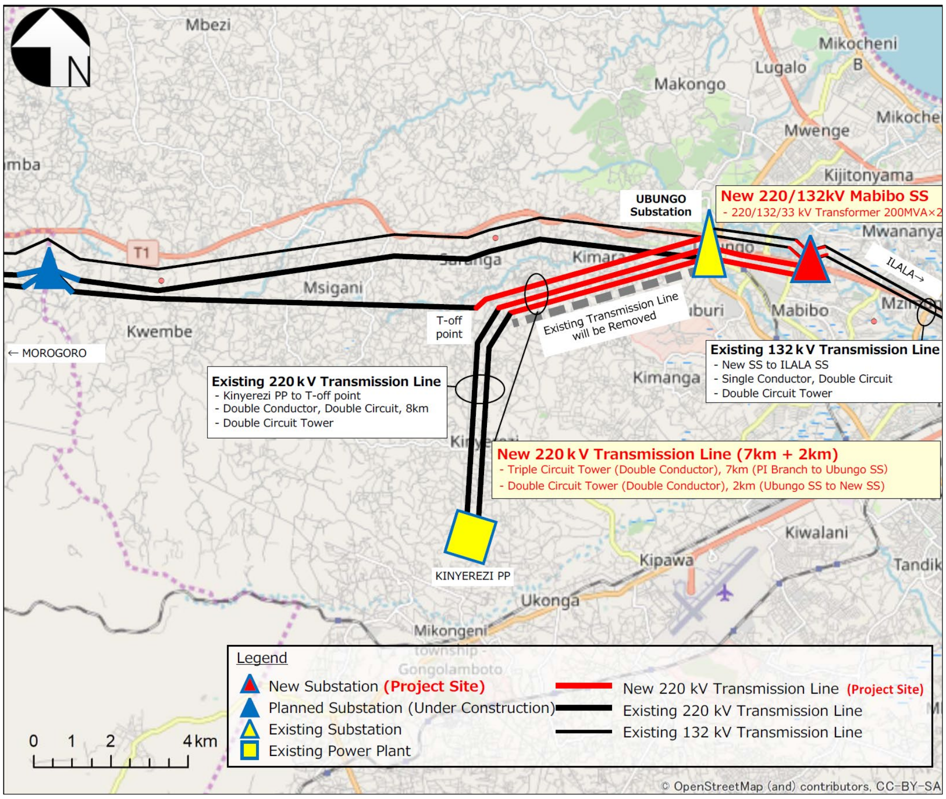


Figure 1-3-1-1.1 Location of project site and project outline

1-3-1-2 Baseline of environmental and social conditions

The baseline of environmental and social conditions is shown in Table 1-3-1-2.1.

Table 1-3-1-2.1 Baseline of environmental and social conditions

Environmental Items		Summary
Social environment	Economic activity	Tanzania has achieved high growth rates based with its vast natural resources and tourism, with GDP growth averaging 6-7 % per year during 2009-17. Dar es Salaam used fiscal stimulus and monetary policy easing to mitigate the effects of the global recession and, in general, benefited from lower oil prices. Tanzania has nearly completed its transition to a market economy, although the government maintains a presence in telecommunications, banking, energy, and mining. While gold production has increased to about 35 % of exports in recent years, the economy still depends on agriculture, which accounts for slightly less than a quarter of GDP and feeds about 65 % of the labor force. All land in Tanzania is owned by the government, which can lease land for up to 99 years. The proposed reforms to allow land ownership, especially foreign land ownership, have not been widespread so much. Tanzania's financial sector has expanded in recent years, with foreign banks accounting for about 48% of the banking industry's total assets. Competition among foreign commercial banks has significantly improved the efficiency and quality of financial services, but interest rates remain relatively high, reflecting high fraud risk. Tanzania's banking reforms have reportedly contributed to increased private sector growth and investment.
	Residents, Indigenous populations and others	The city of Dar es Salaam is divided into five districts (Ilala, Kinondoni, Temeke, Ubungo, and Kigamboni) and 90 county wards (ward). Ubungo District, the project site, is further subdivided into 14 county wards. Based on 2019 population projections, Ubungo District had a population of 1,403,311, of which 679,185 were males and 724,126 were females. The municipality's population grew at an annual rate of 5.0%, which is slightly lower than the 5.6% annual growth rate of the state population and significantly higher than the 2.4% annual growth rate of the national population. The average number of households in the district is 4.0, the same as the average number of households in the state, and the high annual growth rate in the Ubungo district is most likely due to high migration rates as well as natural population growth.
		Indigenous Peoples: In Tanzania, the concept of tribes exists, but there is no concept of indigenous peoples. It is estimated that there are currently over 120 tribes; no census has been conducted for the tribes since the 1970s, so there is no up-to-date information on the exact number of people belonging to each tribe. According to the IWGIA, Tanzania has a total of 125-130 ethnic groups, which fall into four categories: the Bantu, Kushite, Nilohamite, and San, who are primarily pastoralists and hunter-gatherers. The approximate populations of the major ethnic minorities are known as follows Maasai (in Tanzania): approx. 430,000 Barabaig (belonging to the Datoga Group): approx. 87,978 Hadzabeat tribe：approx. 1,000 Akie (Ndorobo) tribe：approx. 5,268
	Land Use	Land Use in Tanzania Agricultural land: 43.7 % (2011 est.) Arable land: 14.3 % (2011 est.) / Permanent crops: 2.3 % (2011 est.) / Permanent pasture: 27.1 % (2011 est.) Forest: 37.3 % (2011 est.) Others: 19 % (2011 est.)
	Poverty	Population below the poverty line: statistical data show 22.8 % in Tanzania (2015 estimate).
	Infrastructure Public Facilities	The Ubungo District (Ubungo Municipal Council) currently has 68 health facilities, 17 of which are publicly owned, while the other 51 are operated by private organizations (2018). The district also has 60 publicly owned, 53 privately owned, and all 113 kindergartens, 64 publicly owned, 54 privately owned, and all 118 elementary school. The main source of water for Ubungo residents is the lower and upper reaches of the Ruvu River, which is managed by the Dar es Salaam Water and Sewerage Authority (DAWASA).

Environmental Items		Summary
		Sixty-eight percent of the Ubungo district has direct access to clean and safe water, while the remaining 32% do not have smooth access.
	Cultural Property	Cultural Heritage: Tanzania has a wealth of important cultural heritage resources dating from the Pliocene period, approximately 4 million years ago, to the present. These resources can be categorized into seven groups a) Archaeological or paleontological sites such as Olduvai Gorge, Laetoli Footprint, Isimila Stone Age site, and Engaruka Ruins. b) Historic sites such as Kaole, Kunduchi, Kilwa Kisiwani, and Songo Mnara Ruins. c) Historic towns such as Bagamoyo, Kilwa Kivinje, Mikindani, etc. d) Traditional settlements such as Kalenga in Iringa and Bweranyange in Kagera. e) Historic buildings such as the Colonial Administration Building (BOMA) in many districts of Tanzania.
	Cultural Property	f) Sites commemorating special items such as colonial cemeteries, World War I and World War II cemeteries, and defensive walls. g) Natural features and structures such as the Mbozi Meteorite, Amboni Caves, and Kondoa Rock Art Shelter. The Department of Antiquities, as a governmental agency, is responsible for the preservation, conservation, protection, and management of these cultural heritage resources. Cultural heritage resources are legally protected by the Antiquities Act of 1964 (Act No. 10 of 1964) as amended in 1979 as well as the Regulations (rules and regulations) of 1981, 1991, 1995, and 2002.
	Health	In principle, waste management is directly the responsibility of local authorities: the Local Authorities (Urban Authorities) Act 1982 imposes on urban authorities the duty to "remove garbage and filth from public or private places" and to provide and maintain public garbage containers for the temporary accumulation and collection of waste materials. City councils play a key role in the financing, planning, and service delivery of waste collection and disposal services. According to the current management structure, waste management services are placed under the Waste Management Department, with other departments such as Works, Health, and Urban Planning also involved in some way. The proposed project is expected to engage a large number of workers, including skilled and unskilled employees, and will generate various types of waste during construction and operation, including paper, plastic bottles, plastic bags, and food waste. In addition, due to the generation of sewage from these areas, it is expected that portable toilets and other sanitation facilities will need to be provided. Heavy equipment such as vehicles, excavators, and bulldozers will be used during the construction of the new substation and transmission line facilities. These machines and vehicles are expected to have minimal impact on air quality as they will be regularly inspected and maintained. In addition, emissions of NOx and SOx and noise pollution will be minimized to acceptable levels so as to reduce adverse health impacts on workers and neighboring communities.
	Natural disasters	The country is subject to frequent floods, droughts, and earthquakes. Among natural disasters, Dar es Salaam is vulnerable to flood disasters due to its topographical features, and floods occur in the city almost every year. In 2019, heavy rains caused severe flooding in Dar es Salaam, condemning more than 1,200 families in May, damaging roads and bridges, and wiping out 1,560 dwellings mainly in Kinondoni, It wiped out 1,560 dwellings, mainly in the municipalities of Kinondoni, Temeke and Ilala. Dar es Salaam alone has been affected by similar disasters in 2009, 2010, 2011, 2014, 2015, 2017, and 2018, with seven in 2017-18 alone.
Natural environment	Topography	Elevations in Dar es Salaam are generally below 200 m. above sea level. The area is generally flat, gently undulating plain with slopes ranging from 0 to 3 %, and the old alluvial terraces are not inundated. There are three main soil types; (1) well drained, slightly dark to dark red, yellowish red or orange sand and loamy sand with a sandy loam layer underneath, of weak structure very low fertility; (2) flat terrain and poorly to moderately drained, loamy sand with dark brown, light yellow, light gray or white mottled sand, weak structure and very low fertility; (3) and flat terrain and poor drainage, from waterlogged subsoil (0-7 to 1.5 m deep) over iron ore layer that prevents deep penetration. The topography of the area allows for stable rice cultivation. Recent floodplains along Mushimbashi River valley have a mix of alluvium

Environmental Items		Summary
		and frequent flooding. This soil type is marginally suitable for arable agriculture. In areas that are not flooded by the river, mixed soils on recent or older alluvial deposits are found. Fruits and vegetables are grown mainly in these valleys. The transmission line will be installed between the T-off point (π branch) in Kimala, Ubungo district of Dar es Salaam and the Mabibo district. The T-off point is located on the top of a small hill with an altitude of about 120 m and is the branch point of the transmission line from Kinyerezi power station to two substations in Dar es Salaam (Ubungo and Morogoro substations). The new transmission line will be installed on the existing site by replacing the existing 220 kV transmission line between the T-off point and Ubungo substation. It will also replace the existing 132 kV transmission line between Ubungo substation and the new Mabibo substation as well. From the highest T-off point, the transmission line will be constructed on a gentle slope from an altitude of 120m at the T-off point to an altitude of 60m at Mabibo district along the ridge of the hill. The ridge is further along the Kibang (Ubungo) River towards the Arabian Sea.
	Geology	Tanzania's geology began to form during the Precambrian, Archean and Proterozoic eras, in some cases more than 2.5 billion years ago. Basement rocks of igneous and metamorphic rocks form the Archean Tanzanian Craton, surrounded by the Proterozoic Uvendian Belt, Mozambique Belt, and Karagwean Coal Belt. The region underwent crustal downwarping during the Paleozoic and Mesozoic when the giant Karoo supergroup was deposited. Within the past 100 million years, Tanzania has experienced coastal marine sedimentary rock deposition and inland rift formation, giving rise to large rift lakes. Dar es Salaam is located in a coastal area dominated by Cenozoic marine sediments.
	Climate	In Dar es Salaam, rainfall is bimodal, with peaks in November and April. Annual precipitation averages 1,268 mm. The average monthly minimum temperature in July is 18.2 degrees Celsius. In general, Dar es Salaam city enjoys a humid climate that varies from 26°C in August to 35°C in December and January. Having a typical coastal equatorial climate, Dar es Salaam's regime is characterized as hot and humid with small seasonal and daily fluctuations in temperature. Temperatures range from a maximum of 31.5-32.1°C to a minimum of 18.1-18.6°C, with an average daily temperature of about 26°C, a seasonal range of about 4°C, and an average daily range of about 8°C. Relative humidity reaches 100% almost every night of the year and rarely falls below 55% during the day. (Second Tanzania National Communication to the United Nations Framework Convention on Climate Change, 2014)
	Hydrology	The country is divided into nine watersheds according to Law No. 10 of 1981 (Mainland). Dar es Salaam is located in the 66,867.18 km^2 Wami Ruvu Basin, which flows from its source in the Eastern Arc Mountains to the Indian Ocean (Arabian Sea) via the Wami River through the steppe savannah.
	Flora and fauna	The project specifically does not include activities that develop/disturb natural habitats associated with flora and fauna. The entire proposed substation and transmission line site is located in the currently operational area under the existing transmission line. There are two 220 kV and 132 kV transmission lines between the Kimara π branch and Ubungo substation, and two 132 kV transmission lines between Ubungo substation and the new Mabibo substation. The new transmission facility will replace the existing facility. In the existing transmission line area, grass species predominate. According to a related study conducted on the Ubungo-Ilala transmission line (2013), Dichanthium annulatum, Sporobolus pyramidalis, and Tridax procumbens, Euphorbia hirta, and Ocimum baqcilicum species herbs were reported as the main species covering the land. With regard to fauna, no significant wildlife has been observed around the proposed project area due to urbanized development in the City. The major animals observed during the survey in the above study were birds, lizards, and various species of invertebrates, including butterflies, grasshoppers, and ants.
	Protected area	Forestry: Dar es Salaam's forest resources are strongly affected by human activities, especially agriculture, settlement, and other development. In Dar es Salaam, the natural forests of Dondwe and Mabwe Pande are located near the city boundaries. A small but significant portion of the Pugu forest in the coastal region also extends into Dar es Salaam City. Other natural forests include mangrove forest reserves. The Mabwepande Forest supports several endemic plants. According to the Coastal Region Investment Profile (January 2015), there are 44 official forest

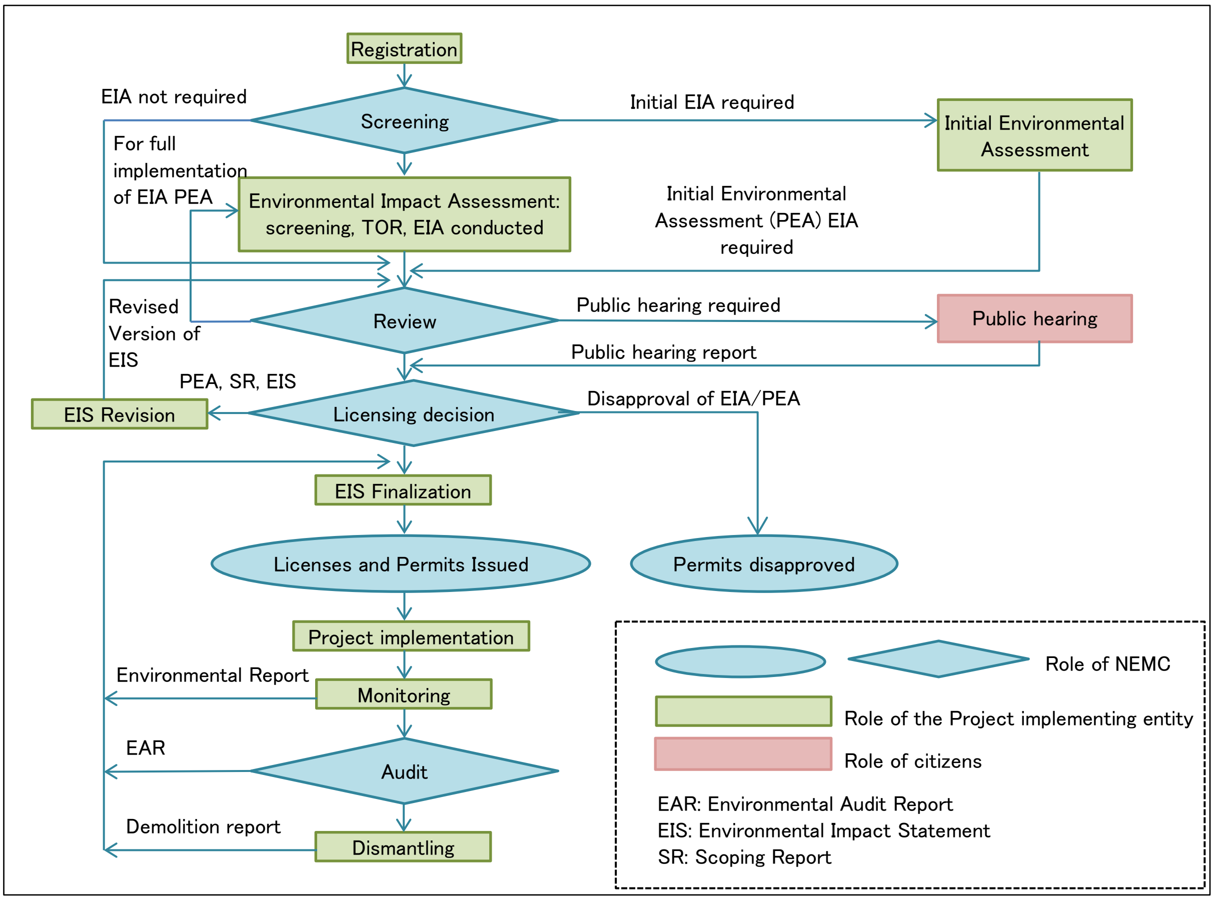
Environmental Items		Summary
		reserves in the coastal region, with a total of 335,712 ha of forest protected for production. In addition, there are informal forests on 2.2 million ha of common land. As part of the Pwani region, Mafia Island also has a forest reserve. Among the proposed forest reserves located near transmission lines and substations, the Pugu Forest Reserve is located approximately 4 km southwest of the existing Kinyerezi power station. Wildlife and Protected Areas: The city of Dar es Salaam has very limited wildlife resources due to high demand for land for settlement and industrial development. The city has only one wildlife sanctuary remaining, Mabwepande Forest Reserve in Kinondoni City, approximately 10 km away from the project area. As one of eight national hotspots in coastal woodlands, the reserve is home to a wide variety of monkeys, bats, and birds, making it an important bird habitat. Dar es Salaam city and coastal areas contain a wide variety of aquatic resources in marine and freshwater ecosystems. However, the project area is located about 6-7 km from the nearest coastline, hence no significant impact is expected.
Environmental pollution	Air pollution	An air quality assessment of air pollutants was conducted in 2014 as part of the environmental study for the Dar es Salaam Master Plan. Findings showed that the average oxygen level at the four sites was 20.88%, with a range of 20.8-20.9%. The average temperature level was 34.56 °C. On the other hand, no air gas pollutants such as carbon monoxide (CO), carbon dioxide (CO2), and sulfur dioxide (SO2) were detected, and the concentration of nitrogen oxides (NOx) was low. NOx was observed at the Janwani and Mwanayamara sites with heavy vehicle traffic. With reference to the Tanzanian Environmental Management (Air Quality Standards) Regulations (2007), air quality observed at all these sites was within acceptable levels.
	Water quality	Tanzania is divided into nine basins that experience unimodal and bimodal rainfall patterns. Dar es Salaam is located in the Wami/Ruv basin. The project site is located in the Mshimbaji River Basin, which flows directly into the Indian Ocean, along the Kibang/Ubungo River, a tributary of the same river. Stream water quality is of great concern due to chemical contamination from industrial effluents

Source: JICA preparatory survey team, based on secondary sources.

1-3-1-3 Environmental and Social Consideration System/Organization in the Recipient Country

(1) Outline of law

The Environmental Management Act (EMA, 2004) is the law that provides the legal and institutional framework for the sustainable management of the environment and natural resources in the country, including the roles and responsibilities of organizations regarding environmental management, environmental impact assessment (EIA); Strategic Environmental Assessment (SEA); Pollution Prevention and Control; Waste Management; The flow of environmental assessment in the country concerned and outlines of laws and regulations related to environmental assessment are shown below (Figure 1-3-1-3.1, Table 1-3-1-3.2).



Source: Energy Sector EIA guideline, MEM, 2012

Figure 1-3-1-3.1 EIA procedures in Tanzania

Table 1-3-1-3.1 Main laws related to environmental assessment in Tanzania

Law	Overview
The Environmental Management (Environmental Impact Assessment and Audit)(Amendment) Regulations,2018	This revision provides for new categories of assessments and their EIA process. The four project categories A, B1, B2, and special category were rearranged from the two categories A and B in the previous regulations of 2005. Category A is EIA-mandatory projects, category B1 includes boundary projects, and category 'B2' includes non-EIA-mandatory projects and special categories. Detailed activities by sector are provided in Annex 1. In relation to the reorganized categories, the examination criteria and application forms corresponding to each category are specified in Appendix 2.
EIA and Audit regulations, 2005	These regulations stipulate the rules for the procedures and conduct of environmental impact studies and environmental audits stipulated under the Environmental Management Law. It prohibits projects from being implemented without an environmental impact assessment as required under the Environmental Management Act, and defines the content and form of an environmental impact assessment, as well as the basic principles of environmental audits.
Environmental Management Act, 2004, Cap 191	A law that provides a legal and institutional framework for the sustainable management of the environment. It outlines the principles of management, impact and risk assessment, pollution prevention and control, waste management, environmental quality standards, public participation, compliance and enforcement. Provides a basis for the implementation of international environmental instruments. Provides for the implementation of national environmental policies. Repeals the National Environmental Management Act of 1983 and provides for the continued existence of the National Environmental

Law	Overview
	Management Council. Regulates the establishment of the National Environmental Trust Fund and other related matters.
The Environmental Management (Standards for the Control of Noise and Vibrations Pollution)2015 THE ENVIRONMENTAL MANAGEMENT ACT ARANGEMENT OF REGULATIONS	This Code governs the control of noise and vibration in the country. It specifies permissible reference levels for noise and vibration, with the permissible noise levels depending on conditions in surrounding areas, namely environmentally sensitive areas, residential areas, mixed residential areas, small-scale production industrial areas, and industrial areas. It also specifies how the relevant area maps are to be developed.
Solid Waste regulations, 2009(Amended 2016)	These regulations govern domestic solid waste management under the Environmental Management Act of 2004.
Hazardous waste regulation 2019	This regulation replaced the 2009 regulation governing domestic hazardous waste handling. Hazardous wastes are classified into four categories, 1st, 2nd, 3rd and 4th, in the Schedule of Regulations based on their level of hazard.
THE ENVIRONMENTAL MANAGEMENT (WATER QUALITY STANDARDS) REGULATIONS, 2007	This regulation regulates domestic water quality management under EMA 2004. Permissible limits for effluent quality into public water are specified in Schedules 1 to 9 of the Regulation.
Forest Act, 2002	This law regulates domestic forest management. The responsible ministry is the Ministry of Natural Resources and Tourism, and forest reserves are mainly organized into three categories: - Production Forest Reserve: Reserved or used primarily for the sustainable production of timber and other forests. - Conservation forest reserves: Reserved or used primarily for water protection, soil conservation, and wildlife protection. - Natural Forest Reserves: Mainly used to protect natural and scenic areas of national or international importance and to maintain and enhance biodiversity and genetic resources.
Water resources management Act, 2009	A law that provides an institutional and legal framework for the sustainable management and development of water resources. Outline the principles of water resource management. To provide prevention and control of water pollution. Provides for stakeholder and public participation in the implementation of the National Water Policy, repeals the Water Use (Regulations and Regulations) Act, and establishes related matters.
Occupational health and Safety Act, 2003	Laws and regulations governing occupational accidents.
Wildlife Conservation Act No.5, 2009	Laws governing the conservation, management, protection and sustainable use of wildlife and wildlife products. Provides for the repeal of Section 283 of the Wildlife Conservation Act and other related matters.
Land Use planning Act, 2007	A law that regulates the procedures for preparing, managing and enforcing land use plans. Provides for the repeal of the National Land Use Planning Board Act and related matters.
Urban Planning Act, 2007	This is a law that regulates city planning.
Water supply and sanitation Act, 2009	A law providing for sustainable management and sound operation, and transparent regulation of water supply and sanitation services, with the aim of influencing the National Water Policy, 2002. Provides for the establishment of water supply and sanitation authorities and community-owned water supply organizations. It also stipulates the appointment of service providers, the repeal of the Water Supply Act and related matters.
Fire and Rescue Act, Cap 427	This is a law that regulates firefighting and rescue.
Public Health Act, 2009	Laws governing the promotion, preservation and maintenance of public health with the aim of ensuring the provision of comprehensive, functional and sustainable public health services to the public and providing other relevant matters.
Graves Removal Act, Cap 73	A law that provides for the removal of graves from land necessary for public purposes. Pursuant to the provisions of the Act under Section 3, “Where the land on which the grave is situated is required for public purposes, the Minister may remove the grave and the remains buried therein from the land. In such cases, all measures necessary for the restoration of the grave and the repositioning of the

Law	Overview
	remains shall be taken". The law states that the graves shall be relocated after official notification to the concerned parties and after publication in the Official. Article 9 provides for compensation to be paid to interested parties who perform removal, transportation, reinstatement, and reburial of graves or bodies and remains on behalf of the government.
Energy and Water Utilities Regulatory Authority Cap 414, (2001)	The law regulates the use of energy and water resources, including electricity.
Industrial and Consumer Chemicals (Management and Control) Act, 2003	The law regulates the handling (production, management, import, transport, export, storage, trade, and disposal) of chemical substances in Tanzania (industry and consumers) and related matters.

Source: JICA preparatory survey team

(2) Gap analysis between JICA Environmental and Social Guidelines (2010) and national EIA laws

GAP analysis is being conducted in related projects under JICA's scheme. With reference to the results of existing analyses, an analysis of the country's legal system for environmental impact assessment was carried out as follows. No particular difference was observed. Therefore, it is considered that there will be no particular problem with the environmental and social considerations of this project if it is implemented in accordance with the environmental assessment laws and regulations of the country concerned.

Table 1-3-1-3.2 Gap between Tanzanian Law and JICA Environmental and Social Guidelines

JICA Environmental Guidelines World Bank Safeguard Policy	Relevant laws of Tanzania	Main difference
・Projects must not involve significant conversion or significant degradation of critical natural habitats or critical forests. ・JICA will not support projects involving significant conversion of natural habitats unless a comprehensive analysis demonstrates that there are no feasible alternatives for the project and its location, and that the overall benefits of the project outweigh the potential environmental costs. JICA will not support projects that involve significant conversion of natural habitats unless a comprehensive analysis demonstrates that there are no feasible alternatives for the project and its location and that the overall benefits of the project outweigh the potential environmental costs. If the Environmental Impact Assessment (EIA) indicates that the project will result in significant conversion or degradation of natural habitats, the project will include mitigation measures that are acceptable to JICA. JICA will only accept other forms of mitigation if they are technically justified.	・Under The Environmental Management Act 2004, protected areas are to be determined by the Minister of the Environment, taking into account the ecology and biota characteristics; interests of the local population, and harmony with the international community (Article 47). ・National Policies for National Parks in Tanzania, 1994, states that the main purpose of establishing national parks is to conserve resources and to pass them on to future generations (Chapter 3.1). On the other hand, when a project is to be undertaken within a national park, an environmental impact assessment is conducted and the project is licensed after considering positive and negative impacts (Chapter 2.9).	The purpose of conducting an EIA is to identify both positive and negative impacts of the project and consider mitigation measures for negative impacts and promotion measures for positive impacts. However, Tanzanian national law leaves room for projects to be permitted even within national parks, depending on the results of the EIA.
・Verify compliance with laws, regulations, standards, and other relavant documents related to the environment and local communities established by the partner country and the local government concerned, and that they are in line with policies and plans related to the environment and local communities.。	There is an environmental assessment system prescribed by EMA.	(None)

JICA Environmental Guidelines World Bank Safeguard Policy	Relevant laws of Tanzania	Main difference
・The environmental assessment report (which may have a different name in some systems) must be written in the official or widely used language of the country where the project is to be implemented. It must be written in a language and style that can be understood by local people.	EIA reports, etc. are to be prepared in a language understood by the parties concerned.	(None)
・In principle, the partner country should take the initiative in disclosing information on environmental and social considerations of the project, and support the partner country as necessary. Proactively encourage counterpart countries to disclose and provide information on environmental and social considerations of the project to local stakeholders. The environmental assessment report must be made publicly available in the country where the project is implemented, including to local residents and other stakeholders, and must be accessible to local residents and other stakeholders at any time, and copies must be made available to them. ・As a general rule, partner countries among others should take the initiative in holding discussions with local stakeholders as broadly as possible within a reasonable range, and support their counterparts as necessary.	・Opportunities for residents to participate are given from the screening stage of the project; public hearings are held by NEMC during the review period of the EIA report, where the EIA report is made public and oral and written comments are accepted. ・The EIA report is kept as a public record at NEMC and is available for inspection whenever necessary.	(None)
The results of monitoring are to be confirmed by counterpart country (and others parties), to ensure that the counterpart country, is accounting for environmental and social considerations. Information necessary for confirming the results of monitoring should be reported by the counterpart party in writing or by other appropriate means. The results of monitoring by the counterpart country should be disclosed on a public website to the extent that they are available to the general public in the counterpart country.	・NEMC will conduct environmental audits; the entity that prepared the EIA will maintain monitoring data and prepare an annual report, reporting to NEMC its performance against the original plan. In case of negative impacts, appropriate mitigation measures shall be planned and implemented.	There is no difference in the monitoring to be conducted, but the environmental standards referred to may differ between Tanzanian and international standards.

Source: JICA preparatory survey team

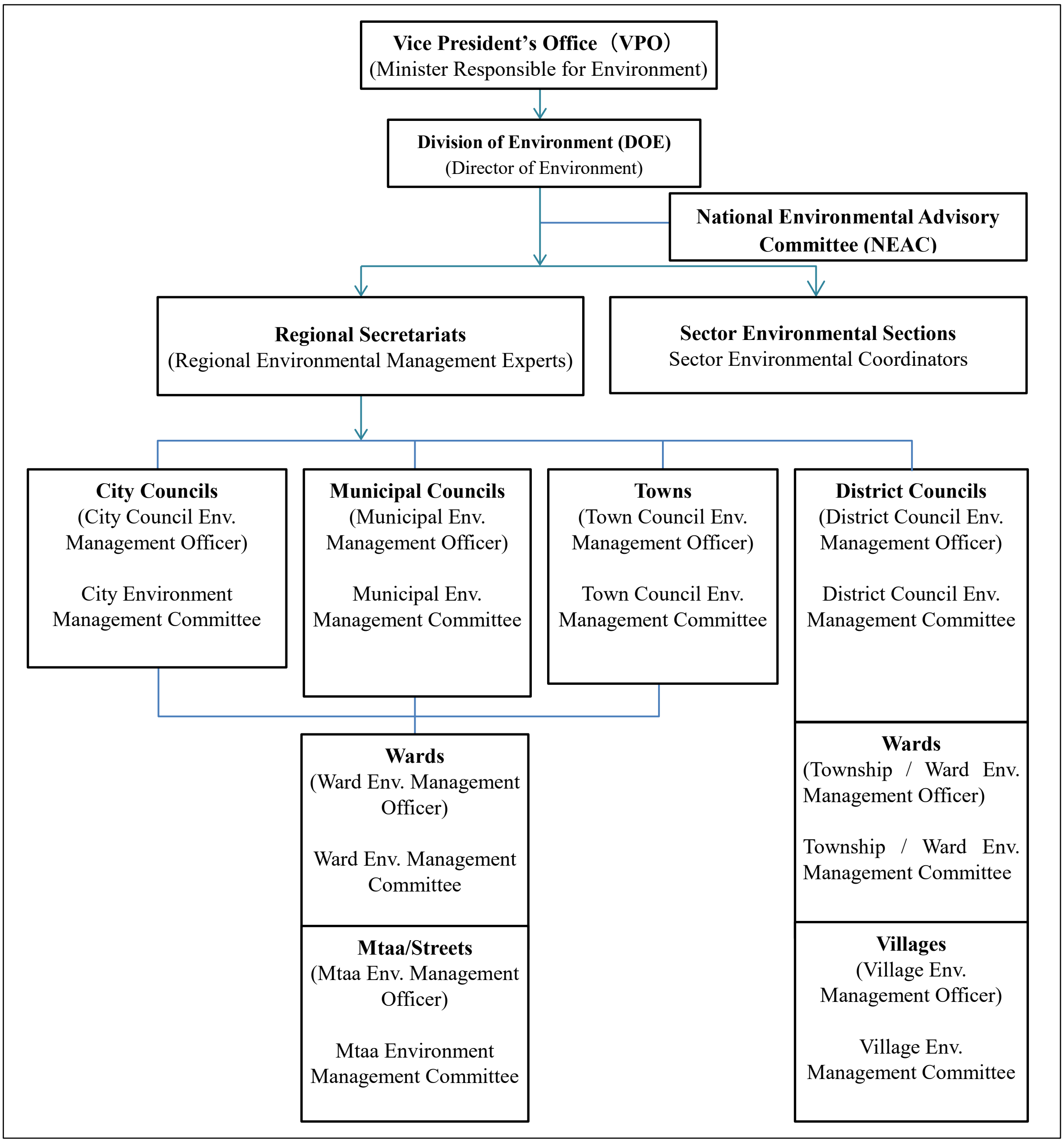
(3) Outline of organizations related to environmental assessment

The Environment Department in the Office of the Vice President, headed by the Minister of National Environment, is in charge of the country's EIA process. EIA is governed by the Environmental Management Act, No. 20 of 2004 (EMA 2004), which encompasses the institutional framework for environmental management in Tanzania and delegates the task of overall coordination of environmental management and provision of central support functions to the Ministry responsible for the environment (VPO). Under it, the National Environmental Management Council (NEMC) is the primary body that handles the EIA process for the Ministry of Environment, from project review to the approval of environmental impact assessment reports.

- National Environmental Advisory Committee (NEAC): This committee has been established to advise the ministries in charge of the environment (corresponding to the Office of the Vice President (VPO)) and other sector ministries on all environmental issues referred to them.。
- Minister for the Environment: The Minister may articulate policy guidelines and may establish regulations and guidelines. The Minister may also direct any agency to perform any

function or activity. The Minister may formulate rules for periodic environmental planning at the sectoral level and regulations to prescribe procedures and methods for the preparation, adoption, and implementation of Environmental Action Plans (EAPs).

- Director of the Environment Bureau, Office of the Vice President (VPO-DOE): The Director of the Environment Bureau coordinates environmental activities, advises the government on environmental laws and international agreements, monitors and evaluates the activities of relevant agencies, and drafts and puts into effect the State of the Environment Report.
- National Environmental Management Council (NEMC): Council functions include: conducting environmental audits, studies and research; advising on the review and approval of Environmental Impact Assessments (EIAs);), initiating procedures to prevent accidents that may cause environmental degradation, implementing programs to promote environmental education, issuing and disseminating manuals on environmental management, businesses engaged in natural resource and environmental management provide advice and technical assistance to and perform other functions as directed by the environmental ministry.
- Sector Ministries: Each sector ministry carries out environment-related functions and duties in accordance with the EMA and other laws (limited to those consistent with the EMA). Sector ministries are involved in environmental management through Sector Environment Sections (SEs) established within each ministry to ensure compliance with the EMA. Since the enactment of EMA, almost all sector ministries and agencies have set up sector environment departments and appointed or hired sector environmental coordinators.
- Regional Secretariat: A Regional Environmental Management Expert (REME) is assigned to the Regional Secretariat. REME is responsible for advising local governments in its jurisdiction on matters related to the implementation and enforcement of EMAs. REMEs build links between localities and environment directors, and several local governments have appointed or hired REMEs since the establishment of the EMA.
- Local government: EMA authorizes environmental management functions to local governments. In addition, EMA has appointed an environmental officer, and has designated several committees to perform functions related to the environment.



Source: DOE, Vice-President Office, 2012

Figure 1-3-1-3.2 Organizational structure for environmental management in Tanzania (DOE-VPO, 2012)

1-3-1-4 Comparative Study of Alternative Plans

A study of alternatives was carried out in the process of narrowing down the project scope considering technical, economic and environmental considerations. Especially in order to achieve the purpose of the project, the load flow analysis was carefully conducted and the following options were considered to be selected as suitable options for the project. Here, a brief comparison of the environmental aspects of the considered options is made. The results, as shown below, indicate that the proposed project was the best option among the options considered.

Table 1-3-1-4.1 Environmental comparison of alternatives

	Business component	Social environment (relocation of residents)	Natural environment
Alt-1	・New Muburahati S/S: about 2ha (65m×307m) ・Transmission line between Kinyerezi P/P and Muburahati S/S: Total length about 20km 1) Extension of transmission line along the existing line between Kinyerezi P/P and Kimara T-off: about 7 km 2) New transmission line between Kimara T-off and KM-06; about 1.6km 3) Extension of transmission line between KM-06 point and Ubungo S/S: about 7km 4) Transmission line replacement between Ubungo S/S and Muburahati S/S: about 5km	・Newly established Muburahati S/S: 56 projects ・Transmission line between Kinyerezi P/P and Muburahati S/S 1) Extension of transmission lines along the existing line between Kinyerezi P/P and Kimara T-off: 74 projects 2) New transmission lines between Kimara T-off-KM-06: 46 projects 3) New 220 kV 2-circuit transmission line between existing 132 kV transmission line and 220 kV transmission line between KM-06 site and Muburahati S/S (within ROW of current transmission line operation) 4) Transmission line replacement between Ubungo S/S and Muburahati S/S (within ROW of current transmission line operation) 176 or more in total	・Muburahati substation site is on a slope, and it is necessary to consider the prevention of landslides and runoff. ・It is necessary to acquire new land on the east side of the existing transmission line from the power plant to the end of the existing line, and limited impacts on the natural environment are expected. ・From existing Kimara T-off to KM-06, acquisition of new land in the residential area, and limited impact on the natural environment is also expected. ・New land acquisition is not assumed between KM-06 and Muburahati S/S.
Alt-2	・New Muburahati S/S: about 2ha (65m×307m) ・Replacement of existing transmission line between Kinyerezi P/P-Ubungo S/S: 13km ・Replacement of existing transmission line between Ubungo S/S and Muburahati S/S: about 5km	・Newly established Muburahati S/S: 56 projects ・Between Kinyerezi P/P and Kimara T-off: Existing transmission line is used ・Between Kimara T-off and Ubungo S/S: Newly installed within the existing transmission line ROW ・Replacement of transmission line between Ubungo SS and Muburahati S/S: (within ROW of current transmission line operation) 56 or more in total	・Muburahati substation site is on a sloping land, and it is necessary to consider measures to prevent landslides and runoff. ・There is no assumption of new land acquisition for replacement of the old transmission line, and the impact on the natural environment is low.
Alt-3	・New Muburahati S/S: about 2ha (65m×307m) ・Replacement of existing transmission line between Kinyerezi PP and Ubungo S/S: about 13 km	・Newly established Muburahati S/S: 56 projects ・Additional transmission lines along the existing line between Kinyerezi P/P and Kimara T-off: 74 projects ・Between Kimara T-off and Ubungo S/S: Newly installed within the existing transmission line ROW: Unconfirmed (within the current transmission line operation ROW) ・Replacement of transmission line between Ubungo SS and Muburahati S/S: (within ROW of current transmission line operation) 130 or more in total	・Muburahati substation site is on a sloping land, and it is necessary to consider measures to prevent landslides and runoff.

	Business component	Social environment (relocation of residents)	Natural environment
Alt-4	・New construction of Mabibo Substation: approx. 2.5 ha ・power line 1) New transmission line between π branch and KM-06 point: about 2 km 2) Replacement of transmission line between KM-06 point and Mabibo substation: about 10 km 3) Construction of a new transmission line between Kinyerezi power station and the Luguruni line: about 15 km	・New Mabibo substation: 0 projects ・power line 1) New transmission line installation between π branch and KM-06 point: 46 cases 2) Reimbursement between KM-06 point and Mabibo substation: (within the ROW currently operated by the transmission line) 3) Kinyerezi power station - New Luguruni substation: 35 projects 137 or more in total	・The site for the substation is located within the land for transmission lines on flat land, and no particular impact on the natural environment is expected. ・Acquisition of new land will be required for the construction of a new transmission line of about 15 km between Kinyerezi power station and Luguruni substation. Although limited, impacts on the natural environment are also expected.
Alt-5	・New Muburahati S/S: about 2ha (65m×307m) ・power line 1) New transmission line between Kimara T-off and KM-06; about 2km 2) Transmission line replacement between KM-06 site and Muburahati S/S: about 10km 3) Construction of new transmission line between Kinyerezi P/P and Luguruni S/S: about 15km ・Connection to Ubungo S/S	・Newly established Muburahati S/S: 56 projects ・power line 1) New transmission lines between Kimara T-off and KM-06: 46 projects. 2) Replacement between KM-06 site and Muburahati S/S: (within ROW of current transmission line operation) 3) New construction of Kinyerezi P/P-Luguruni S/S: 35 projects ・Connection to Ubungo S/S: (within ROW of current transmission line operation) 137 or more in total	・Mburahati substation site is on a sloping land, and it is necessary to consider measures to prevent landslides and runoff.
Alt-6	・New construction of Mabibo Substation: approx. 2.5 ha ・power line Kimara T-off in Kimara (Kinyerezi power station-Morogoro substation and Kinyerezi power station- Ubungo substation transmission line branch point) and new Mabibo substation: total length about 9km ・Ubungo substation Expansion ・Kinyerezi power station - Luguruni substation	・New Mabibo substation: 0 projects ・New transmission line between π branch and Mabibo substation: about 7 (south side of Ubungo substation) 7 in total	・The site for the substation is on a flat land for transmission lines, so no particular impact on the natural environment is expected. ・There is no assumption of new land acquisition for replacement of the old transmission line, and the impact on the natural environment is low.

Source: JICA preparatory survey team

1-3-1-5 Project Scoping

(1) Project screening

The project was classified as Category B by JICA prior to the start of the study. No significant environmental impacts have been identified that would require a change in the category identified at this time (Table 1-3-1-5.1) The status of environmental impacts related to JICA screening is presented below.

Table 1-3-1-5.1 Environmental items considered in project screening (November 2019)

Environmental Items	Subitem	Summary
Environmentally sensitive characteristics	Involuntary Resettlement Large-scale groundwater pumping Large-scale land clearing, land development, and/or land reclamation Large-scale logging	- A review of the site selection process led to the decision to locate the new construction site in Mabibo Ward, Ubungo District. This site is located within the ROW of the existing transmission line between the existing Ubungo and Mabibo substations and between Mabibo Market and the site of the National Institute of Transportation Studies (NIT), an area of approximately 50m x 500m managed by TANESCO. Resettlement for the project is not expected. - A transmission line is planned between the π-branch and Mabibo substation via the existing Ubungo substation. The new transmission line is planned to replace the existing facilities: there is an existing 220 kV transmission line between the π-branch and Ubungo substation, and an existing 132 kV transmission line between the existing Ubungo substation and Mabibo substation. The new transmission line facilities would be constructed within the ROW of the existing transmission line. - The need to secure approximately 1 ha of new ROW south of Ubungo substation will require the relocation of approximately 7 residential households and 40 simple stores for mobile sales. - Some areas under the existing transmission lines are used as cemeteries. They are located approximately 600 m (east) from the π-branch and 1,200 m (east) from Ubungo substation. - Temporary agriculture (informal) is taking place in part of the substation on a 50m x 150m scale. - Several structures within the existing transmission line right-of-way (Way Leave) (seven warehouses owned by the National Social Security Fund, a wall and parking lot, and the Tanzania Ports Authority boundary wall) are in the process of negotiation with their owners (government agencies) for removal under the responsibility of TANESCO's transmission line division and should be removed by the start of the project.
Environmentally sensitive areas	-Natural Environment- 1) Protected areas (e.g., national parks) 2) Primary forests, tropical natural forests 3) Ecologically important habitats 4) Habitats of endangered species protected by national laws or international treaties 5) Areas with large accumulations of soil salts or soil erosion risks	- The project site does not include (is not in close proximity to) any specific environmentally sensitive areas, such as protected areas, forests, or habitats of endangered species. The area is located in the Ubungo district of Dar es Salaam, an area already under industrial development.

Environmental Items	Subitem	Summary
	6) Areas with significant desertification trends.	
	-Social Environment- 1) Areas of unique archaeological, historical, and cultural value 2) Living areas of ethnic or indigenous minorities, nomadic peoples with traditional lifestyles, or areas of special social value	- The area is an area where transmission lines have already been constructed (within the existing transmission line ROW) and no specific impacts to historical or cultural archaeological heritage are anticipated.
Permits and licenses		- Environmental clearance by the government is required. The implementing agency, TANESCO, is required to submit the procedures for the EIA to the National Environmental Management Council (NEMC), which is the competent authority for environmental impact assessment.

Source: JICA preparatory survey team

(2) Project Scoping

Preliminary scoping of the expected impacts of the project was conducted at the time of the survey. The results of the scoping are as follows:

Table 1-3-1-5.2 Scoping Matrix (August 2019)

Environmental Items	Preliminary scoping		Evaluation Reasoning
	Construction stage	Operation stage	
1. Countermeasures against pollution			
Air Quality	B-	D	**Construction stage:** Exhaust gas and dust emissions from construction vehicles and construction equipment are expected. **Operation stage:** No specific atmospheric emissions are expected.
Water Quality	D	D	**Construction stage:** Since large-scale land alteration and construction work is not anticipated, water quality degradation due to soil runoff is expected to be limited. **Operation stage:** No wastewater is expected to be generated.。
Waste	B-	B-	**Construction stage:** With the land preparation, it is envisaged that old transmission facilities will be removed between the T-off point and Ubungo substation, and between Ubungo SS and the existing Mubrahati S/S. Some of the removed facilities will be disposed of as waste, and proper management of these is required. **Operation stage:** A certain amount of industrial waste is expected to be generated through maintenance activities.
Soil Pollution	B-	B-	**Construction stage/Operation stage:** Soil and groundwater contamination may occur if the insulating oil of the transformer leaks.
Noise and vibration	B-	B-	**Construction stage:** Noise is expected due to construction work. **Operation stage:** Noise generation from transformers in substations is expected.
Land subsidence	D	D	**Construction stage:** Land subsidence is not expected because the project site has flat topography and no large-scale groundwater pumping or large-scale land modification is expected. **Operation stage:** Since large-scale groundwater pumping is not expected, no land subsidence is expected.
Bad odor	D	D	**Construction stage/Operation stage:** Since the project does not anticipate the use of odor-producing substances, no odors are expected to be generated during construction and operation.
Sediment	D	D	**Construction stage:** Since no large-scale land modification is involved, soil erosion from construction work will not affect the bottom sediment. **Operation stage:** Soil runoff from maintenance activities is not expected to affect bottom sediments.

Environmental Items	Preliminary scoping		Evaluation Reasoning
	Construction stage	Operation stage	
2. Natural environment			
Protected Area	D	D	**Construction stage/Operation stage:** The project site is not located in a protected area.
Ecosystems	D	D	**Construction stage/Operation stage:** The project site is located in an industrial area and no specific ecological disturbance is expected.
Hydrology	D	D	**Construction stage:** Since the construction work will not involve large-scale land alteration, no impact on groundwater or rivers is anticipated. **Operation stage:** Operation and maintenance activities are not expected to impact groundwater because these activities do not involve land alteration.
Topography & Geology	D	D	**Construction stage:** Construction, operation and maintenance activities are not expected to affect the topography and geology of the area because they do not involve large-scale land alteration. **Operation stage:** Operation and maintenance activities are not expected to affect the topography and geology of the area because they do not involve large-scale land alteration.
3. Social environment			
Resettlement	B-	D	**Construction stage:** Small-scale resettlement is anticipated. The potential site for the substation was selected to minimize the impact on the surrounding community. The transmission line facility would be constructed on a currently operational transmission line site, replacing an existing transmission facility. **Operation stage:** Resettlement is not expected to occur during Operation stage maintenance work.
Livelihoods	B+	B+	**Construction stage:** Increased employment opportunities are expected during the construction period. **Operation stage:** If the project improves the electricity supply, it is expected to improve the lives and livelihoods in Dar es Salaam.
Cultural Heritage	D	D	**Construction stage/Operation stage:** No cultural heritage is expected to exist within the project site.
Landscape	D	D	**Construction stage/Operation stage:** The project does not involve significant changes in the landscape.
Minorities and indigenous peoples	D	D	**Construction stage/Operation stage:** There are no ethnic minorities or indigenous peoples living in the project site.
Land use, natural resources	D	D	**Construction stage:** No major land use changes are anticipated. New substations and transmission facilities are expected to be constructed within the current transmission line right-of-way of existing transmission lines. **Operation stage:** Operation and maintenance work does not include land use changes.
Water use	D	D	**Construction stage/Operation stage:** The project does not involve any major water withdrawals, and therefore, no impacts on water use are anticipated.
Existing social infrastructure and social services	B-	D	**Construction stage:** The proposed substation site is adjacent to the National Transportation Research Institute site, and construction work must be considered to avoid impact, and construction operations must be properly managed. **Operation stage:** Operation and maintenance activities are not expected to impact existing social infrastructure and facilities.
Uneven distribution of damage and benefits	B-	D	**Construction stage:** Appropriate consideration should be given when hiring the local workforce to avoid uneven distribution of harm and benefits over their employment opportunities. **Operation stage:** The project will improve the electricity supply in Dar es Salaam as a public service and is not expected to cause damage and uneven distribution of benefits in the Operation stage.
Gender and children's rights	D	D	**Construction stage/Operation stage:** No significant impact on gender and children's rights is anticipated.
Conflicts of interest within the community	D	D	**Construction stage/Operation stage:** This project will improve the electricity supply in Dar es Salaam as a public service, and no conflict of interest in the region is expected at the operation stage. However, appropriate consideration should be given to compensation during construction.

Environmental Items	Preliminary scoping		Evaluation Reasoning
	Construction stage	Operation stage	
HID/AIDS and other infectious diseases	D	D	**Construction stage/Operation stage:** Due to the scale of construction and operation of the project, a large influx of outside labor is not expected, and since local labor is expected to be employed, the risk of HIV/AIDS and other infectious disease outbreaks due to an influx of outside workers is considered very small.
Working environment	B-	B-	**Construction stage:** Risk of accidents and diseases during construction is assumed. **Operation stage:** Risks of accidents such as electric shock and falls from heights are assumed during maintenance activities.
4. Others			
Accident	B-	B-	**Construction stage:** The proximity of substation construction sites to public markets increases the risk of traffic accidents due to the transportation of construction materials around these sites. **Operation stage:** Although very rare, overhead wires can be cut by accident or disaster.

A+/-: Significant positive/negative impact expected.
B+/B-: Some positive/negative impact expected.
C+/-: Positive/negative impact of unknown magnitude.
D+/-: No impact expected。

Source: JICA preparatory survey team

1-3-1-6 Environmental and Social Considerations Survey TOR

Based on the preliminary environmental assessment of the project during the scoping phase, the following draft environmental studies were conducted by the TANESCO Environmental Department and the local sub-contractor for the preparation of the EIA report, the contents of which were to be approved by NEMC. Based on the previous studies, the survey team discussed the following issues with the TANESCO Environment Department.

Table 1-3-1-6.1 Survey TOR of Environmental and Social Considerations (Tentative Version: English)

Item	Survey item	Method
Preamble (i) Summary; and (ii) Acknowledgements; (iii) Abbreviations; (iv) Preface; (v) Project Background and Overview;	Business Overview	Project overview description based on project documents (field report in November 2019)
(vi) Policy, Administrative Legal Framework;	Legal framework applicable to environmental assessment	Review and analysis of the national legal framework
(vii) Baseline or Existing Conditions;	Baseline information on the project site	Review and analysis of secondary information on the project's environmental, social environmental, and pollution prevention covering items on the JICA Environmental Checklist
(viii) Assessing Impacts and Identifying Alternatives;	Impact assessment of the following projects	Analysis of environmental impacts associated with the project
Comparison of Alternatives	Identification of alternatives; Comparison of transmission line routes Substation site boundary	Identification of alternatives to minimize relocation, site acquisition and minimize negative impacts; Identification of project sites; Interviews with relevant agencies

Item	Survey item	Method
Air Quality	Construction-related air pollution control measures	Confirmation of secondary information On-site confirmation Interviews with relevant organizations
Waste	Waste Management and Disposal in Substation and Transmission Line Construction	Verify existing information On-site confirmation Investigate waste management at substations
Soil and groundwater contamination	Measures to prevent insulating oil leakage in substations	Confirmation of secondary information On-site confirmation Groundwater level survey at substation Consideration of mitigation measures
Noise	Noise levels and impact on adjacent areas	Confirmation of land use for each substation in accordance with the District Office's land use plan Interview with Tanzania Bureau of Standards (TBS) regarding noise standards Comparison of noise levels and noise standards at the substations Confirmation of the site Consideration of mitigation measures
Relocation	Scope of relocation and land acquisition	Conduct site survey (LARAP survey) and verify existing information Conduct relocation studies and develop a simplified resettlement plan
Existing social infrastructure and institutions	Impact on existing social infrastructure and institutions	On-site verification, interviews Verification of existing information Consideration of mitigation measures
Imbalance between benefits and damages	Impact on existing social infrastructure and institutions	Conduct field survey (LARAP survey) and verify existing information Conduct relocation studies and develop a simplified resettlement plan Study of mitigation measures
Working environment	Impact on workers	Identification of legal framework for working environment Study of mitigation measures
Accidents	Risk of accidents in the vicinity of the project site during construction and operation	Field Survey Gathering information on TANESCO's policies and actions regarding health and safety issues

Source: JICASurvey, JICA Guidelines for Environmental and Social Considerations, Environmental The Environmental Management (Environmental Impact Assessment and Audit)(Amendment) Regulations,2018

1-3-1-7 Results of Environmental and Social Considerations Survey

The local situation with respect to environmental and social considerations is as described in the baseline situation above. In light of the local conditions, a summary of the survey results conducted is presented below.

Table 1-3-1-7.1 Summary of Environmental Survey Results

	Environmental Items	Status and Forecast
Countermeasures against pollution	Air Pollution	Emissions of exhaust gases and dust from construction vehicles and construction equipment are expected during the construction of the substation and transmission lines. No specific emissions are expected during the operation stage.
	Water Pollution	Since no large-scale land modification or construction work is expected for the construction, deterioration of water quality due to soil erosion is considered to be limited. The project crosses rivers (Mbezi River) and streams at several locations on the transmission line. Earthwork associated with construction, improper waste disposal and sewers can cause water pollution and increase turbidity. No waste water is expected from the project site at the operation stage. Improper disposal of oil spills, and improper waste disposal and sewage from substations can cause pollution of surface waters.
	Waste	With land preparation, between T-off point and Ubungo substation, and Ubungo Removal of old transmission facilities between S/S and existing Mubrahati S/S is envisaged. Some of the removed facilities will be disposed of as waste, and proper management of these is required. A certain amount of industrial waste is expected to be generated through maintenance activities in the operation stage.
	Soil Pollution	Soil and groundwater contamination may occur if the insulating oil of the transformer leaks.
	Noise and vibration	Noise is expected due to construction work. Noise generation from transformers in substations is expected.
	Land subsidence	Land subsidence is not expected because the project site has flat terrain and no large-scale groundwater pumping or large-scale land modification is expected. Since large-scale groundwater pumping is not expected, no land subsidence is expected in the Operation stage.
	Bad odor	The project does not envisage the use of odor-causing substances, so the generation of odors associated with construction work and operation is not expected.
	Sediment	Since construction does not involve large-scale land modification, soil runoff from construction work will not affect the bottom sediment. It is not expected that soil runoff from operation stage maintenance activities will affect the bottom sediment.
Natural environment	Protected areas	The project site is not located in a protected area.
	Ecosystem	The project site is located in an industrial zone, and no particular ecological disturbance is expected.
	Hydrology	Since the construction work does not involve large-scale land modification, impacts on groundwater and rivers are not expected. Since operation and maintenance activities do not involve land modification, impacts on groundwater are not expected.
	Topography & Geology	Since the construction work, operation and maintenance activities will not involve large-scale land alteration, it is not expected to affect the topography and geology of the area. Since operation and maintenance activities do not involve large-scale land alteration, it is not expected to affect the topography and geology of the area.
Social	Involuntary Resettlement	Large-scale resettlement of residents by the project is not expected. 18 homes/households and 30 mobile niches could be affected, mainly with the land acquisition of about 1ha south of Ubungo where the existing formal power grid land is not managed. It was chosen to have little impact on the surrounding area. In addition, the transmission line facility will be constructed within the currently operated transmission line site to replace the existing transmission line facility.

	Environmental Items	Status and Forecast
		・Part of the cemetery (approximately 600m (to the east) from the T-off point, approximately 1200m (to the east) from Ubungo S/S, and approximately 2,700m (to the east) from Ubungo S/S may be affected . ・Temporary farming (irregular) on a scale of 50m x 150m is being carried out at a part of the substation, which will be affected. ・Several structures within the existing Way Leave (7 warehouses owned by the National Social Security Fund, walls and parking lots, boundary walls of the Tanzania Ports Authority) are under the responsibility of TANESCO's Transmission Lines Division. It is in the process of negotiations for removal with the owner (government agency) and must be removed before the start of the project. No resettlement is expected for operation and maintenance work.
	Livelihoods	Employment opportunities are expected to increase during construction. If this project improves the power supply, it is expected to improve the life and livelihood of Dar es Salaam.
	Cultural Heritage	No cultural heritage is expected to exist within the project site.
	Landscape	The project will not involve significant changes in landscape.
	Minorities and indigenous peoples	There are no ethnic minorities or indigenous peoples living in the project area.
	Land use and local resource use	No major land use changes are expected for the construction stage. The new substation and transmission facilities are expected to be built within the existing transmission line site of the existing transmission line. Operation and maintenance work does not include land use changes.
	Water use (daily use)	This project does not involve large-scale water intake, so no impact on water use is expected.
	Existing social infrastructure and social services	The candidate construction site for the substation is adjacent to the site of the National Institute of Transportation, and construction work requires consideration not to affect it, and proper management of construction work is required. Operation and maintenance work is not expected to impact existing social infrastructure and facilities.
	Uneven distribution of harms and benefits	Appropriate consideration should be given to avoid uneven distribution of benefits and damages in relation to employment opportunities when employing local labor force. This project is intended to improve the power supply of Dar es Salaam as a public service, and uneven distribution of damage and benefits at the operation stage is not assumed.
	Gender and children's rights	No significant impact on gender and children's rights is expected.
	Conflicts of interest within the community	This project is intended to improve the power supply of Dar es Salaam as a public service, and no conflicts of interest within the region are expected at the operational stage. However, appropriate consideration is required when compensating for construction.
	HIV/AIDS and other infectious diseases	Considering the scale of construction and operation of this project, a large influx of labor from outside is not expected, and employment of local labor is expected. The risk of developing infections is considered very small. The influx of construction workers increases the risk of contracting communicable diseases, including HIV/AIDS and sexually transmitted diseases.
	Working environment	There is a risk of accidents and diseases occurring during construction. Risks of accidents such as electric shocks and falls from high places are assumed during maintenance activities.
Other	Accidents	The construction sites of substations are close to public markets, increasing the risk of traffic accidents due to transportation of construction materials around these sites. Although very rare, an accident or disaster can cut overhead power lines.

Source: JICA preparatory survey team

1-3-1-8 Impact assessment

The expected environmental impacts of the project confirmed by the results of the environmental survey are shown below. In terms of the social environment, there will be some relocation, and there will be no major impacts on the natural environment expected, other than the air and noise levels in the surrounding environment during construction.

Table 1-3-1-8.1 2 Environmental impact assessment

Environmental Items	Scoping		Survey results		Reasons for Evaluation
	Construction stage	Operation stage	Construction stage	Operation stage	
1. Anti-pollution measures					
Air Quality	B-	D	B-	D	**Construction stage:** Exhaust gas and dust emissions from construction vehicles and construction equipment are expected. **Operation stage:** Atmospheric emissions are not expected to be significant.
Water Quality	D	D	B-	B-	**Construction stage:** Since large-scale land alteration and construction work is not anticipated, water quality degradation due to soil runoff is expected to be limited. **Operation stage:** No wastewater is expected to be generated.
Waste	B-	B-	B-	B-	**Construction stage:** With the land preparation, removal of old transmission facilities between the T-off point and Ubungo substation and between Ubungo S / S and the existing Mburahati S / S is envisaged. Some of the removed facilities will be disposed of as waste and proper management of these facilities will be required. **Operation stage:** A certain amount of industrial waste is expected to be generated through maintenance activities.
Soil Pollution	B-	B-	B-	B-	**Construction stage/Operation stage:** Leakage of transformer insulating oil could result in soil and groundwater contamination.
Noise and vibration	B-	B-	B-	B-	**Construction stage:** Noise associated with construction work is expected to be generated. **Operation stage:** Noise emissions from the substation transformers are expected to be generated.
Land subsidence	D	D	D	D	**Construction stage:** Since the project site has a flat topography and no large-scale groundwater pumping or large-scale land alteration is anticipated, land subsidence is not expected to occur. **Operation stage:** Since large-scale groundwater pumping is not expected, land subsidence is not expected to occur.
Bad odor	D	D	D	D	**Construction stage/Operation stage:** Since the project does not anticipate the use of odor-producing substances, no odors are expected to be generated during construction and operation.
Sediment	D	D	D	D	**Construction stage:** Since the project does not involve large-scale land alteration, soil runoff from the construction work will not affect the bottom sediment.

Environmental Items	Scoping		Survey results		Reasons for Evaluation
	Construction stage	Operation stage	Construction stage	Operation stage	
					Operation stage: Soil runoff from maintenance activities is not expected to affect the bottom sediment.
2. Natural environment					
Protected Area	D	D	D	D	**Construction stage/Operation stage:** The project site is not located in a protected area.
Ecosystems	D	D	D	D	**Construction stage/Operation stage:** The project site is located in an industrial area and no specific ecological disturbance is expected.
Hydrology	D	D	D	D	**Construction stage:** Since the construction work will not involve large-scale land alteration, no impact on groundwater or rivers is anticipated. **Operation stage:** Operation and maintenance activities are not expected to impact groundwater because these activities do not involve land alteration.
Topography & Geology	D	D	D	D	**Construction stage:** Construction, operation and maintenance activities are not expected to affect the topography and geology of the area because they do not involve large-scale land alteration. **Operation stage:** Operation and maintenance activities are not expected to affect the topography and geology of the area because they do not involve large-scale land alteration.
3. Social environment					
Resettlement	B-	D	B-	D	**Construction stage:** No large-scale resettlement is expected by the project. 18 homes/households and 30 mobile niches could be affected, mainly with the land acquisition of about 1ha south of Ubungo where the existing formal power grid land is not managed. It was chosen to have little impact on the surrounding area. In addition, the transmission line facility will be constructed within the currently operated transmission line site to replace the existing transmission line facility. ・Part of the cemetery (approximately 600m (to the east) from the T-off point, approximately 1200m (to the east) from Ubungo S/S, and approximately 2,700m (to the east) from Ubungo S/S may be affected . ・Temporary farming (irregular) on a scale of 50m x 150m is being carried out at a part of the substation, which will be affected. ・Several structures within the existing Way Leave (7 warehouses owned by the National Social Security Fund, walls and parking lots, boundary walls of the Tanzania Ports Authority) are under the responsibility of TANESCO's Transmission Lines Division. It is in the process of negotiations for removal with the owner (government agency) and must be removed before the start of business. **Operation stage:** No resettlement is anticipated for operations and maintenance tasks.
Livelihoods	B+	B+	B+	B+	**Construction stage:** Increased employment opportunities are expected during the construction

Environmental Items	Scoping		Survey results		Reasons for Evaluation
	Construction stage	Operation stage	Construction stage	Operation stage	
					period. **Operation stage:** If the project improves the electricity supply, it is expected to improve the lives and livelihoods of people in Dar es Salaam.
Cultural Heritage	D	D	D	D	**Construction stage/Operation stage:** No cultural heritage is expected to exist within the project site.
Landscape	D	D	D	D	**Construction stage/Operation stage:** The project does not involve significant changes in the landscape.
Minorities and indigenous peoples	D	D	D	D	**Construction stage/Operation stage:** There are no ethnic minorities or indigenous peoples living in the project site.
Land use, natural resources	D	D	D	D	**Construction stage:** No major land use changes are anticipated. New substations and transmission facilities are expected to be constructed within the current transmission line right-of-way of existing transmission lines. **Operation stage:** Operation and maintenance work does not include land use changes.
Water use	D	D	D	D	**Construction stage/Operation stage:** The project does not involve any major water withdrawals, and therefore, no impacts on water use are anticipated.
Existing social infrastructure and social services	B-	D	B-	D	**Construction stage:** The proposed substation site is adjacent to the National Transportation Research Institute site, and construction work must be considered to avoid impact, and construction operations must be properly managed. **Operation stage:** Operation and maintenance activities are not expected to impact existing social infrastructure and facilities.
Uneven distribution of damage and benefits	B-	D	B-	D	**Construction stage:** Appropriate consideration should be given when hiring the local workforce to avoid uneven distribution of harm and benefits over their employment opportunities. **Operation stage:** The project will improve the electricity supply in Dar es Salaam as a public service and is not expected to cause damage and uneven distribution of benefits in the Operation stage.
Gender and children's rights	D	D	D	D	**Construction stage/Operation stage:** No significant impact on gender and children's rights is anticipated.
Conflicts of interest within the community	D	D	D	D	**Construction stage/Operation stage:** This project will improve the electricity supply in Dar es Salaam as a public service, and no conflict of interest in the region is expected at the operation stage. However, appropriate consideration should be given to compensation during construction.
HID/AIDS and other infectious diseases	D	D	B-	D	**Construction stage/Operation stage:** Due to the scale of construction and operation of the project, a large influx of outside labor is not expected, and since local labor is expected to be employed, the risk of HIV/AIDS and other infectious disease outbreaks due to an influx of outside workers is considered very small. **Construction stage:** The influx of construction

Environmental Items	Scoping		Survey results		Reasons for Evaluation
	Construction stage	Operation stage	Construction stage	Operation stage	
					workers increases the risk of transmission of communicable diseases, including HIV/AIDS and sexually transmitted diseases.
Working environment	B-	B-	B-	B-	**Construction stage:** Risk of accidents and diseases during construction is assumed. **Operation stage:** Risk of accidents such as electric shocks and falls from heights during maintenance and management activities are assumed. accidents such as electric shock and falls from heights during maintenance and management activities.
4. Other					
Accidents	B-	B-	B-	B-	**Construction stage:** The proximity of substation construction sites to public markets increases the risk of traffic accidents due to the transportation of construction materials around these sites. The risk of traffic accidents due to transportation of construction materials around these locations is increased. **Operation stage:** Although very rare, overhead lines can be cut by accident or disaster. The overhead lines may be cut by accident or disaster, although this is very rare.

A+/-: Significant positive/negative impact expected.
B+/B-: Some positive/negative impact expected.
C+/-: No significant positive/negative impacts expected.
D+/-: No impact expected.

Source: JICA preparatory survey team

1-3-1-9 Mitigation measures and costs of implementing mitigation measures

An Environmental Management Plan will be prepared in the Environmental Impact Assessment Report to be approved by the NEMC. The following are the draft environmental mitigation measures that have been shared with the TANESCO Environment Department and the local subcontractor as possible interim mitigation measures for the environmental impacts identified at this time.

Table 1-3-1-9.13 Environmental mitigation measures (environmental management plans)

Impact Item	Activities & Locations	Effect	Mitigation and remediation measures	Designated Organization	Cost
Site preparation and construction phase					
Water Resources	Construction of towers and substations	Impacts on surface water and groundwater quality	・ Secure a distance from the river or stream to the steel tower. ・ Implement measures to minimize contamination of surface water ・ Restrictions on construction and excavation during the rainy season ・ Establishment of storage areas for batteries and waste at substations, etc., and implementation of outflow prevention measures. ・ In order to prevent penetration into the ground, install drainage, tanks, etc. on hard places such as concrete.	TANESCO	15,000 USD

Impact Item	Activities & Locations	Effect	Mitigation and remediation measures	Designated Organization	Cost
			・ Implement measures to prevent spills and leaks. ・ Developing guidelines and procedures for immediate cleanup actions after oil, fuel, or chemical spills. Preparation of standard operating procedures to control oil spills, leaks and/or seepages. ・ Training of personnel in charge of operation of the above procedures. ・ Periodic check and replacement of the oil separator.		
Air Quality	Site preparation including excavation and backfilling (clearing, grading, and leveling).	Impact on local air quality	・ Designate a transport network, locate stockpile locations, and ensure that all exits from the construction site are loaded up to the truck body. ・ Limiting the unloading height of the filling material as much as possible during filling. ・ Rapid compaction of landfills to avoid fugitive dust emissions. ・ Regular maintenance and inspection of construction machinery. ・ Stopping the engine when not in use ・ Sprinkle water to prevent dust. ・ Use of a dust mask ・ Coating of construction materials in trucks and storage areas. ・ Maintain a distance between project activities and the outside world.	Contractor Occupational Safety and Health Administration (OSHA)	40,000 USD
Noise and Vibration	Construction of substations and transmission towers.	Noise and vibration generation	・ Maintenance of equipment and vehicles in accordance with manufacturer standards. ・ Working hours are limited to daytime. ・ Provide information on blasting operations by posting written times in local gathering areas. ・ Blocking and shutting down of plants, compressors, generators and engine compartments when not in use. ・ Refrain from using noisy equipment in the early morning. ・ Limit the number of devices that can be used at one time. ・ Implementation of equipment maintenance work away from places requiring consideration for noise. ・ Restrict the movement speed of vehicles.	TANESCO Contractor Occupational Safety and Health Administration (OSHA)	10,000 USD
Waste	Operation of construction equipment and machinery.	Solid and liquid waste management	・ Training of workers in the use of waste disposal and sanitation equipment in designated areas. ・ Ensure proper storage of construction materials and waste to minimize potential damage and contamination of materials. ・ Separation of hazardous and non-hazardous waste and provision of appropriate containers for each type of waste. ・ Implement systematic waste storage that allows container-to-container inspection to monitor for leaks and spills. ・ Ensure that storage areas have impermeable enclosures. ・ Disposal of waste by a licensed contractor. ・ Appropriate trash receptacles in the work area.	TANESCO Contractor District/municipal engineer	30,000 USD

Impact Item	Activities & Locations	Effect	Mitigation and remediation measures	Designated Organization	Cost
			· Treatment and discharge of wastewater in accordance with Tanzanian water quality standards. · Raise awareness of environmental and safety issues among workforce staff. · Connect to available municipal wastewater systems or establish your own treatment system.		
Employment	· Waste generated from the construction site	Increased employment opportunities	· Develop and implement local hiring and procurement management plans. · Consult with government authorities, especially stakeholders including Mutter and – Ward managers, in developing local hiring plans. · Communicate employment opportunities to Mutter and Ward managers in a timely manner. · Communicate with local businesses and others as needed regarding contracting opportunities, including awareness of future investment and employment opportunities such as food sales.	TANESCO Contractor Ubungo District	10,000 USD
Community health, safety and security	Site clearance, including excavation and backfilling; site development and grading	Potential increase in infectious and sexually transmitted diseases (HIV/AIDS, STD's)	· Instruct all workers on routes of transmission and common symptoms of the disease, susceptibility, and enforcement of HIV/AIDS laws and regulations, etc. · Establish a code of conduct for workers. · Include specific measures on anti-social behavior in the code. · Provide on-site health care. · Prepare emergency management procedures in case health problems escalate and require immediate attention. · Implement a grievance mechanism.	TANESCO Contractor Ubungo District	15,000 USD
Accidents, Hazards & Disasters	Construction of substations and transmission towers.	Behavioral changes	· Provision and use of appropriate personal protective equipment (PPE). · Provision of health checkups for workers · Providing relevant safety measures, first aid procedures and emergency response training to workers. · Provision of first aid kits at work. · Long-term monitoring of exercise conduct. · Provision of safety signs. · Regular maintenance of machinery and equipment to minimize oil leaks. · Increased awareness of all security and safety issues and hazards on the site.	TANESCO Contractor Occupational Health Administration (OSHA), Ubungo District (Municipal /District councils)	10,000 USD
Cultural Assets	Inflow of workers into the area.	Security issues	· Close contact with affected households. · Compliance with required cultural and legal procedures. · Provision of compensation as stipulated in the Abbreviated Resettlement Action Plan (ARAP).	TANESCO, Ubungo district	30,000 USD
Vulnerable groups	Site clearance, construction, maintenance, and operational activities	Health and safety risks to workers on site	· Provision of income recovery programs for vulnerable households · Support on how to proceed with compensation procedures		10,000 USD

Impact Item	Activities & Locations	Effect	Mitigation and remediation measures	Designated Organization	Cost
Land and housing	Site preparation and construction activities	Destruction of graves/cemeteries;	・ Implementation of land acquisition procedures in accordance with the framework of the simplified resettlement plan. ・ Providing income recovery opportunities to people who have lost their livelihoods due to land acquisition. ・ Maintaining ongoing and open communication with PAPs and other stakeholders. ・ Providing assistance to vulnerable groups on how to proceed with compensation procedures. ・ Establishment of a grievance mechanism to address concerns.	TANESCO Ministry of Land and Human Settlements and Development Ubungo district	300,000 USD
Operational Stage					
Water resources	Accidental accidents due to substation operational activities	・Impact on surface water and groundwater quality	・ Establishment of storage areas for batteries and waste at substations, etc./Implementation of outflow prevention measures. ・ In order to prevent penetration into the ground, install the drainage/tank etc. on a hard place such as concrete. ・ Implement measures to prevent spills and leaks. ・ Developing guidelines and procedures for immediate cleanup actions after oil, fuel, or chemical spills. ・ Preparation of standard operating procedures to control oil spills, leaks and/or seepages ・ Training of personnel in charge of operation of the above procedures. ・ Periodic check and replacement of the oil separator.	TANESCO Ubungo district	20,000 USD
Noise vibration	Machine operation during operational phase	Generate noise and vibration	・ Installation of portable barriers to shield compressors and other small fixed equipment where necessary. ・ Well-maintained equipment for on-site operation. ・ Thorough regular maintenance of equipment, such as lubricating moving parts, tightening loose parts, and replacing worn components. ・ For devices with directional noise, consider the direction as far away from the receptor as possible. and ・ Avoid on-site and off-site transportation of materials through existing areas.	TANESCO	5,000 USD
Waste	Waste from control rooms and substations	Generation of solid and hazardous waste	・ Education of on-site workers to avoid, reduce and recycle waste. ・ Installation of site and waste storage facility signage within the project site. ・ Management and disposal of collected waste in accordance with required regulations. ・ Disposal of waste by licensed contractors.	TANESCO	5,000 USD/year
Power supply	Business operation	Increased power supply	・ Increase in revenue ・ Improve people's standard of living. ・ Ensuring the growth of cities and towns. ・ Strengthening of development activities such as business and industry. ・ Reduce electricity bills ・ Reduced power loss. ・ Improved voltage to equipment	TANESCO	5,000 USD

Impact Item	Activities & Locations	Effect	Mitigation and remediation measures	Designated Organization	Cost
Community health, safety and security	Presence of new infrastructure	・Accidents and injuries on site	・ Providing appropriate training for security personnel. ・ Long-term monitoring of exercise conduct. ・ Raise awareness of all security and safety issues related to transmission towers and substations. ・ Construction of fences around transmission towers and substations. ・ Installation of safety signs. ・ Implement grievance mechanisms.	TANESCO	50,000 USD
Accident, danger, disaster	Construction, maintenance and operation activities	・Risks to the health and safety of workers on site	・ Provide training on relevant safety measures, first aid procedures, and emergency response to workers. ・ Provision of first aid kits to work sites and workers' quarters. ・ Provision and use of appropriate personal protective equipment (PPE). ・ Provision of health checkups for workers ・ Providing training on occupational health and safety; ・ Long-term monitoring of training implementation ・ Installation of safety signs.	TANESCO Contractor Occupational Health Administration (OSHA) Ubungo District (Municipal /District councils)	50,000 USD

Source: JICA preparatory survey team (2020.Environmental Impact Assessment Reprot For The Proposed Construction Of 9KM OF 220kV Transmission Line From Kinyerezi T – Off Point To The New Mabibo Substation, Dar Es Salaam)

1-3-1-10 Monitoring plan

In the environmental impact assessment report (EIA study) on environmental and social considerations implemented in 2020, a monitoring plan was formulated based on the above environmental management plan. The monitoring plan will be submitted to NEMC by the implementing body as part of the EIA study report for approval.

Table 1-3-1-10.1 4 Environmental monitoring plan

Business stage/ Impact item	Influence	Monitoring items	Location	Confirmation / Measuring method	Frequency	Responsible entity	Cost (USD)
Site preparation and construction phase							
General	Supervision of compliance with mitigation measures	General compliance with mitigation measures presented in the ESMP	Project Activity Area and Construction Worker Quarters	Visual inspection of all work areas	Daily	TANESCO	10,000 USD
Water resources	Groundwater quality degradation	pH, temperature, EC, TDS, turbidity, total hardness, Cl, SO4+, NO3-, BOD, COD, total coliforms and heavy metals (As and Pb) Ref: IFC General EHS Guidelines: 1.3 Wastewater and Ambient Water Quality Presence/absence and use of approved chemicals	Wells in the vicinity	Standard analysis methods	・Before starting construction activities ・According to requests from neighboring residents.	TANESCO Contractor Occupational Safety and Health Administration (OSHA) Personnel	10,000 USD

Business stage/ Impact item	Influence	Monitoring items	Location	Confirmation / Measuring method	Frequency	Responsible entity	Cost (USD)
		Water/soil contamination/contamination occurrence presence/absence of functional oil traps and skimmers presence/absence of maintenance schedules contamination levels per TZS860:2006				Ubungo District	
Air quality	Generation of dust	Dust references:. Tanzania Air Quality Standards Regulations IFC General EHS Guidelines: 1.1 Air Emissions and Ambient Air Quality	Village near access road	On-site inspections, measurements and reports	On request	TANESCO Contractor Occupational Safety and Health Administration (OSHA) Personnel Ubungo District	5,000 USD
Noise	Noise generation	Noise Level Reference:. Tanzania IFC Noise Standards Regulations General EHS Guidelines: 1.7 Noise	Sites mentioned in the request	Visual inspection report	On request	TANESCO Contractor Occupational Safety and Health Administration (OSHA) Personnel Ubungo District	10,000 USD
Waste	Solid waste management	Adequacy of solid waste management measures (e.g., proper storage, collection, disposal) Presence/absence of functional mobile toilet and soakaway (underground seepage)/septic tank systems Presence/absence and type of solid waste on transmission line property Presence/absence of regulated solid waste collection bins Presence/absence of functional disposal facilities Presence/absence of recycling facilities	Waste storage sites	Noise level measurements	Weekly	TANESCO Contractor Occupational Safety and Health Administration (OSHA) Personnel Ubungo District	5,000 USD

Business stage/ Impact item	Influence	Monitoring items	Location	Confirmation / Measuring method	Frequency	Responsible entity	Cost (USD)
		Presence/absence of functional programs to reduce and recover solid waste					
Employment opportunities	Increased employment	Number and gender of locals employed Availability of training programs for workers Number of workers trained based on skills Type of assistance provided	Affected communities	Visual inspection of all waste collection sites and ensure proper disposal	Every other year during mobilization period (construction and operation)	Contractors Ubungo District Mutter District Head	5,000 USD
land and housing	Loss of land and housing	Number of meetings and types of information distributed Number of affected persons compensated at reacquisition price Availability of a functional grievance mechanism Number and type of grievances Status and scope of project activities outside the core designated area	Affected communities	On-Site Inspection and Report	Concurrent with mobilization and construction	Contractors District Land Administrator Property Assessor (Head)	5,000 USD
Community health and safety	Increased risk of accidents and disasters	Accidents, events, complaints	Affected communities	Reports and Surveys	As requested to occur.	TANESCO	5,000 USD
Accidents, danger, disaster	Increased disaster and accident risk	Availability of training programs Number of staff certified and trained in safety practices Availability of a functioning first aid kit with full package and appropriate functional personal safety equipment (PPE) Availability of company enforcement policies Availability of warning signs Availability and use of approved chemicals Close call accidents, events, occupational illnesses, hazardous incidents	Project Activity Area and Construction Worker Quarters	Reports and investigations	Quarterly during mobilization period of construction	TANESCO Contractor Occupational Safety and Health Administration (OSHA) Person Ubungo District	5,000 USD
Operation stage							
General	Supervision of compliance with mitigation measures	General compliance with mitigation measures presented in the Environmental and Social Management Plan	Project Activity Areas	Visual inspection of all work areas	Daily	TANESCO	5,000 USD/year

Business stage/ Impact item	Influence	Monitoring items	Location	Confirmation / Measuring method	Frequency	Responsible entity	Cost (USD)
		(ESMP) and the Operations Manual					
Waste	Solid waste	Proper collection, transport and management	Waste collection at substations	Visual inspection of all waste collection sites and ensure proper disposal On-site inspections and reporting	Monthly	TANESCO	5,000 USD/year
Community health and safety	Increased risk of accidents and disasters	Accidents, events, complaints	Affected Communities	Events, accidents, community complaints	As they occurs.	TANESCO	5,000 USD/year
Accidents, danger, disaster	Increased risk of accidents and disasters	Close calls, accidents, occupational illnesses, hazardous events	Project Activity Area and Construction Workers Camp	As defined in the construction phase Health and safety plan prepared by the contractor	Depends on the definition of health and safety plan	TANESCO	5,000 USD/year

Source: JICA preparatory survey team (2020.Environmental Impact Assessment Reprot For The Proposed Construction Of 9KM OF 220kV Transmission Line From Kinyerezi T – Off Point To The New Mabibo Substation, Dar Es Salaam)

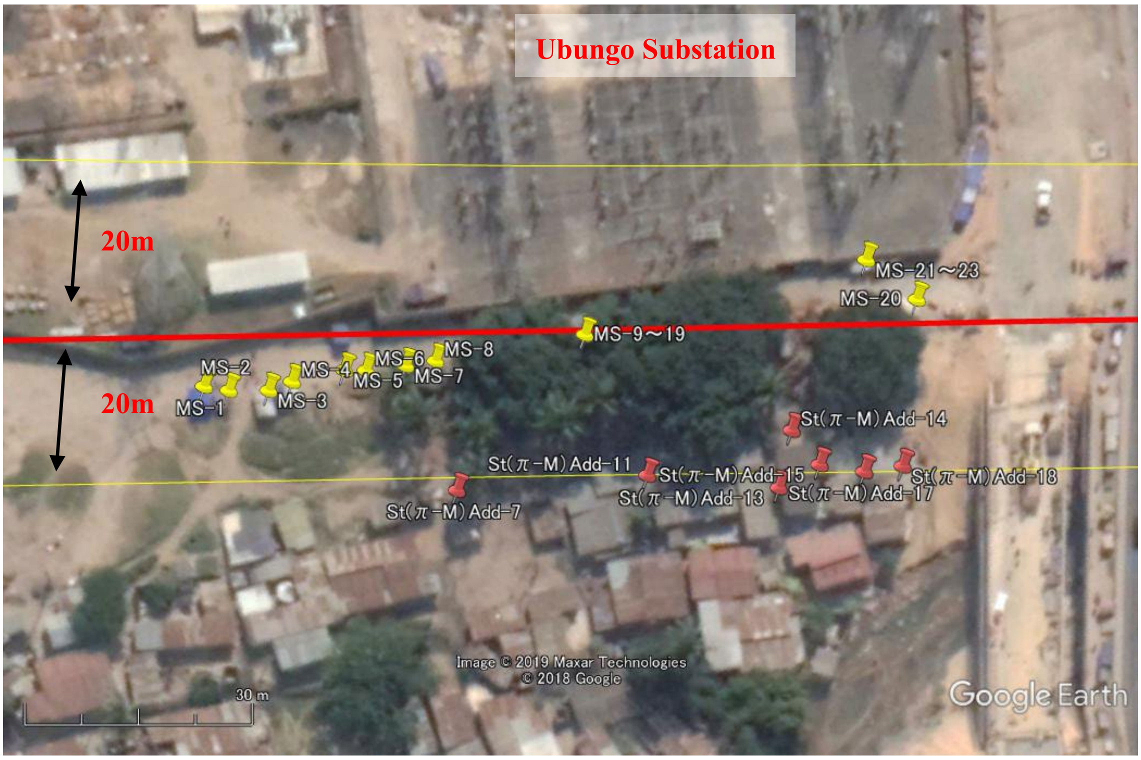
1-3-1-11 Stakeholder consultation

In order to explain the project, a series of briefing sessions were held at relevant government agencies and residents in the project implementation area. Residents generally agreed to the project, but some residents expressed dissatisfaction due to confusion with other projects. The outline of the meeting is shown in Table 1-3-2-10.1 below.

1-3-2 Land Acquisition and Resettlement

1-3-2-1 Necessity of land acquisition and resettlement

The new transmission line will connect the π-branch in Kimala to the substation in Mabibo for a total distance of about 9 km. The new transmission line and the new substation in Mabibo will be constructed essentially within the limits of the existing transmission line right-of-way. The new 220 kV three-circuit transmission line facility will replace the existing 220 kV single-circuit facility between the π branch in Kimala and Ubungo substation, and the existing 132 kV single-circuit facility between Ubungo substation and the new Mabibo substation. It will be installed to replace two lines of 220kV. Additional land was needed because the new line would pass through the existing Ubungo substation and connect to the existing 132 kV line without entering the substation.



Note: The red line is the assumed center line of the new power transmission line, the yellow line is the affected area, the red pin is for housing, and the yellow pin is for mobile simple stores.

Figure 1-3-2-1.1 Situation on the south side of Ubungo substation

1-3-2-2 Legal Framework for Land Acquisition and Resettlement

(1) Legal system related to land acquisition and resettlement

Major legal systems related to land acquisition and resettlement in Tanzania are shown below.

Table 1-3-2-2.1 Major Laws and Regulations Related to Land Acquisition and Resettlement

Law	Overview
Constitution of the United Republic of Tanzania (1977 - as amended)	The Constitution provides for the protection of the rights and interests of citizens in matters of property and acquisition. Under Article 24 (1), every person has the right to own property and to protect the property he or she holds in accordance with the law. Sub-article (2) provides that deprivation of property for any purpose without authority of law is unlawful and provides for fair and adequate compensation.
Land Act, 1999	Laws governing standards for lands other than village lands, land management, dispute resolution and related matters.
Land (Assessment of the Value of Land for Compensation) Regulations, 2001	These regulations prescribe the basic concepts regarding the valuation of land at the time of compensation. Market value is the basis for compensation and is determined using the actual recent sales of similar property or a comparative method evidenced by the income approach or the replacement cost method where the property is of a special nature and unsalable. The regulations also provide for prompt payment within six months of acquisition.

Law	Overview
Land acquisition Act 1967, Cap 118	The law prescribes the powers and procedures for acquiring land and the degree of compensation required. Sections 3 and 4 of the law authorize the Tanzanian authority to acquire land for any property or period of time needed for public purposes, such as the exclusive use of the government, use by the general public, government schemes, development of social services of any kind, including land reclamation, or commerce.
Land Use planning Act, 2007	An Act to provide for procedures for the preparation, management, and implementation of land use plans; to repeal the National Land Use Planning Commission Act; and to provide for related matters.
Urban Planning Act, 2007	A statute that regulates urban planning.
Graves Removal Act, Cap 73	An Act providing for the removal of graves from land needed for public purposes. Pursuant to the provisions of this Act under Section 3, "Where the land on which a grave is located is needed for a public purpose, the Minister may remove the grave and the bodies buried therein from the land and, in such case, may take such steps as may be necessary or suitable for the restoration of the grave and the relocation of the bodies authorized for the purpose and All measures shall be taken." The law specifies, among other things, that the grave shall be relocated after official notice has been given to the interested parties and published in the Official Gazette. Article 9 of the law provides for compensation to be paid to interested parties who remove, transport, restore, and alter graves or corpses on behalf of the government.
The Land (Assessment of the Value of Land for Compensation) Regulations, 2001	These regulations govern claims for compensation or "never-ending improvements" on land paid for by the government. The basis of valuation is the market value of the land, and certain allowances may be allowed: compensation for loss of profit on the land includes the value of never-ending improvements, disturbance allowance, transportation allowance, accommodation allowance, and loss of profit.

Source: JICA preparatory survey team

(2) GAP analysis of the legal framework for land acquisition and resettlement between the JICA Guidelines for Environmental and Social Considerations (2010) and relevant national legislation

The GAP analysis was conducted in a JICA study conducted for TANESCO in 2014 under the JICA scheme (Substation Rehabilitation and New Line and Substation Construction Plan Preparatory Study for Dar es Salaam in the United Republic of Tanzania). The previous results were used as a reference to develop a relocation planning policy for this project.

Table 1-3-2-2.2 GAP analysis between JICA Environmental and Social Considerations Guidelines for Land Acquisition and Resettlement (2010) and the relevant national legislation

No.	JICA Guidelines	Legal system of Tanzania	Gap between JICA guidelines and legal system in Tanzania	Policy on resettlement in this project (draft)
1.	Involuntary resettlement and loss of means of livelihood must be avoided by examining all possible means. (JICA GL)	There are no specific measures on avoidance of involuntary resettlement or loss of means of livelihood in the legal system of the "Ta" countries, although this	There is no particularly significant divergence between the two. While the Tanzanian Land Law does not	Consider alternatives to avoid unnecessary loss of means of livelihood.

No.	JICA Guidelines	Legal system of Tanzania	Gap between JICA guidelines and legal system in Tanzania	Policy on resettlement in this project (draft)
		item will be considered by the Environmental and Social Impact Assessment (ESIA). The EIA Guidelines 2012 for the energy sector follows the adaptation of the World Bank OP.4.12 on involuntary resettlement through the 1996 National Land Policy and the World Bank OP.	mention avoiding involuntary resettlement, the same concept is applied through regulations and guidelines.	
2.	If avoidance is not possible after consideration, effective measures must be taken to minimize the impact and compensate for the loss. (JICA GL)	If relocation is unavoidable, compensation is provided in accordance with the law. (Land Law, 1999 -Cap 113, Part II Section 3 (1) (g) , Sections 34 and 156) Compensation includes the market value of the land combining capital, land impairment allowance, relocation allowance, accommodation allowance, and loss of profit allowance. However, the cost of relocation through depreciation, not the reacquisition price, would be assessed. In some cases, market prices are not adequately taken into account, or sufficient information is not provided to the affected parties of the project, or other necessary matters are not adequately taken into account when assessing the project.	The reacquisition price (market price and various manual costs) is not mentioned in the legal system of Tanzania. Mitigation measures to minimize the impact of transfers are not explicitly mentioned in the legal system of Tanzania.	Consider the reacquisition price (market price and the cost of the procedure to be included in the compensation measure).
3.	Displaced persons will be provided with compensation and support that will enable them to improve or at least restore their pre-relocation living standards, income opportunities and production levels. (JICA GL)	Alternative services to the affected social services (such as alternative health or educational facilities) may be provided, but the legal system of the "ta" countries does not address livelihood restoration.	Livelihood restoration is not specified in the legal system of the "ta" countries.	In this Simplified Resettlement Plan, compensation for the affected portion will be considered for those whose houses and other structures will be partially affected by the project. However, this will be limited to the extent that the affected area is not large and does not affect the quality of life and livelihood of the people concerned. If the affected area is large and the quality of life is affected,

No.	JICA Guidelines	Legal system of Tanzania	Gap between JICA guidelines and legal system in Tanzania	Policy on resettlement in this project (draft)
				full compensation for the structure will be considered. In addition, a livelihood restoration plan including the relocation period will be considered to ensure that the standard of living is restored or improved. Examples may include supporting employment and providing alternative access to social services to the relocated persons during the relocation period.
4.	Compensation should be based on replacement costs wherever possible. (JICA GL)	Compensation is supposed to be at market price, but in normal operation compensation is made at a price that takes depreciation into account. (The legal system of the "Ta" countries does not provide for the use of prices taking depreciation into account.)	No payment was made at the reacquisition price.	Consider adopting the reacquisition price (market price and the cost of the procedure).
5.	Compensation and other assistance must be provided prior to physical displacement. (JICA GL)	Compensation must be paid prior to relocation. (Land Acquisition Act, 1967 (15- (1)) and Land Act 1999- Cap 113)	The legal system of Tanzania does not take into account any other assistance to the project affected persons.	In addition to the compensation provided by the legal system, consider providing other assistance as needed.
6.	In the case of a project involving large-scale involuntary resettlement, a resettlement plan must be prepared and made public. It is desirable that the resettlement plan include the contents stipulated in OP4.12 Annex A of the World Bank Safeguard Policy. (JICA GL)	Compensation must be provided for large-scale resettlement (Land Acquisition Act 1967 Part II Section 11 and Land Cap 113, Part II Section 3 (1) (g))	The legal system of Tanzania does not mandate the formulation of resettlement plans.	Prepare resettlement plans in accordance with JICA guidelines to adequately address the impacts of resettlement.
7.	In preparing a resettlement plan, sufficient information must be made public in advance, and consultations with the affected people and communities must be held based on this information. (JICA GL)	Prior to conducting an assessment, affected persons and local agencies are notified of the project, its impacts, the assessment, and the compensation process. (Land Code Cap. 113 Sections 34 (6), 35 (3))	Tanzania's legal system does not provide as much detail as the JICA guidelines or the World Bank's safeguard policy regarding the extent of consultation with affected people and others.	Consider detailed and effective consultation and information sharing with affected persons
8.	The consultation should be explained in a	Prior to conducting an assessment, affected persons and	The legal system of Tanzania does not	Consider detailed and effective consultation and

No.	JICA Guidelines	Legal system of Tanzania	Gap between JICA guidelines and legal system in Tanzania	Policy on resettlement in this project (draft)
	language and in a manner understandable by those affected. (JICA GL)	local agencies are informed about the project, its impacts, and the assessment and compensation process. (Land Act Cap. 113 Sections 34 (6), 35 (3) and Part XIV Sections 168 (1) and 169 (1) and (2). And Land Acquisition Act Part II Section 7(1))	provide as much detail as the JICA guidelines or the World Bank's safeguard policies regarding the extent of consultation with affected people and others.	information sharing with affected persons.
9.	Appropriate participation of affected people and communities should be promoted in the planning, implementation and monitoring of countermeasures for involuntary resettlement and loss of livelihoods. (JICA GL)	Tanzania land law requires compensation but does not mandate a resettlement plan.	In Tanzania, there is no effective and adequate participation of affected persons in the planning, implementation, and monitoring processes of resettlement programs.	Consideration will be given to ensure appropriate and effective participation of affected persons in the planning, implementation, and monitoring processes of the resettlement plan.
10.	A mechanism for handling complaints from affected people and communities must be in place. (JICA GL)	The legal system in Tanzania provides mechanisms for dealing with complaints, including taking complaints to the courts. (Land Acquisition Act 1967, Sections 13 (1) and (2) and Land Act, Cap 113. Part XIII Section 167 (1))	The grievance mechanisms in Tanzania are not easily accessible to the affected persons.	Provide an easily accessible grievance mechanism for all affected parties with reference to examples from other projects.
11.	Affected populations will be identified and recorded through initial baseline surveys (including population census, wealth and wealth surveys, and socio-economic surveys) to establish entitlement to compensation and assistance. This should be done as early as possible in order to prevent the influx of people seeking benefits such as compensation and support. (WB OP4.12 Para.6)	Affected persons are identified during the assessment process and the assessment date is the cut-off date for entitlement.	Socioeconomic baseline studies are not part of the assessment process.	As part of the assessment process, socioeconomic baseline data will be examined.
12.	Recipients of compensation and support are those who have legal rights to land, those who do not have legal rights to land, but whose rights are recognized under the legal system of the country if they claim rights,	Recipients of compensation and assistance are those who have legal rights to land. This includes those who have customary and traditional rights to land under the law. In addition, people who do not have legal rights to land at the	The legal system of Tanzania does not address squatters.	Illegal occupants who own permanent structures on the site and cemeteries on the site will be compensated, but not for the land.

No.	JICA Guidelines	Legal system of Tanzania	Gap between JICA guidelines and legal system in Tanzania	Policy on resettlement in this project (draft)
	and those who possess rights. shall not be able to confirm the legal rights and claims of the land (WB OP4.12 Para.15)	time of assessment but who have invested in the land are eligible for compensation for assets other than land. Land Law Cap 133.		
13.	Prioritize land-based resettlement strategies where the livelihoods of displaced persons are land-based. (WB OP4.12 Para.11)	Compensation for land may be in the form of either cash or land. Land Act Cap 113 Section 49 (3) Land Acquisition Act , 1967 Section 11 (2)	There is no policy of prioritizing land-based relocation strategies.	Considering the land shortage in Dar es Salaam, a land-based relocation strategy will be followed for those locations deemed appropriate.
14.	Provide assistance during the transition period. (WB OP4.12 Para.6)	-	The legal system of Tanzania makes no mention of assistance during the relocation period and livelihood restoration assistance.	Consider assistance during the relocation period (e.g., assistance in acquiring new land, assistance in paying for land registration procedures, provision of temporary social services, etc.) and assistance in restoring livelihoods.
15.	Particular consideration will be given to the socially vulnerable among the resettled population, especially the poor, landless, the elderly, women, children, indigenous peoples and ethnic minorities. (WB OP4.12 Para.8)	-	The legal system of Tanzania does not specifically provide for any consideration of specific segments of the population affected by the project; all affected persons are treated equally in the compensation process.	The presence of such groups will be confirmed through socioeconomic surveys in the proposed project site, and if identified, their needs will be noted so that particular attention is given to the elderly, women, and children.
16.	For projects involving resettlement of less than 200 people or land acquisition, a resettlement plan (summary version) will be prepared. (WB OP4.12 Para.25)	Compensation for land may be in the form of either cash or land. Land Act Cap 113 Section 49 (3) Land Acquisition Act , 1967 Section 11 (2)	Simplified resettlement plans are not required by Tanzanian legislation.	In order to properly address the impacts of the relocation, as a best practice, the project will have a policy of developing a simplified resettlement plan.

Source: JICA preparatory survey team

Remark: the JICA (2014) Preparatory Survey on the Project for Rehabilitation of Substations and Construction of New Lines and Substations in Dar es Salaam in the United Republic of Tanzania and relevant legislations

1-3-2-3 Scale and scope of land acquisition and resettlement

Due to the project, 18 houses/households with 102 people will lose part or all of their residences and will need to be resettled. Of these, 4 houses/households (12 people) will be relocated to public land under existing power lines, and 14 houses/households (90 people) will be relocated due to new land acquisition. In addition to these resident relocations, 10 commercial facilities, 30 simple commercial facilities (mobile sales facilities) used by 30 sellers, 1 part of a school facility (toilets), Three fences and

135 cemeteries will need to be relocated.

Table 1-3-2-3.1　Size of households affected by resettlement (ARAP 2021)

No.	Loss Type	Impacted households/structures			Number of people affected		
		Regular	Non-regular	Total	Regular	Non-regular	Total
Items that will need to be relocated							
1	**Houses on official land**						
	Fully	-	3	3	-	11	11
	Partially	-	1	1	-	1	1
2	Houses on privately owned land						
	All houses	11	-	11	72	-	72
3	Rental	3	-	3	18	-	18
4	Commercial facilities, etc. (on land used for power lines)	-	10	10	-	-	-
5	Commercial facilities (on private land)	-	-	-	-	-	-
6	Commercial facilities (leased)	-		-	-	-	
7	Facilities, etc. including cultural facilities						
	Communal toilets (12 rooms) at Kilongole B Elementary School (estimated user)	-	1	1	-	(1,857)	(1,857)
	Fence	-	3	3	-	-	-
	Cemetery	-	135	135	-	-	-
8	Simple commercial facilities		30	30	-	30	30
No need to relocate							
9	Land/structure owner	-	2	2	-	2	2
	Total (1-9)	**14**	**185**	**199**	**90**	**44 (1,857)**	**134 (1,857)**

Source: JICA preparatory survey team (2021 ARAP)

1-3-2-4　Specific measures for compensation and support (including recipient requirements and calculation of compensation)

Specific measures for compensation and support were discussed with TANESCO, the executing agency, and the relevant government agencies in the preparation of the ARAP (ARAP) draft for the field reconsignment study. The following entitlement matrix outlines the specific measures of compensation and support for the Project.

Table 1-3-2-4.1　Entitlement Matrix

Project Affected People (PAP) Categories		Loss type	Compensation for Loss of Land	Compensation for loss of structures and assets	Compensation for crop loss	Allowance
Household or Person						
A1	Households or persons with residential properties with residential and/or non-residential buildings on the transmission line site	Loss of residential property Loss of residential and non-residential building assets	Compensation for land at reacquisition value as follows Compensation (cash or in-kind) for residential land parcels at the reacquisition value of the area. Compensation for transaction costs (payment of compensation for	Cash compensation without depreciation according to the following:. The area covered, the Type of building and ; Materials used and condition.	N/A	Disturbance allowance at the bank rate of the estimated land value at the time of valuation. Lodging Allowance and Transportation costs for moving expenses equivalent to 36

Project Affected People (PAP) Categories		Loss type	Compensation for Loss of Land	Compensation for loss of structures and assets	Compensation for crop loss	Allowance
			transaction costs to the PAP and allowing the PAP to waive transaction costs)			months rent of the relocated house. 12 tons for 20 km (not applicable for backward relocation of a house).
A2	Owners or operators of unregistered businesses, with or without permits; squatters or sellers operating kiosks, restaurants	Loss of commercial structure	In the case of squatters or sellers of private land, the PAP pays for the loss of business land	Assistance in relocating movable structures	N/A	Allowance for damage
A3	Intrusive households or persons owning residential structures on power line property	Loss of housing	Assistance in purchasing a new parcel	Provide PAP with time to relocate to an area of their choice Assistance in building a new home	N/A	No allowance is provided.
A4	Intrusive household or residential business structure owner on transmission line property	Loss of owner's business	No compensation for land	Assistance in purchasing a new parcel	NA	No allowance is provided.
A 5	Intruder households or renters of residential structures on power line property	Loss of the lessee's place of residence	No compensation for land	Assisted relocation	NA	Travel allowance
A6	Intrusive households or persons growing crops on transmission line and substation property (annual and perennial/tree crops)	Loss of agricultural land Loss of fruit, shade trees, and other perennial crops	Does not provide compensation for land Provides sufficient time to harvest crops	N/A	No cash compensation for fruit, shade trees, or other commercially valuable permanent crops (such as bananas) Provides sufficient time to harvest	No allowance is provided.
A7	Households or persons outside the transmission line site that may be affected by temporary access roads or construction activities	Loss and damage to building assets. Loss of crops.	N/A	Negotiated cash compensation (paid by contractor) for the cost of repairing damaged building assets	Negotiated cash compensation (negotiated and paid by the contractor) for the replacement value of the lost crop	No allowance is provided.
A8	Households or persons whose graves are located on transmission line property	Loss of burial sites (cemeteries) on power line property.	N/A	N/A	N/A	Cash compensation required by the Grave Removal Act No. 9 of 1969

Project Affected People (PAP) Categories		Loss type	Compensation for Loss of Land	Compensation for loss of structures and assets	Compensation for crop loss	Allowance
						to cover the ceremonial costs of the grave that will be under the foundation of the steel tower. Grave relocation costs (caskets, burial works, etc.) stipulated and negotiated by the relevant district health authorities to be borne by the project Alternative burial plots will be allocated by the district council
B. Schools/Public Institutions						
B1	Agencies or authorities that own buildings and land on the transmission line site	Loss of toilet facilities encroaching on power line property Loss of developed land	No compensation will be paid. The district council must ensure that other toilet facilities are provided to the school.	No compensation	N/A	No allowance is provided.
C. Other						
C1	Households with vulnerable members of society (elderly households, households headed by women, households with chronic illness or disability, orphans, etc.)					Assistance based on identified vulnerability states and their needs

Source: JICA preparatory survey team (2021 Draft ARAP)

1-3-2-5 Complaint Handling Mechanism

Land acquisition complaints for public purposes are legally protected for all citizens of the country under Section 13(1) of the Tanzania Land Acquisition Act 1967 and relevant legislation such as the Land Act 1999. there is The Land Acquisition Act has been criticized as a costly and complex system. Therefore, a simple grievance system for this project will be established and applied in parallel with Tanzania's legal grievance system, referring to the methods used in other domestic cases.

1-3-2-6 Implementation system (identification of agency responsible for resettlement and its responsibilities)

The main organizations involved in the process of land acquisition, resettlement and compensation as part of the implementation system of the Abridged Resettlement Action Plan and their roles are outlined below.

Table 1-3-2-6.1 Roles and Responsibilities of Each Organization in ARAP Implementation

Organization	Roles and Responsibilities
TANESCO	Disclosing the ARAP to the community after it has been developed Holding community-wide meetings with the affected households (PAPs) Authorization for contractors to begin demolition work Sending of relocation notices to the affected households (PAPs) in Ubungo Junction concerned Liaison with different government agencies in the implementation of the ARAP
Ministry of Finance and Planning	Payment of compensation funds to TANESCO headquarters office for payment to the households covered by the compensation and to the public authorities
Ministry of Lands, Housing and Human Development	Confirmation that the amount paid to the affected household (PAP) is equal to the value of the affected property Approving (signing) asset valuation reports Administration of various land related laws Land allocation, acquisition, registration and land management
District (Ward and Mtaa Level)	Local level management Identifies and identifies the affected households (PAPs) Receive and manage complaints from the affected households (PAPs) Receive and regularize grievances through Mtaa Grievance Redressal Committee (MGR) Submit unresolved grievances to the District Grievance Redressal Committee (DGRC), also known as the Social Services Committee (SSC)
Ubungo Municipal Council (District Grievance Redress Committee (DGRC))	Sending relocation notices to the affected households (PAPs) Assisting small scale commercial workers in Kibo Mutaa (mtaa) in Ubungo District to access new areas Removal of graves
	Receive unresolved grievances from Mtaa Grievance Redress Committee and rule on unresolved grievances submitted by MGRC Submits unresolved grievances to the appropriate court
NGO and others	Raise public awareness of the resettlement process Facilitating local community participation in the implementation of the ARAP Member of the Grievance Committee, assisting the PAP on technical issues and raising awareness on various issues

Source: JICA preparatory survey team (2021 ARAP)

1-3-2-7 Implementation Schedule

A tentative implementation schedule for the ARAP is presented below. The study schedule has been significantly delayed due to COVID-19 and other factors, and the project component of the substation is currently under review. Flexible modifications to the process will be necessary as the project progresses in sequence (as of March 2021).

Table 1-3-2-7.1 ARAP Implementation Schedule

Activity	Implementation process after the decision to support* (months/weeks)												Implementation Period
	1 month				2 months				3 months				
	1/4	2/4	3/4	4/4	1/4	2/4	3/4	4/4	1/4	2/4	3/4	4/4	
Finalize design and conduct socioeconomic studies													Contractor, TANESCO and Asset Evaluation Team
Prepare property evaluation and compensation schedule													TANESCO and Asset Evaluator
Approval of evaluation report and compensation schedule													Department of Land, Housing and Development Government Property Assessor Ubungo District Commissioner and Dar es Salaam Regional Commissioner
Notification of planned activities in consultation with PAP and PAP's role in ARAP implementation and compensation													TANESCO, Relocation Committee and NGOs
Disclosure of compensation entitlement requirements and opening of bank accounts													TANESCO
Payment of compensation and provision of other assistance													TANESCO, Relocation Committee and NGOs
Assistance to vulnerable PAPs													TANESCO
Conduct baseline checks, claims, disputes, and grievances of all types													TANESCO and the Grievance Committee
Notification to secure the transmission line site (RoW)													TANESCO
Monitoring of ARAP issues during the start of construction and operational phases													TANESCO, Independent Monitoring Consultant
Review of ARAP activities and evaluation/update of unexpected objects as needed													TANESCO

* The ARAP will be implemented promptly after the Cabinet decision on the Project by the Japanese government, and the amount of compensation will be agreed upon with the residents, and payment will be completed prior to the start of construction.

Source: JICA preparatory survey team (2021 ARAP)

1-3-2-8 Costs and financial resources

The estimated costs of resettlement and land acquisition and other costs are estimated in the draft ARAP report as follows. The actual costs will be finalized after the draft detailed design is finalized, followed by another round of identification of affected PAPs and assessment of affected assets. All budgets for the implementation of the ARAP will be borne by TANESCO, the implementing agency. Funds will be raised by TANESCO and will be disbursed to the PAPs by bank transfer or cash as directed by the government during the implementation period of the ARAP.

Table 1-3-2-8.1 Estimated cost of ARAP implementation

Item	Unit/Quantity	Amount of compensation (Tshs)
Compensation & Benefits		
➢ House Compensation	7 houses	385,000,000
➢ Land Compensation	6,600m² x 20,000 (m²/Tshs)	132,000,000
➢ Lodging allowance		118,800,000
➢ Relocation allowance		1,650,000
➢ Nuisance Allowance		320,000
➢ Tomb Relocation Allowance	135 units (estimated)	40,000,000
➢ Tomb relocation allowance (payable to Ubungo District Council)		67,500,000
➢ Allowance for the socially vulnerable		40,000,000
Total (A)		797,270,000
Public facilties		
➢ Fence and wall construction costs	Tanzania Ports Office	Cost to be determined in consultation with the Land Evaluation Committee
➢ Site Acquisition	and Pension Fund Office	The cost will be determined in consultation with the Land Evaluation Committee.
➢ Toilets at Kilungule Primary School	8,000 m² x 20,000 (m²/Tshs)	Ubungo Ward Office expenditure
ARAP Implementation Costs		
➢ Compensation and administration of ARAP implementers, including grievance committees		5,000,000
➢ Internal monitoring and evaluation		5,000,000
	Total (C)	10,000,000
(A) + (C)		807,270,000
	Reserve funds (5%)	40,363,500
	Total	**847,633,000**

1-3-2-9 Monitoring system and monitoring form by implementing agency

The implementation of the resettlement plan will be monitored throughout the entire process to ensure that the compensation plan is smoothly implemented and that the interests of the affected persons (PAPs) are fully taken into account. Monitoring can be divided into two categories: internal monitoring and external monitoring. Internal monitoring will be carried out by TANESCO to ensure that there is overall equity and transparency while the compensation process is being implemented in accordance with the simplified resettlement plan based on legal rights. The internal monitoring consists of a database created from the ARAP for records on compensation of assets and daily observations by the implementing staff. The team by TANESCO will document the progress of land allocation and resettlement and report on activities from the start of the operation. External monitoring will be carried out through a contracted independent qualified consultant who will visit the project area on a regular (quarterly) basis to check on the receipt of fair compensation and proper grievance redressal. The results of the internal monitoring will be reviewed to ensure overall compliance of the ARAP and a report will be prepared and submitted to TANESCO and the ARAP Committee. Key monitoring items are listed below.

Table 1-3-2-9.1 Monitoring Item

Object	Indicator	Volume
Building/Structure	Quantity of other structures to be destroyed/relocated	• Quantity, type and dimensions of other structures to be demolished/relocated;
Land	Land acquisition	• Acquisition of land from cultivated land; • Development • Acquisition of land from private land; • Approval for use of public lands
Compensation, reconstruction, restoration	Number of affected persons compensated	• Number of affected individuals • Number of owners by type of loss • Compensation amount by type and owner
Loss and Damage	Number of complaints from affected parties	• Number of households damaged or lost due to construction (digging of waterways, noise levels, blasting, increased traffic, etc.);

Source: ARAP 2021

1-3-2-10 Public consultation

The public participation process for the proposed Project was planned to meet the requirements set forth in the JICA Guidelines, the Environmental Management Act (EMA, 2004), the EIA and Audit Regulation 17 (URT, 2005) and other relevant legislation. Most of the consultations were also conducted in conjunction with the assembly of baseline information for the Initial Environmental Impact Assessment (IEE). This process ensured that all stakeholders had the opportunity to raise concerns and views as part of an open and transparent process, thereby ensuring a comprehensive environmental and social study. Effective resettlement planning requires regular consultation with the various stakeholders of the project. Stakeholders include individuals or groups who are or may be affected by the project and who may play a significant role in shaping or influencing the project identified early in the process. These include:

i. Local people and businesses affected by the project (i.e., PAPs);
ii. Local government officials;
iii. Local municipal government leaders (Mtaa);
iv. Local community organizations.

The meeting was convened through publicity by the regional municipality (Mtaa Executive Officer) to those involved. The composition of the participants in each regional municipality (Mtaa) and other meetings is as follows (Table 1-3-2.9).

Table 1-3-2-10.1 Composition of Resident Consultation Participants

Mtaa location / Institution name	Men	Women	Total
Mavurunza	120	30	150
Kilungule A and Kilungule B	32	19	51
Baruti	16	14	20
Kibo	36	33	69
Kisiwani	43	15	58
Kibangu	25	16	41
NSSF	03	0	3
TANESCO	01	0	1
Total	276	127	403

Source: JICA preparatory survey team (2021 ARAP)

A series of presentations were held at relevant government agencies and in the project area to explain the project to residents. While the project was generally accepted by residents, some residents expressed dissatisfaction with the project due to confusion with other projects. In order to involve stakeholders in the preparation of the ARAP, several methods of public consultation were employed, including individual interviews, focus group discussions, and public consultation meetings. A summary of the public consultations is provided below.

Table 1-3-2-10.2 Key Comments and Responses from the Community Consultation

Meeting purpose	Location	Date	Views and Concerns (Stakeholders)	Response
Introduction and discussion of the project with the Ubungo District Office in charge of environmental and urban planners	Ubungo Municipal Council	31. 12.2019	・ Acknowledgement of government Measures to Enhance Electricity in Dar es Salaam	
			・ Suggestion from the Ubungo District authorities that the district's environmental and land officers and urban planners need to be involved in the impact assessment.	・ It was agreed that the district authorities would be involved in the impact assessment.
Ward, Mtaa leadership and local community:. Meeting to explain activities to confirm awareness of the project	Mavurunza - in Kimara ward	10.01.2020	・ Stakeholders are concerned about the expansion of the transmission line site for the installation of a new transmission line. They complained that they saw TANESCO staff marking over the existing site, indicating a need or land acquisition. However, the consultant explained that TANESCO has indicated that the project is essentially within the existing site and does not require new land. ・ Requests from stakeholders for information on when the project will begin. ・ Request for consideration of using underground cables to minimize land acquisition. ・ TANESCO requested that access roads to the transmission lines be maintained and managed so that they can be easily accessed for maintenance of the transmission lines and subsequent accidents.	・ Consultations with TANESCO officials in cooperation with the head of Mtaa and the community, as well as a site visit, confirmed that the structures are illegally located within TANESCO's transmission line site. Therefore, the residents have already removed the structures from the existing transmission line site of the transmission line.
Ward, Mtaa leadership and local community:. Meeting to explain activities to confirm awareness of the project	Kimara Baruti in Kimara ward	11.01.2020	・ If upgrading a transmission line from 132 kVA to 220 kVA will increase the generation of electromagnetic fields and increase the impact on communities living adjacent/near the transmission line, what measures will TANESCO take to reduce this impact? ・ TANESCO indicated that the site was extended by 15 meters on the community land and property side without consultation with the owners and before any assessment and compensation was made. Residents were fully informed about the procedures for acquiring land for the site in accordance with the Land Code. ・ TANESCO has this request to explain the study (e.g., to extend the site) to the residents through the Kimarabati Ward Office before proceeding with the project development plan. ・ Most of the land in the Kimarabarti District and surrounding areas has not been surveyed	・ The existing transmission line site was acquired with all adverse effects from electromagnetic fields considered. Therefore, no impacts from the transmission line are anticipated. ・ The marker posts were installed by land department officials based on the official boundaries of TANESCO.

			and the District is currently engaged in squatter upgrading/formalization activities. Urban planning seems to exclude areas marked by TANESCO, even if they do not belong to TANESCO. ・ As a local community, a request that the marker posts installed by TANESCO be removed and that the land be included in the upgrading/formalization process and that the community obtain a deed of title. ・ The local community also expressed their concerns to Mayor Ubungo, but frustration that they have not received any response. They request an urgent and clear response on this issue.	・ The markers were not installed by TANESCO, but by Land Department officials who knew the boundaries of TANESCO. Therefore, there is no way for TANESCO to remove the marker by the responsible authorities.
Meeting to explain activities to confirm awareness of the project	Kilungule A in Kimara ward	11.01.2020	・ A request that TANESCO, in cooperation with the Ministry of Lands, Human Settlements and Urban Development and the Ubungo Municipal Council (Urban Planning Department), review the existing boundaries of the transmission line. ・ TANESCO's request that boundaries be determined using GPS or other more reliable equipment rather than a tape measure.	
Ward, Mtaa leadership and local community: Meeting to explain activities to confirm awareness of the project	Kilungule B in Kimara ward	11.01.2020		
Ward, Mtaa leadership and local community: Meeting to explain activities to confirm awareness of the project	Kibangu in Makuburi ward	11.01.2020	・ Residents agree to the project, but request that consideration be given to employment opportunities and protection of the environment and health during construction.	EIA report requires contractors to hire people around the project and observe occupational health and safety (OHS) as indicated in the mitigation measures
Ward, Mtaa leadership and local community: Meeting to explain activities to confirm awareness of the project	Kibo in Ubungo ward)	29.01.2020	・ Stakeholders pointed out that the properties in the area have been assessed since 2013, but no compensation has been paid so far. The affected households (PAPs) request for the presentation of a compensation timeframe to them to enable them to find a new local settlement (alternative site).	TANESCO management is aware of the assessment made in 2013 but has not received funds from the government to pay compensation.
			・ He complained that he has been living in a difficult environment since the assessment was done, as changes made after the assessment are not covered by compensation and he is not allowed to make any improvements to his house. ・ Stakeholders do not want a new study by the consultant because the property has been appraised; request for payment per the 2013 appraisal.	
Ward, Mtaa leadership and local	Kisiwani in Ubungo ward	29.01.2020	・ Stakeholders confirmed that TANESCO's transmission line site is used for a variety of activities.	The project is expected to begin in early January. TANESCO will ensure

community: Meeting to explain activities to confirm awareness of the project			・They requested information on when the project would begin so that they could make the site available. ・Request that they be informed in advance about the start of the project so that they can prepare for the relocation.	that the community is notified in advance of the project start date.
Principal, Kilungule Primary School (Kilungule Primary School)	Kilungule Primary School		School management and the Ubungo district office have confirmed that toilet facilities for both teachers and students are within the power line site. The number of affected toilet facilities for students is 12 rooms and 2 toilets for teachers. The school does not have a large plot of land to build another toilet. Expect to build alternative toilets for teachers and students instead using the remaining land planned for other activities. The school has 1,818 students, of which 978 are boys and 840 are girls. The school has 39 teachers, of whom 4 are male and 35 are female. The issue of toilet relocation has already been made known to the Ubungo district office and they are in the process of relocating. Also, a request to build a fence for the safety of the students during the construction of the proposed project.	
National Social Security Fund : NSSF	NSSF Headquarters	06.04.2020	The NSSF is the legal owner of the Ubungo Kisiwani land and has organized a meeting with TANESCO officials to discuss the property rights issue. Presentation of documents to a consultant (ARP) requires approval from top management. Documents should therefore be requested in writing. Land ownership for Ubungoki crocodiles should be discussed with the real estate department. Land ownership has contractual implications for the tenants who lease the land for their business.	
TANESCO Environment Department	Confirmation by phone		TANESCO has already been in contact with NSSF officials regarding the expansion of walls and other storage facilities within TANESCO's power line site. NSSF claims it has title to the land it owns at Ubungo Kisiwani and has not encroached on TANESCO's transmission line site.	The matter has been submitted to Dar es Salaam and the Cost Land Commission for settlement with the agency claiming to own the TANESCO transmission line right-of-way (RoW) deed.

Source: JICA preparatory survey team (2021 ARAP)

1-3-3 Other

1-3-3-1 Draft Monitoring Form

A tentative draft monitoring form based on the draft EIA report and the draft ARAP is presented below. Together with the monitoring plan described above, it needs to be finalized through the formal environmental impact assessment procedures and approvals currently in place.

Environmental and Social Considerations Monitoring Form (Draft)

(1) <u>Environmental Consideration (Based on the Environmental Monitoring Plan) Environmental considerations (based on environmental monitoring plan)</u>

Monitoring Item	Monitoring Results during Report Period
Site Preparation and Construction Phase	
General (Periodical Visual inspection of all active work areas general compliance with mitigation measures presented in the ESMP)	
Water Resource (Standard analytical methods/Visual inspection of all active work areas in Before construction activity/ Upon request)	
Ambient Air (Visual inspection /Reports of air quality upon request)	
Noise (Noise level measurement upon request)	
Waste (Periodical visual inspection of all waste collection sites/ Field inspection and reports)	
Employment opportunities (Periodical reports and surveys)	
Land and Residential Structures (Records of Incidents, accidents and community complaints)	
Community Health and safety (Records of Incidents, accidents and community complaints)	
Accidents, risks and hazards (Field inspection, measurements and reports at occurrence)	
Operation Phase	
General (Periodical Visual inspection of all active work areas general compliance with mitigation measures presented in the ESMP)	
Waste (Periodical Visual inspection of all waste collection sites and confirmation of proper disposal)	
Community Health and safety (Records of Incidents, accidents and community complaints)	
Accidents, risks and hazards (Field inspection, measurements and reports at occurrence)	

(2) Monioring form for the Abbreviated Resettment Action Plan (ARAP)

a) Detail of location: ______________________________

b) Type of work: ______________________________

c) Monitoring Period From Date Month Year

To Date Month Year

d) Frequency (Before Clearance)

(2)-1 Form: Removal and Relocation of Existing Utilities (Building/Structures/Land)

No	Date of advanced notice	Date of Compensa-tion	Date of commence-ment of relocation	Type of utility	Geographic Location (before)	Geographic Location (after)	Picture of original state	Picture of completion state	Remark

(2)-2 Monitoring of the Grievance

No.	Issues (with Date)	Raised by	Applied Measures	Responsible Party for Taking Measures

Sample Monitoring Form: Monitoring of Analysis (When required)

In the Environmental Monitoring Plan some environmental parameters shall be monitored on requested. In the case, the following form can be refered for the monitoring with the necessary modification.

(1) Water Resource (Before construction activity/ Upon request)

a) Type of work: ____________________

b) Phase □ Construction / □ Operation

c) Monitoring Times : □

d) Monitoring Period From Date Month Year

To Date Month Year

e) Weather ____________

Parameter	Unit	Location					Applicable Standard	
		1	2	3	4	5		(Unit)
Temp	℃							
pH	-							
EC	μS/m							
TDS	mg/L							
Turbidity	NTU							
Total hardness	mg/L							
Cl	mg/L							
SO4+	mg/L							
NO3-	mg/L							
BOD	mg/L							
COD	mg/L							
Total Coli.	CFU/100mL							
As	mg/L							
Pb	mg/L							

Source: prepared by JICA preparatory survey team based on JICA guideline

(2) Ambient Air (upon request)

a) Type of work: ____________________

b) Phase □ Construction / □ Operation

c) Monitoring Times: □ 1st / □ 2nd / □ 3rd /□ 4th

d) Monitoring Period: From Date Month Year

To Date Month Year

Air Quality: Frequency (upon request) parameters shall be modified depending on the requirement

Parameter	Sampling Point	Date and Duration	Method	Result (Minimum) (μg/m³)	Result (Average) (μg/m³)	Result (Maximum) (μg/m³)	Remarks
Particulate Matter (PM_{10})							
Particulate Matter ($PM_{2.5}$)							
Micro Climate (temperature, humidity, wind speed and direction, pressure).							

(3) Noise(Upon Request)

a) Type of work: ____________________

b) Phase □ Construction / □ Operation

c) Monitoring Times : □ 1st / □ 2nd / □ 3rd /□ 4th

d) Monitoring Period From Date Month Year

To Date Month Year

e) Noise : Frequency (Upon Request)

Is there any implementation of noise and vibration level survey in this monitoring period? □ Yes □ No

If "Yes", please describe and fill in below the table.

No.	Location	Items	Unit/Frequency	Type of area	Results		Remarks
		Parameter			#1	#2	
1		Noise (L_{eq})					

(4) Waste (Periodically)

a) Detail of location: ____________________

b) Type of work: ____________________

c) Monitoring Period From Date Month Year

To Date Month Year

S.N.	Type of waste	Volume (Unit)	Detail	Treatment Measure	Remark
1	Construction soil	(ton)			
2	Concrete	(ton)			
3	……				
4					
5					

Source: prepared by JICA preparatory survey team based on JICA guideline

(5) Employment opportunities

a) Detail of location: ____________________

b) Type of work: ____________________

c) Monitoring Period From Date Month Year

To Date Month Year

(6) Accidents(At Occurrence)

Form Record of Accident: Frequency (As needed)

No.	Date	Time	Place	Cause	Number of Affected Persons	Remark
1.						
2.						
3.						
4.						
5.						

End of Document

1-3-3-2 Environmental and Social Considerations Checklist

An environmental review was conducted using the JICA Environmental and Social Considerations Checklist as follows: although the EIA and ARAP have not been formally approved by the reviewing agency, NEMC, at this stage, we are in the process of completing the revisions to the comments received from the agency.

Classification.	Environmental Items	Main items to check	Yes: Y No: N	Specific environmental and social considerations (Reasons for Yes/No, rationale, mitigation measures, etc.)
1. Licensing and Description	(1) EIA and environmental permits	(a) Has an environmental assessment report (EIA report) been prepared? (b) Has the EIA report been approved by the government of the country concerned? (c) Is the approval of the EIA report, etc. accompanied by any conditions? If so, are they satisfied? (d) In addition to the above, have environmental permits and approvals been obtained from the local competent authorities, if necessary?	(a) Y (b) N (c) N (d) N	(a), (b), (c), and (d) The project's project registration was approved by the National Environmental Management Council (NEMC) authorities in April 2020 through the submission of screening reports from the implementing agencies, and a formal The draft EIA report has been prepared under the formal procedure and is being processed by TANESCO.
	(2)Explanation to local stakeholders	(a) Have the project contents and impacts been adequately explained to and understood by local stakeholders, including information disclosure? (b) Have comments from residents and other stakeholders been reflected in the project content?	(a) Y (b) Y	(a) Public consultations were conducted in preparation for the preparation of the Screenig Report and ARAP for the EIA. The views of stakeholders in the consultations were collected to be reflected in the project activities. (b) The public consultations were conducted in several steps Comments from the consultations during the preparation of the Screening Report have been reflected in the plan.
	(3)Consideration of alternatives	(a) Have multiple alternatives to the project plan been considered (including environmental and social items during the review)?	(a) Y	(a) Alternatives were considered to minimize social and environmental impacts. The location of the substation was reconsidered and a flat area was selected to avoid environmental impacts such as involuntary resettlement and soil erosion in the subject area.
2. Pollution	(1) Water quality	(a) Will soil runoff from topsoil exposures such as embankments, cuts, etc. degrade the water quality of the surrounding downstream waters? If so, what measures will be taken?	(a) N	(a) The site for the substation construction is topographically flat and serious soil erosion is not expected. Although there are no particularly large river flows within the subject area, turbidity control measures will be implemented during construction in light of the surrounding impacts.
3. Natural environment	(1)Protected areas	(a) Is the site located within a protected area as defined by the laws of the country concerned, international treaties, etc.? Will the project affect a protected area?	(a) N	(a) No protected areas or other areas designated by law in the vicinity of the construction site have been identified.
	(2)Ecosystem	(a) Does the site contain primary forests, natural tropical forests, or ecologically important habitats (coral reefs, mangrove swamps, tidal flats, etc.)? (b) Does the site contain habitats for valuable species that require protection under the laws of the country concerned, international conventions, etc.? (c) If there are concerns about significant impacts on ecosystems, will measures be taken to reduce the impacts on ecosystems?	(a) N (b) N (c) N (d) Y (e) N (f) N	(a) Transmission line facilities would be constructed within the currently operating transmission line right-of-way to replace existing transmission facilities. (b) New transmission lines and substations would be constructed within currently operating transmission lines. (c) No significant ecological impacts are expected.

Classification.	Environmental Items	Main items to check	Yes: Y No: N	Specific environmental and social considerations (Reasons for Yes/No, rationale, mitigation measures, etc.)
		(d) Will measures be taken to block wildlife and livestock migration routes, fragment habitats, etc.? (e) Will deforestation, poaching, desertification, and drying of wetlands occur as a result of the project? (d) Is there a risk of introduction of exotic species (species not previously found in the area), pests and diseases, etc., and disturbance of the ecosystem? What measures will be taken to prevent such disturbance? (f) If the project is to be built in an undeveloped area, will the natural environment be significantly damaged by new development in the area?		(d) No specific impacts are expected. (e) No specific impacts are expected. (f) New transmission lines and substations would be constructed within the currently operated transmission line right-of-way. No significant natural environmental impacts are expected.
	(3)Topography and geology	(a) Are there any poor geological conditions on the transmission and distribution line route where landslides or landslides are likely to occur? If so, are appropriate measures taken in terms of construction methods, etc.? (b) Will landslides or landslides occur due to civil engineering works such as embankments, cuttings, etc.? Are appropriate measures taken to prevent landslides and landslides? (c) Will soil runoff occur from embankment areas, cut and fill areas, soil dumping areas, and soil sampling areas? Will appropriate measures be taken to prevent soil runoff?	(a) N (b) N (c) N	(a), (b) The project site is flat, and slope failures and landslides are not expected. (c) No large-scale earthwork is envisaged, but appropriate measures should be taken to minimize soil erosion, especially during the rainy season.
4. Social environment	(1)Resettlement	(a) Will involuntary resettlement occur as a result of project implementation? If so, will efforts be made to minimize the impact of resettlement? (b) Will the resettled residents be adequately informed of compensation and livelihood restoration measures prior to resettlement? (c) Will a resettlement survey be conducted and a resettlement plan be developed that includes compensation at reacquisition price and restoration of livelihoods after resettlement? (d) Will compensation payments be made prior to resettlement? (e) Has a compensation policy been formulated in writing? (f) Does the plan give appropriate consideration to the socially vulnerable groups among the relocated residents, especially women, children, the elderly, the poor, and ethnic minorities and indigenous peoples? (g) Will the relocated residents be agreed upon prior to relocation? (h) Will a system be in place to properly implement the resettlement? (h) Will there be sufficient capacity and budgetary measures to implement the resettlement? (i) Is there a plan for monitoring the impact of resettlement? (j) Is a grievance mechanism in place?	(a) Y (b) Y (c) Y (d) Y (e) Y (f) Y (g) Y (h) Y (i) Y (j) Y	(a) The location of the substation was reconsidered and a flat area was chosen to avoid environmental impacts such as involuntary resettlement and local soil erosion. (b) A public consultation was held during the drafting of the ARAP. Also, the PAP in the region has already described government compensation in other government actions. (c) The proposed ARAP describes replacement costs and other necessary assistance. (d) Advance payments are explained in the draft ARAP. (e) The compensation policy is prepared and documented in accordance with the national policy and JICA's Guidelines for Environmental and Social Considerations (2010). (f) During resettlement, special assistance to affected residents, including socially vulnerable groups, is considered, such as assistance with alternative settlements. (g) PAP's requests have been confirmed through consultations with residents. Individual agreements will be confirmed at the detailed evaluation stage after ARAP approval. (h) The organizational framework consisting of the implementing agency and relevant local governments is explained. The budget for resettlement will be borne by TANESCO, the executing agency. (i) A monitoring plan has been prepared and a monitoring form is attached to the draft ARAP.

Classification.	Environmental Items	Main items to check	Yes: Y No: N	Specific environmental and social considerations (Reasons for Yes/No, rationale, mitigation measures, etc.)
	(2)Livelihood	(a) Will there be adverse impacts of the project on the livelihoods of residents? If necessary, will consideration be given to mitigate impacts? (b) Is there a risk of disease outbreak (including HIV and other infectious diseases) due to population influx from other areas? Will appropriate public health considerations be taken into account, if necessary? (c) Will there be radio interference due to towers, etc.? If significant radio interference is anticipated, will appropriate measures be taken? (d) Will the construction of the transmission line be compensated for under the line in accordance with national laws?	(a) Y (b) N (c) N (d) N	(a) The draft ARAP was developed based on research to avoid serious impacts on the PAP. (b) HIV prevalence is relatively high at the project site, as elsewhere in Tanzania; Sufficient awareness-raising activities are required for workers and related parties. (c) Since the new transmission lines and substations will replace the old facilities within the existing transmission line site, no significant changes in radio interference are expected. In Tanzania, land for transmission lines is in principle not permitted for other land uses. (d) New facilities will be constructed to replace older facilities on the currently operating transmission line site. Appropriate compensation will be provided in case of land acquisition.
	(3) Cultural heritage	(a) Is there a risk that the project may damage archaeological, historical, cultural or religious heritage, historic sites, etc.? (b) Is the project likely to damage archaeological, historical, cultural, or religious heritage or historic sites, and will measures prescribed by the national law of the country concerned be taken into account?	(a) N	(a) No sensitive archaeological, historical, cultural, or religious facilities have been identified at the project site; There are existing graves in two places under the transmission line, and when designing the transmission tower, it is necessary to consider minimizing the impact and, if relocation is required, appropriate compensation.
	(4) Landscape	(a) If there are landscapes that require special consideration, will they be adversely affected? If so, will necessary measures be taken?	(a) N	(a) The new facility will replace the old facility on the land currently in operation for the transmission line, and no significant impact on the landscape is expected.
	(5) Ethnic minorities, indigenous peoples	(a) Are consideration given to reducing the impact on the culture and lifestyle of the country's minorities and indigenous peoples? (b) Are the land and resource rights of minorities and indigenous peoples respected?	(a) N (b) N	(a), (b) No ethnic minorities or indigenous peoples have been identified in or around the project site.
	(6) Labor environment	(a) Are the country's labor environment laws to be complied with in the project being observed? (b) Are safety measures taken to prevent industrial accidents, such as installation of safety equipment, control of hazardous substances, etc., for project-related personnel? (c) Are soft measures for project-related personnel planned and implemented, such as the formulation of health and safety plans and the implementation of safety education (including traffic safety and public health) for workers, etc.? (d) Are appropriate measures taken to ensure that security personnel involved in the project do not infringe on the safety of project-related personnel and local residents?	(a) Y (b) Y (c) Y (d) Y	(a), (b), (c), (d) In accordance with the Industrial Safety and Health Law of 2003, Electricity Ordinance Cap. , TANESCO has formulated the "Safety and Health Policy" revised in 2008 and the "Contractor Occupational Health and Safety Guidelines" revised in 2011. Projects will be implemented in accordance with these policies and guidelines.

Classification.	Environmental Items	Main items to check	Yes: Y No: N	Specific environmental and social considerations (Reasons for Yes/No, rationale, mitigation measures, etc.)
5. Other	(1) Impacts during construction	(a) Will mitigation measures be provided for pollution during construction (noise, vibration, turbidity, dust, exhaust gases, waste, etc.)? (b) Will the construction adversely affect the natural environment (ecosystem)? Will mitigation measures be provided? (c) Will the project adversely affect the social environment? (c) Will the project adversely affect the social environment, and will mitigation measures be provided?	(a) Y (b) Y (c) Y	(a), (b), (c) mitigation measures for all possible impacts should be taken in accordance with the approved EIA report and relevant environmental laws and policies.
	(2) Monitoring	(a) Is the operator's monitoring planned and implemented for the above environmental items with possible impacts? (b) Are the items, methods, frequency, etc. of the plan judged to be appropriate? (c) Is the operator's monitoring system (organization, personnel, equipment, budget, etc. and its continuity) established? (d) Are the methods and frequency of reporting from the operator to the competent authorities specified?	(a) Y (b) Y (c) Y (d) Y	(a), (b), (c), (d) The monitoring framework is presented in the EIA report. The requirements for monitoring are laid down in the Environmental Management (Environmental Impact Assessment and Audit) (Amendment) Regulations, 2018.
6. Notes	Refer to other environmental checklists	(a) If necessary, the applicable checkpoints in the checklist for roads should also be added and evaluated.	(a) N	(a) No specific impacts have been identified that require reference to other sector checklists.
	Precautions for Use of Environmental Checklists	(a) Where appropriate, also identify any transboundary or global environmental impacts (e.g., possible elements related to transboundary disposal of waste, acid rain, ozone depletion, and global warming issues).	(a) N	(a) No specific impacts have been identified that are directly related to global environmental issues.

1-3-3-3 Implementation process for environmental and social considerations

The Initial Environmental Examination (IEE), Environmental Impact Assessment (EIA) and Abbreviated Resettlement Action Plan (ARAP) for this study were carried out according to the process shown in the table below. The formal documents of NEMC at each stage of the implementation process are shown in Appendix 9 and Appendix 11.

Table 1-3-3-3.1 Implementation process for environmental and social considerations

	Activities	2019			2020												2021												2022												Remarks
		10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
IEE	Project Brief submitted to NEMC						O																																		
	Screening decision issued by NEMC							O																																	See Appendix-9
	Social & economic baseline survey for IEE report completed									O																															
EIA	Scoping Report & ToR submitted to NEMC									O																															
	NEMC approval of Terms of Reference for full-ESIA Study											O																													
	Submission of Draft ESIA Report to NEMC													O																											
	NEMC comments on ESIA Report																						O																		
	Submission of ESIA Final Report to NEMC																										O														See Appendix-10
	Environmental Clearance Certificate issuance by NEMC																															O									See Appendix-11
ARAP	Submission of final A-RAP to NEMC																O																								
	Approval of RAP by NEMC																															O									

R : Report
D: Comment/Decision/Approval by NEMC

Chapter 2 Contents of the Project

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

This project is meant to help to enhance substation and transmission facilities in Dar es Salaam to improve the serious damage done to economic activity in the area by insufficient supply capacity from power transmission/distribution facilities and aging facilities. The outline of the Project is shown in Table 2-1-1.1.

Table 2-1-1.1 Outline of the Project

	Major Components		Quantity/Capacity
Procurement/Installation	**1. 220/132 kV Mabibo substation**		
	(1) Transformer		
	1) 220/132/33 kV transformer	(Outdoor)	200 MVA×2 units
	2) 33/0.4 kV earthing transformer	(Outdoor)	400 kVA×2 units
	(2) 220 kV Switchgear (GIS, double busbar system)		
	1) Transmission line bay	(Outdoor)	1 set
	2) Transformer bay	(Outdoor)	2 sets
	3) Busbar (Voltage transformers for busbar)	(Outdoor)	1 set
	4) Accessories for 220 kV outdoor switchyard	(Outdoor)	1 lot
	(3) 132 kV Switchgear (GIS, double busbar system)		
	1) Transmission line bay	(Outdoor)	4 sets
	2) Transformer bay	(Outdoor)	2 sets
	3) Busbar (Voltage transformers for busbar) (Outdoor)		1 set
	4) Accessories for 132 kV outdoor switchyard (Outdoor)		1 lot
	(4) 33 kV Switchgear (GIS, single busbar system)		
	1) 33 kV Feeder panels (1)	(Indoor)	2 panels
	2) 33/0.4 kV Transformer panels	(Indoor)	1 panel
	3) 33 kV Feeder panels (2)	(Indoor)	1 panel
	4) Cable connection panel	(Indoor)	1 panel
	(5) Control and protection	(Indoor)	1 lot
	(6) SCADA system	(Indoor)	1 lot
	(7) Communication system	(Indoor)	1 lot
	(8) Substation power supply system	(Indoor)	1 lot
	2. 220 kV Transmission Lines between Kinyerezi power station - Mabibo substation		Approx. 9.0 km
	(1) Kinyerezi power station (T-off point) – Ubungo substation 220 kV Overhead lines (Bluejay 603 mm^2, double conductor and single conductor), triple circuit tower		Approx. 7.0 km
	(2) Ubungo substation – Mabibo substation 220 kV Overhead lines (Bluejay 603 mm^2, double conductor), double circuit tower		Approx. 2.0 km
	3. 132 kV Transmission Lines between Mabibo substation – Existing Ubungo – Ilala line 132 kV Overhead lines (TACSR 240 mm^2, single conductor), double circuit tower		Approx. 0.5 km
	4. Reinforcement of switchgears at Kinyerezi power station Reinforcement of switchgears		1 lot
	5. Expansion of switchgear bay at Ubungo Substation Expansion of switchgears		1 lot

	Major Components	Quantity/Capacity
Procurement	**6. Maintenance tools for the Equipment of the Project** **7. Spare parts for the Equipment of the Project**	1 lot 1 lot
Construction Work	**8. Foundation for the Equipment of the Project (Switchgears, Transformers, Towers, etc.)** **9. Control building of Mabibo substation**	1 lot 1 building

Source: JICA preparatory survey team

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Basic Policy

This project primarily targets higher level power distribution facilities in the power system in Tanzania. Still, in view of the development plan of the rapidly growing Dar es Salaam city, it is necessary to formulate system plans from a mid- to long-term perspective and aim for the operation and stable supply of power facilities over a wide range.

Along with being an urgent grant aid project, in light of the above point, this project must avoid equipment being replaced before the facilities reach their service life once in service. Thus, the target years for project evaluation and facility planning are to be set carefully.

Also, given that this is a development project in a region with an active socio-economy, environmental and social concerns are to be properly accounted for in the planning phase.

2-2-1-2 Policy on Natural Conditions

(1) Against temperature and humidity conditions

The maximum and minimum temperatures in the project area in 2018 were 33.2°C and 19.5°C respectively, with high temperatures throughout the year. Dar es Salaam also has high humidity throughout the year due to its coastal location, with monthly relative humidity ranging from 76-91%. Almost the same applies to the five-year period from 2014 to 2018.

In Dar es Salaam City, the proposed project site, the heavy rainy season is from March to May, while the light rainy season is around December.

The substation and transmission equipment shall be planned considering the above-mentioned temperature, humidity and altitude. It is a necessary requirement that the equipment operates normally and that there are no problems with operation and maintenance in the event of temporary temperature increases due to outdoor air temperature and direct sunlight, as well as high humidity.

(2) Against rainfall and lightning

The annual rainfall in the project area averages approximately 1,000 mm. In terms of months, rainfall is concentrated from March to May (heavy rainy season) and is also relatively heavy from December to January (light rainy season). The rainy season should be given careful consideration when planning the construction schedule, especially the process of the installation of equipment, outdoor works of the civil and building construction works. In addition, lightning can occur during the rainy season, and there is a risk of lightning strike accidents on towers during the installation work of transmission line, etc. Therefore, sufficient consideration should be given to the construction process involving work at height, and transmission lines and substation equipment should be provided with adequate protection against lightning entering from the transmission lines.

In Dar es Salaam, the proposed project site, the monthly rainfall during the dry season may be less than 10mm, but the monthly rainfall during the heavy rainy season is 200-400 mm, with squalls in some places and frequent flooding. It is necessary to consider appropriate drainage plans based on the sloping site conditions, and to take measures against rainwater such as flood prevention measures for the floor of the control building and the foundations of the substation equipment, and the installation of gutters. In addition, as the groundwater level on Mabibo substation site is as high as GL-0.3m~1.44m, the cable tunnel should be watertight to prevent groundwater inflow and equipped with drainage pit with water pump for rainwater drainage.

(3) Against earthquake

Although there are no records of earthquakes around the project site and seismic forces are not considered in the design guidelines in the area, a seismic horizontal load factor of 0.10 is used for the structural design as mentioned in last chapter.

2-2-1-3 Policy on Socioeconomic Conditions

Since transmission line work in this project will require power outages due to the switching of power lines, it is necessary to plan the process to minimize the impact on customers of the transmission and distribution facilities, and to take measures to shorten the time of outages. During the construction work, consideration should be given to avoid obstruction to residents and traffic in the vicinity as much as possible, as well as avoiding obstruction to existing structures and buried objects. In designing the power transmission line, consideration should also be given to maintain a safe separation distance from surrounding residences and stores along the road boundary line. Moreover, Tanzania side will provide sufficient explanation on the details of the project to TANROAD, landowners, and residents in the surrounding area in advance for the section of the route. Furthermore, when digging to construct the foundations for the eventual construction of the substation and transmission line (including when laying cables), care should be taken not to disturb existing infrastructure facilities such as telephone lines, water lines, and sewage lines. In the case of overhead line construction, it is necessary to ensure safe separation distances from existing infrastructure such as power distribution lines, telephone lines, and roads, and to design and construct lines in a manner that avoids interference with existing infrastructure facilities.

2-2-1-4 Policy on Construction / Procurement Conditions

(1) Basic policy

The project site is located in Dar es Salaam city, which is the centre of the Tanzanian economy, the construction market is good enough for general construction work. There are a number of large construction projects being carried out in the city, including various public, commercial and residential buildings, and there are many construction companies handling these construction projects. Transport vehicles, construction equipment, etc. are available locally, and it is also possible to employ of general workers for substation construction, civil and building work, and transmission line construction work to through local contractors. Therefore, local contractors will be utilized in the project.

Figure 2-2-1-4.1 Example of construction work

On the other hand, the detailed construction plan is required for re-arranging the existing power grid, and high technical level engineers are needed during the installation of equipment and for adjustment and testing after installation, etc. Therefore, it is difficult to use local contractors other than labourers and Japanese engineers need to be dispatched.

In Tanzania, aggregates, cement, rebar and other materials used in civil and construction works are available locally. Considering the development of local industry, locally available materials and equipment will be used as much as possible. However, the substation and transmission equipment to be procured in the project are not manufactured locally. Therefore those are planned to be procured from Japan or a third country, taking into account the existing equipment and the operation and maintenance management capacity of Tanzania side.

As steel is not produced loccally, steel construction is expensive and there are few buildings of steel structure in general usage. On the other hand, there are several ready-made concrete plants in Dar es salaam and reinforced concrete structure are widespread. So the proposed components in the project, control building, foundations of transformer and other equipment, wiring pits and the foundations of transmission tower is planned to be made of reinforced concrete.

(2) Location and conditions of the site for Mabibo substation

At the time of the request, an additional substation was planned adjacent to the existing Mbrahati substation. However, it was found that using the said site would require large costs of development due to the terrain of the site, and resettlement would occur due to the presence of housing in the existing ROW in the site. Therefore, another site was designated as the new substation site in existing RoW adjacent to NIT. The proposed site is a public land with dimensions of approximately 50m × 500m. The land is almost flat, although it has a slope of about 1/100 in the longitudinal direction.

Generally, the main roads in Dar es Salaam are paved, while there are many unpaved roads other than the main roads. The proposed site of Mabibo substation is located approximately 600 m ahead on a road that intersects the main road, and although the road is paved, it is poorly maintained and sinking in some places.

There is a water channel draining factory water in the north part of the project site. The substation layout need to be planned accordingly to avoid the channel.

Figure 2-2-1-4.2 The project site for new Mabibo substation

(3) Leveling plan of the site

The site for the new substation is almost flat, although it has a gentle slope of about 1.0 %, and no major development work will be required. To reduce the amount of development work, the natural terrain will be utilized.

(4) Procurement plan of concrete

As mentioned earlier, there are several ready-mixed concrete plants in Dar es Salaam and the access road to the new Mabibo substation site is paved, although there is sinking partially. So the construction work utilize the ready-mixed concrete. However, the sites of new transmission towers are planned within the existing transmission line route, which makes it difficult for large vehicles to access. It is necessary to consider the use of on-site mixing concrete and to develop its construction plan and schedule for the transmission tower foundations.

Concrete quality testing can be carried out by several testing institutes, including the University of Dar es Salaam and the Dar es Salaam Institute of Technology.

(5) Designing of Control building

The control building provides the rooms for substation equipment necessary for the operation and management of the substation, and its administrative function, such as office, meeting room and toilets, etc. It has a dimension of 35m x 20m and is a single-storey reinforced concrete building. No special finishing materials but locally procured materials will be used for both interior and exterior.

The water will supplied from municipal water piped into neighbouring water pipe. Since there is no sewer system around the area, the concrete septic tank will be constructed and waste water will be discharged into it. If necessary, sludge collection services should be called on.

Air-conditioning equipment will be installed in order to maintain a suitable temperature environment in the equipment rooms.

Regarding external works, the boundary wall or fence and gate shall be responsibility of Tanzania side. The roads within the substation premises will be paved with concrete and drainage channels will be planned considering maintenance and accessibility during the rainy season.

2-2-1-5 Policy on the Use of Local Contractor and Material

(1) Policy for utilizing local companies

Tanzanian construction contractors are required to register with the Contractor Registration Board (CRB), and registration is by construction type (i.e. civil, building, electrical, etc.) and is also divided into seven classes according to the size of construction work that can be carried out. According to 2013 statistical data, there were 99 Class 1 building contractors, which is able to carry out any size of construction, and 2,897 registered building contractors in all classes combined.

Currently, there are a number of construction sites in Dar es Salaam, many of which are medium- and high-rise buildings with large tower cranes. It is relatively easy to procure construction labor, vehicles and equipment, and it is possible to hire skilled and ordinary workers for the project works through local contractors. Therefore, local contractors will be utilized in the project.

However, the substation and transmission equipment to be procured in the project are not manufactured locally. Therefore those are planned to be procured from Japan or a third country, taking into account the existing equipment and the operation and maintenance management capacity of Tanzania side.

(2) Policy for utilizing local materials

Major construction materials such as rebar, cement and aggregates are manufactured and available locally in Tanzania, so procuring the construction materials from third-country is not necessary.

2-2-1-6 Policy on O&M Capacity of Implementing Agency

TANESCO does have a certain level of technical capacity in system operations and has steadily handled O&M for the national power transmission and distribution network.

2-2-1-7 Policy for Setting Grades for Facilities and Equipment and Setting Grades

In light of the conditions described above, materials and equipment to be procured for the project, as well as installation scope and technical standards will be determined based upon the following policies.

(1) Planned Scope for Facilities and Equipment

Project scope will include the facilities and equipment needed to help stabilize the socioeconomic activity of the Dar es Salaam area based on the estimated power demands in 2030 that is the target year of the equipment plan. In terms of the division between the Japan side project and Tanzania side work, the Japan side will plan on consulting with Tanzania side to decide which items Tanzania side can reasonably handle without exceeding Tanzania side abilities.

In order to keep the designs economical, equipment specifications will use standard products conforming to international standards when possible, selecting the minimum required equipment configurations and specifications.

(2) Plan for Setting Grades

Care will be taken not to deviate from the technical levels of TANESCO when designing the power distribution facilities built, procured and installed in the project, conforming to existing facility configurations, TANESCO technical standards and work manuals.

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

As this project will be performed based on the Japan grant aid scheme, installation must be completed within the time limits as given in the Exchange of Notes (E/N) and Grant Agreement (G/A). In order to complete the work within the specified construction period and achieve the results expected from substation construction, the implementation plan must effectively coordinate Japanese and Tanzania work schedules to streamline importing and other various procedures.

With simultaneous construction of the substation, 220 kV transmission line and 132 kV transmission lines, care must be taken to keep scheduling efficient. Work teams need to be formed appropriately; the construction methods used need to be well known to local contractors and engineers, and the implementation system must be structured so that work progresses safely and swiftly.

2-2-2 Basic Plan

2-2-2-1 Pre-condition of the Project

(1) Purpose of Power demand forecast for the Project

The main project components are construction of 220/132 kV Mabibo substation and the transmission line to the substation to improve substation and transmission network in Dar es Salaam area. The substation includes three 220/132 kV voltage class transformers with 200 MVA ×2 capacity, transmission lines supplied from Kinyerezi power station.

The purpose of the preparatory study will be to clarify project prerequisites by estimating power demand in the Dar es Salaam area. It will act as base data to verify project relevance and effectiveness in light of the power transmission/distribution facility plan, including flow analysis and evaluations on how well the project coordinates with other development projects.

(2) Target year for the Project

Relevance and effectiveness of the project as a grant aid project, including its urgency and benefit, will be confirmed through the preparatory study. This project primarily targets higher level power transmission/distribution facilities in the Dar es Salaam city. Still, in the absence of medium-to-long-term system plans, there are concerns that operation of lower level power facilities and even supply stability may also be impacted as the project targets Dar es Salaam area experiencing significant growth.

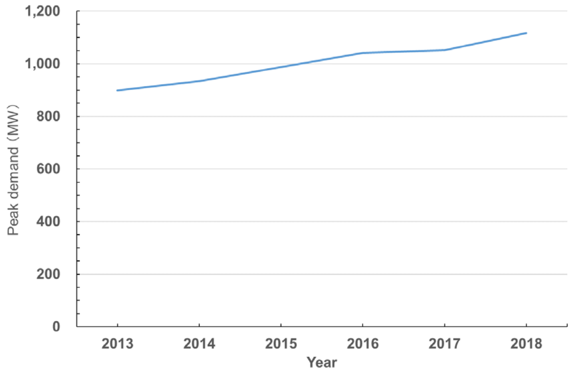
The target year for project evaluation will be three years after service starts. This project must avoid equipment being replaced before the facilities reach their service life once in service. Also, the target year for facility planning should be consistent with recent projects for enhancing upper level system power substation/transmission in metropolitan areas and cities, as well as other similar grant aid projects. Therefore, the target year for facility planning will be three years after service start.

Target year for project evaluation:	2030 (Three years from start of service)
Target year for facility plan:	2030 (Three years from start of service)

2-2-2-2 Power demand and supply situation and power demand forecast

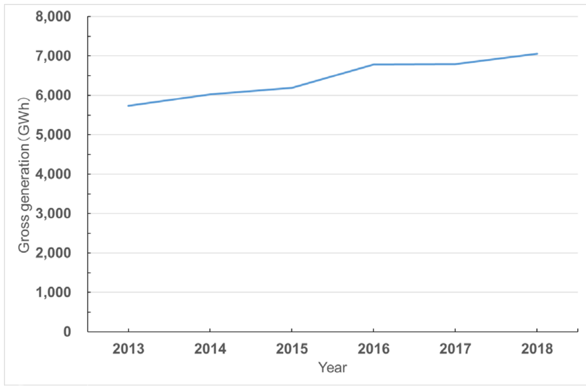
(1) Power demand and supply situation

Overall national peak demand (MW) and gross generation (GWh) in Tanzania from 2013 to 2018 is shown in Fig. 3-2-2.1 and Fig. 3-2-2-2.2, respectively. The growth rate for peak demand and gross generation is 4.4%/ year and 4.2%/year in average, from 2013 to 2018. In the same period, real GDP in Tanzania has recorded a stable growth of 6.7/year in average.



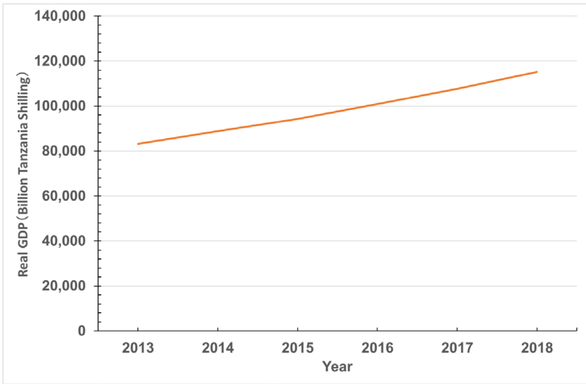
［Source］TANESCO

Figure 2-2-2-2.1 Peak demand in Tanzania



［Source］TANESCO

Figure 2-2-2-2.2 Gross generation in Tanzania



［Source］IMF(2022) "World Ecenomic Outlook Database"

Figure 2-2-2-2.3 Real GDP growth in Tanzania

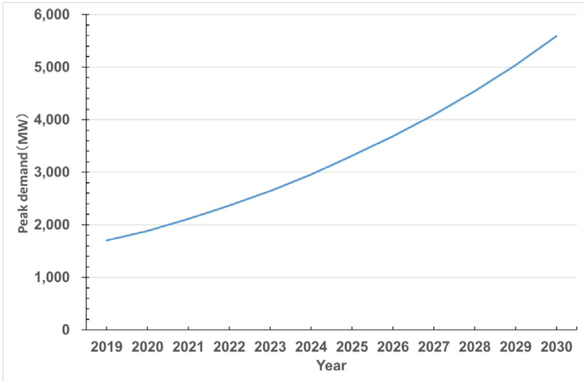
(2) National power demand forecast

Overall national power demand in Tanzania is forecasted by applying power demand forecast model of PSMP2016 as a basis and adjusting the model incorporating the resent trend of power demand described above. The power demand forecast model was developed using an Excel-bas econometric model "Simple-E". Input parameters to the model such as real GDP, population in the future are estimated to forecast the future power demand. Table 2-2-2-2.1 shows the growth rate of GDP in the future. Figure 2-2-2-2.4 shows the results of overall, nationwide power demand forecast (Peak demand, MW).

Table 2-2-2-2.1 GDP growth rate in the future

	2019～2025	2026～2030
Real GDP growth rate (%)	7%/ year	6%/ year

［Source］JICA preparatory team

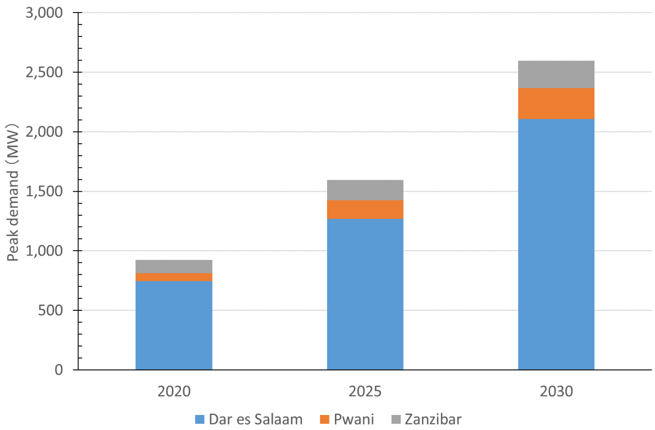


［Source］ JICA preparatory team

Figure 2-2-2-2.4 Overall nationwide power demand forecast（Peak demand）

(3) Power demand forecast for Dar es Salaam

Based on the overall nationwide power demand forecast of Tanzania, power demand for Dar es Salaam was forecasted by allocating the demand by regions based on regional GDP and population. Figure 2-2-2-2.5 shows the regional power demand forecast of Dar es Salaam (Peak demand, WM).



［Source］ JICA preparatory team

Figure 2-2-2-2.5 Regional power demand forecast in Dar es Salaam

(4) Transformer capacity and current reinforced plan at each substation

Table 2-2-2-2.2 shows the current transformer capacity and new expansion plans for substations within the scope of power system analysis.

Table 2-2-2-2.1 Rated capacity of transformers in substation on power system analysis

Substation	Voltage [kV]	Rated capacity of transformers [MVA(*unit)]		Remark
		Present (2020)	Reinforced (2030)	
Ubungo	220/132	300, 150 *2	300 *2	Plan
	132/33	90 *2	120 *2	
Kinyerezi	220/132	120, 50	120 *2	Plan
Tegeta	132/33	50 *2	65 *2	Reinforced to avoid overload

Makumbusho	132/33	45 *2	55 *2	Reinforced to avoid overload
New city center	132/33	50 *2	-	
Ilala	132/33	60 *4	-	
FZ II (Gongolamboto)	132/33	50	50 *2	Reinforced to avoid overload
FZ III（Kipawa）	132/33	117 *2	-	
Mbagala	132/33	50	65 *2	Reinforced to avoid overload
Mlandizi	132/33	50 *2, 20, 10	50 *2. 20 *2	Reinforced to avoid overload
Chalinze	132/33	55	-	
New Kigamboni	132/33	50 *2	-	
Kurasini	132/33	50	50 *2	Reinforced to avoid overload
Luguruni	220/33	90 *2	-	
Morogoro	220/132	90, 150 *2	-	
Mabibo	220/132	-	200 *4	
	132/33	-	100 *2	

(5) Assumed load distribution to each substation

Table 2-2-2-2.3 shows the estimated demand values for Dar es Salaam in 2030 as described above for the cases where no countermeasures are taken at the substations in the system analysis model and the cases where Mabibo substation is newly installed. The demand MVA value is assumed to have a power factor of 90%, the same as DSMP.

Table 2-2-2-2.2 Substation allocation of demand forecasted load

Substation	Year 2030 without the project			Year 2030 with the project		
	P[MW	Q[MVar]	MVA	P[MW]	Q[MVar]	MVA
Tegeta	204.4	99.0	227.1	204.4	99.0	227.1
Makumbusho	370.5	179.5	411.7	317.4	153.7	352.7
New city center	177.9	86.2	197.7	166.0	80.4	184.5
Ilala	93.4	45.2	103.8	93.4	45.2	103.8
FZ II（Gongolamboto）	252.1	122.1	280.1	252.1	122.1	280.1
FZ III（Kipawa）	97.0	47.0	107.8	97.0	47.0	107.8
Mbagala	432.0	209.2	480.0	432.0	209.2	480.0
Mlandizi	300.9	145.8	334.4	300.9	145.8	334.4
Chalinze	71.6	34.7	79.6	71.6	34.7	79.6
New Kigamboni	20.0	9.7	22.2	20.0	9.7	22.2
Kurasini	94.9	45.9	105.4	94.9	45.9	105.4
Luguruni	91.1	44.1	101.3	91.1	44.1	101.3
Morogoro	63.6	30.8	70.6	63.6	30.8	70.6
Mabibo	-		-	64.9	31.5	72.2
Total	2,269.4	1099.1	2,521.5	2,269.4	1099.1	2,521.5

2-2-2-3 Power system analysis

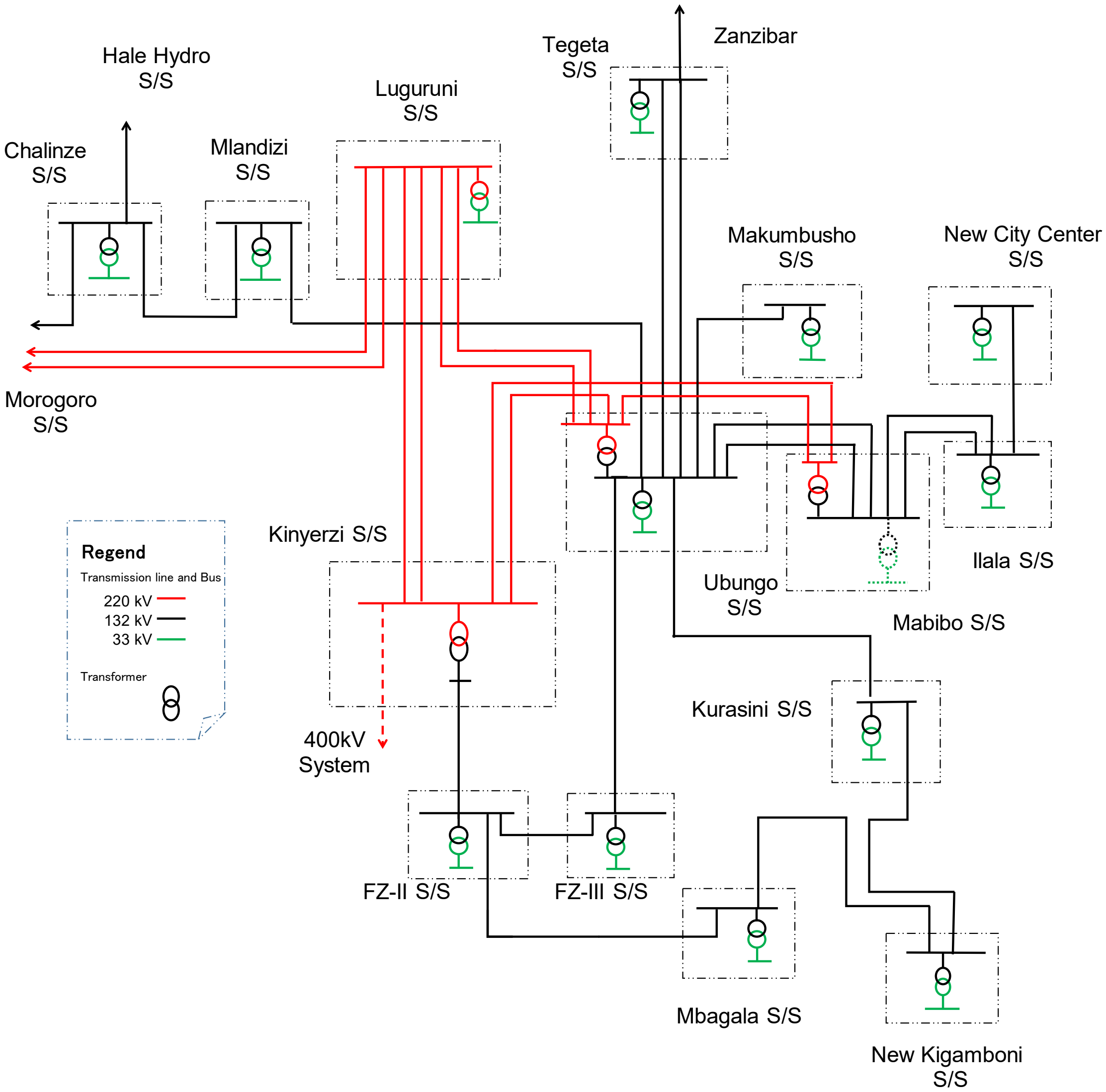
(1) Purpose

The purpose of power system analysis is to identify the validity of the Project, and the power system analysis is carried out by using the power system analysis software. Specifically, the power flow analysis and short circuit analysis are performed with the data collected.

(2) Power system analysis assumptions

The power system analysis assumptions are shown below.

- ➢ Modeling the grid for the power system analysis shown in Figure 2-2-2-3.1, which is mainly consisted of Kinyerezi power station and Ubungo substation.



Source : JICA preparatory survey team

Figure 2-2-2-3.1 Power system analysis model

- ➢ The power system analysis is performed with estimated demand values (peak demand) in 2030 that is the target year for evaluating the Project.
- ➢ Based on the results of the power demand forecast as mentioned earlier, the power system analysis is performed under the load allocation for each substation in 2030.
- ➢ The current transformer capacity and the related reinforced plans in the power system analysis model, which are mentioned in Table 2-2-2-2.2, are applied.
- ➢ In order to avoid overload of existing substation transformers in the power system analysis

model, 132/33kV transformers which is necessary for sizing a new large transformer or replacement, are reinforced or replaced based on Dar es Salaam power system master plan (DSMP). Also, ``countermeasure for overload at load termination'' is remarked in Table 2-2-2-2.2 for substations to be reinforced or replaced.

- The acceptable operating range for the nominal voltage is a base value±5%.
- As countermeasures for maintaining the system voltage, capacitor banks is applied to the buses in order to maintain 33kV bus voltage at the load termination to be 100%
- The output of Kinyerezi power station is 90% respectively for 150MW as Phase-1, 185MW as reinforcement of Phase-1, 240MW as Phase-2.
- The transformer capacity of Mabibo substation on the power system analysis is 200MVA×4 units as 200/132kV transformers, 100MVA×2units as 132/33kV transformers with considering the result of the demand forecast mentioned earlier, DSMP, etc.
- The short circuit analysis requires the technical standard related to the short circuit current of substations which are connected to the grid other than the power system model. However, the standard for the future grid doesn't exist, so the short circuit capacity on the voltage class on each substation is applied. Also, the short circuit current per voltage class is shown below.
  - 400kV : 63kA
  - 220kV : 40kA
  - 132kV : 40kA (40kA is applied even though the 132kV system has 31.5kA and 40kA)

(3) Power system analysis results

Figure 2-2-2-3.2 shows the result of the power system analysis without the Project. According to Figure 2-2-2-3.2, 220kV transmission lines between Kinyerezi – Ubungo and Luguruni – Ubungo are overloaded in 2030.

Figure 2-2-2-3.3 shows the result of the power system analysis with the Project. The maximum power flow is 498MVA on Ubungo – Kinyerezi line, which is sufficiently lower than transmission line capacity of 666MVA. Also, the transformer loading of Ubungo substation can be reduced from Approx. 209% to Approx. 113%. Therefore, the project can provide stable power operation in 2030 that is the target year of evaluating the Project.

(4) Short circuit analysis results

Figure 2-2-2-3.1 shows the result of the short circuit analysis on Mabibo substation. The three-phase short circuit current 7.6kA at 220kV system, 12.3kA at 132kV system. Therefore, no circuit breaker is exceeded because these figures are sufficiently lower than the circuit breaker rating (40kA for 220kV switchgears, 31.5kA for 132kV switchgears)

Table 2-2-2-3.1 Short circuit analysis result in 2030 (three years after completion)

Bus voltage	Three-phase short circuit current
220kV	7.6 kA
132kV	12.3 kA

(5) Recommendation

1) 220kV transmission line between Kinyerezi power station and Luguruni substation

220kV transmission line between Kinyerezi power station and Luguruni substation is one of undertakings of Tanzania side. Should the 220kV line is not constructed by 2030, the power flow analysis result of it is shown in Figure 2-2-2-3.4. According to the Figure, 220 kV line between Kinyerezi power station and Ubungo substation is overloaded if 220kV double circuit line between Kinyerezi power plnat and Luguruni substation is not constructed by 2030. Therefore, the delay of the 220kV double circuit line between Kinyerezi power station and Luguruni substation has a great impact for the system operation, so the transmission line should be constructed.

2) Transformer capacity of Mabibo substation to be constructed on the Project

In the power system analysis mentioned earlier, considering the result of power demand forecast of the Project, DSMP, etc., the validity of the case that Mabibo substation has 4 units of 220/132 kV transformers (200MVA) and 2 units of 132/33kV transformers (100MVA) is evaluated. However, due to the budgetary limitation, etc., the transformer capacity of the substation is expected as 2 units of 220/132kV transformer. The power flow analysis result is shown in Figure 2-2-2-3.5. According to the Figure, 220/132kV transformers in Mabibo substation and Ubungo substation is Approx. 133% and Approx. 142%, respectively. Therefore, 2 units of 220/132 kV transformers (200MVA) and 2 units of 132/33kV transformers (100MVA) should be installed by Tanzania side by 2030.

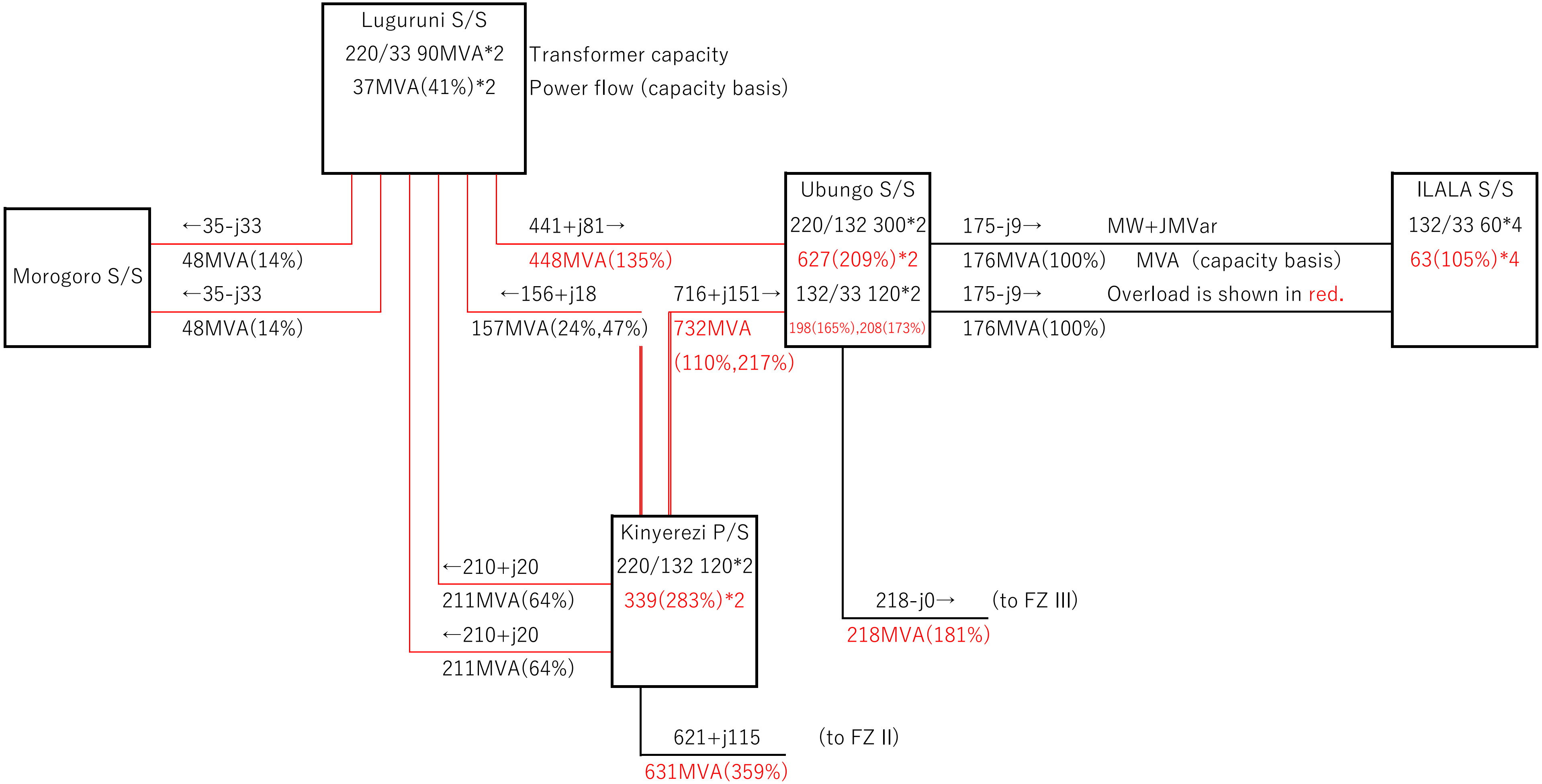


Figure 2-2-2-3.2 Power flow analysis result in 2030 (no project)

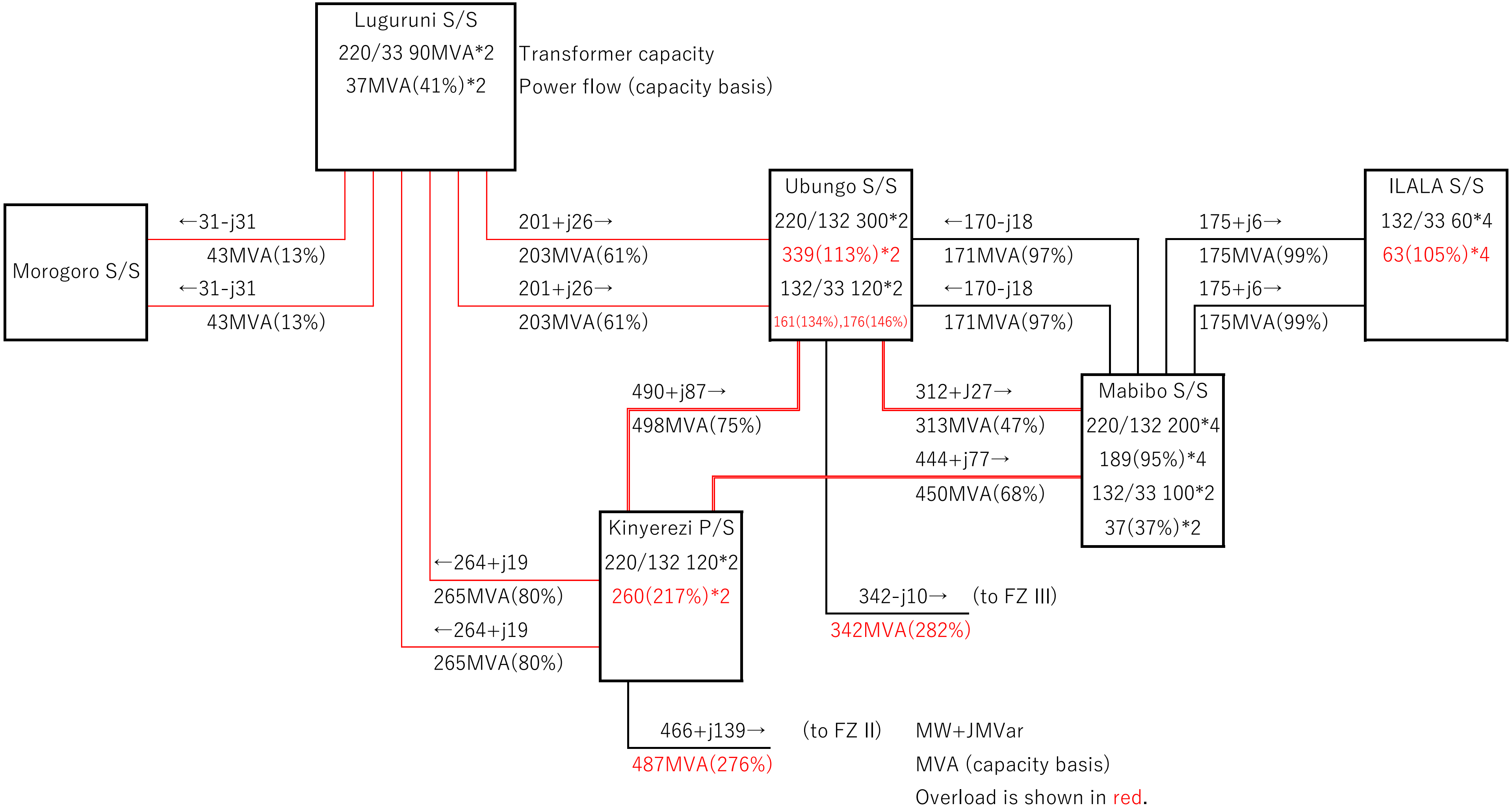


Figure 2-2-2-3.3 Power flow analysis result in 2030 (with project, three years after completion)

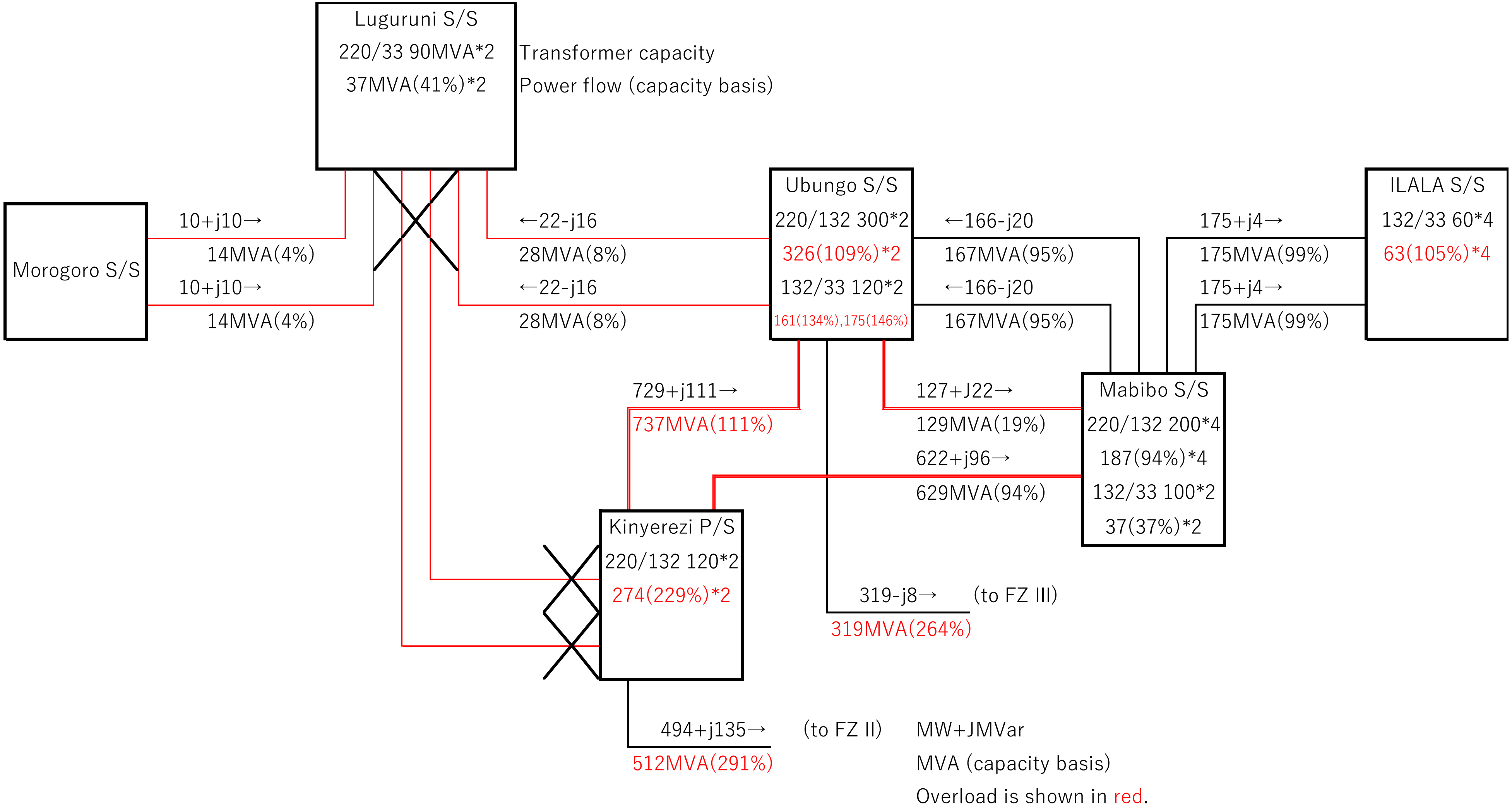


Figure 2-2-2-3.4 Power flow analysis result in 2030 (no 220kV double circuit lines between Kinyerezi P/S and Luguruni S/S)

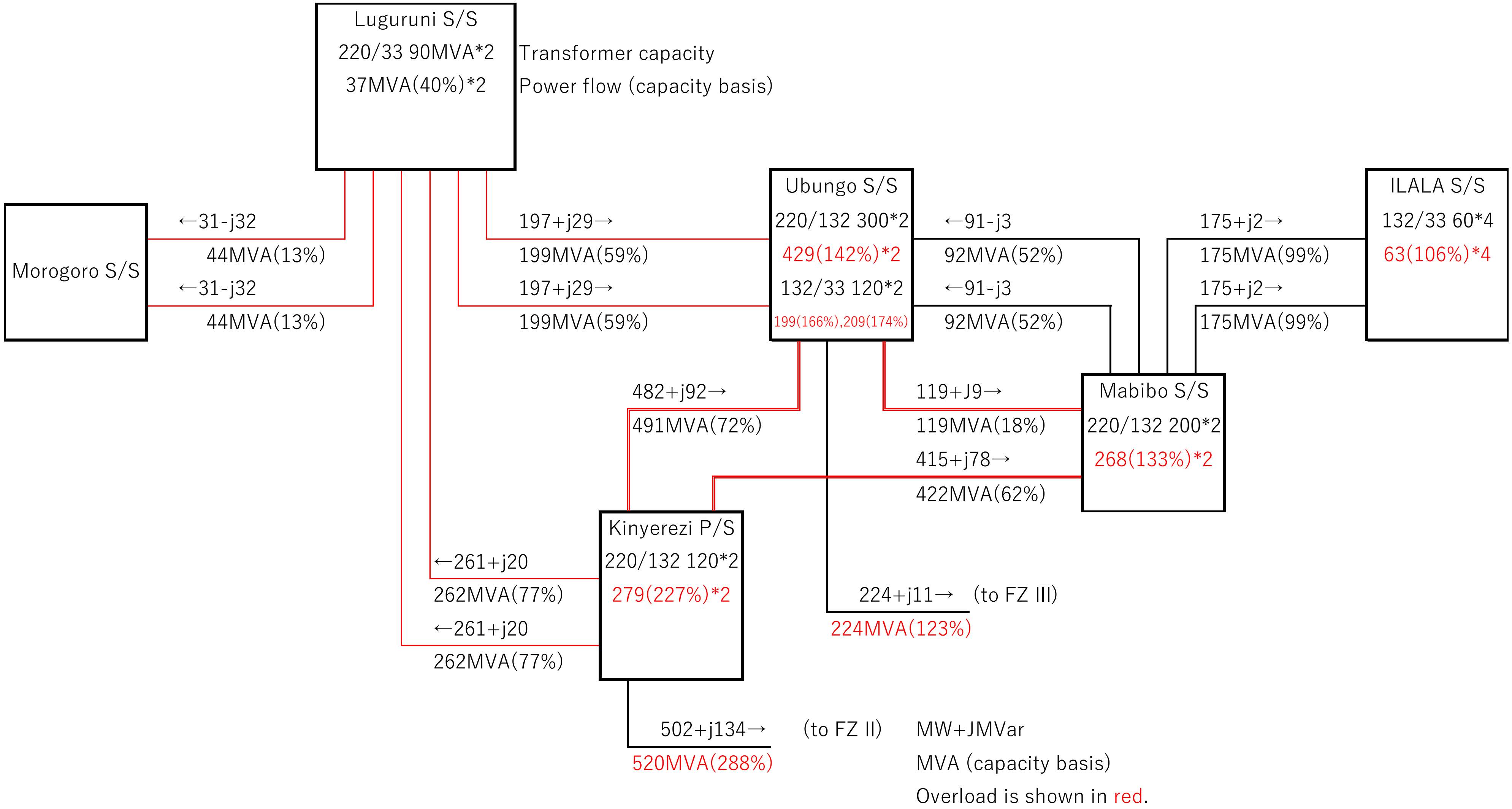


Figure 2-2-2-3.5 Power flow analysis result in 2030 (in case of 2 units only of 220/132kV transformers (200MVA)in Mabibo S/S)

2-2-2-4 Overall Plan

Design conditions of the plan are indicated below.

(1) Weather conditions

Table 2-2-2-4.1 Weather conditions

Description		Project Site
Altitude		50～200 m
Ambient temperature	Maximum	33.2 ℃
	Minimum	19.5 ℃
	Average	27.0 ℃
Maximum wind velocity		25 m/s
Relative humidity (Average)		82 %
Annual rainfall		1,100 mm
Seismic factor		Horizontal 0.10 G

(2) System voltage

Table 2-2-2-4.2 Standard Voltage Levels

	Percentage of nominal voltage			
Voltage Class (kV)	Normal Operation Condition		Emergency Operation Condition	
220	95%	105%	90%	110%
132	95%	105%	90%	110%

(3) Frequecy

50 Hz ± 1.0 Hz （49.0 - 50 – 51.0 Hz）

(4) Short-circuit current

220 kV : Less than 40 kA

132 kV : Less than 31.5 kA

(5) Grounding system

220 kV : Solid grounding

132 kV : Solid grounding

(6) Pollution level for Insulator

Heavy class (IEC-60815-2008)

(7) Applicable Codes and Standards

As a rule, the transmission and substation system equipment shall be designed in accordance with IEC and IEC compatible standards. (JEC and so on)

2-2-2-5 Outline of the Basic design

The outline of the basic design of the Project is indicated below, based on the design conditions mentioned above.

(1) Mabibo substation (Newly installation)

1) Concept

- Mabibo substation is newly installed as a 220/132 kV substation.
- Single circuit of 220 kV transmission line (Kinerezi power plant (pi branch) - Mabibo substation) should be connected to Mabibo substation.
- The four (4) of 132 kV transmission lines from Mabibo substation are cut-in and cut-out to the existing 132 kV Ubungo-Ilala lines (double circuit).
- Since the project site has only 50 - 60 meter in width, a gas insulated switchgear (hereinafter referred to as GIS) should be adopted for both 220 and 132 kV equipment.
- 220 kV GIS should be of outdoor type and double bus system, comprising of one (1) bay for 220 kV transmission line, two (2) bays for 220/132 kV transformers and one (1) bay for 220 kV bus coupler.

  Note) The space for the following three (3) bays should be secured for future expansion.
  - One (1) bay for 220 kV transmission line
  - Two (2) bays for 220/132 kV transformers
- 132 kV GIS should also be of outdoor type and double bus system, comprising of four (4) bays for 132 kV transmission lines, two (2) bays for 220/132 kV transformers and one (1) bay for 132 kV bus coupler.

  Note) The space for following eight (8) bays should be secured for future expansion.
  - Four (4) bays for 132 kV transmission lines
  - Two (2) bays for 220/132 kV transformers
  - Two (2) bays for 132/33 kV distribution transformers
- Two (2) sets of 220/132 kV, 200 MVA transformers should be installed. The cable connection should be applied for both 220 and 132 kV connections.

  Note) The space for following transformers should be secured for future expansion.
  - Two (2) sets of 220/132 kV transformers

- Two (2) sets of 132/33 kV transformers

- 33 kV gas insulated switchgear (indoor type, single bus system) should be provided for power supply for the in-house use in the control building.

  Note) The space for following bays should be secured for future expansion.
  - Two (2) bays for 132/33 kV distribution transformers
  - Eight (8) bays for distribution lines
  - One (1) bay for bus section

- SCADA system should be established and installed for control and monitoring of the substation equipment. The communication system should also be installed so that the substation can be communicated with GCC (Grid Control Center) through the optical fiber network and the communication system enables to operate the substation equipment by GCC operators.

- The substation grounding system should be installed in the entire substation

The details of the design should be shown in the following reference drawings.

SS-01 : Single line diagram for Mabibo Substation (Preliminary)
SS-02 : Layout plan for Mabibo Substation (Preliminary)
SS-03 : Control building layout plan for Mabibo Substation (Preliminary)
SS-04 : System diagram for Mabibo Substation (Preliminary)
SS-12 : Communication Network Diagram (Preliminary)

2) Detailed specifications

Detailed specifications of the main equipment are indicated below.

a) Main transformers

- Applied Standard : IEC, JIS, JEC, JEM or equivalent
- Type : Outdoor, Auto-transformer, with On-load tap changer, hermetically sealed
- Capacity : 160/200 MVA
  The capacity of tertiary winding to be advised later.
  Note) While three 200 MVA transformers were requested at the site meeting, two transformers have been proposed as a result of the re-study of the system analysis in Japan.
- Cooling : ONAN/ONAF
- Frequecy : 50 Hz
- Phase : 3
- Vector group : YNa0(d)

- Rated voltage

  Primary : 221,250 V + 6*1.41%, -12*1.41%

  Secondary : 132,000 V

  Tertialy : 33,000 V

- Insulation : See below

Table 2-2-2-5.1 Insulation voltage

Insulation Voltage	220 kV	132 kV	Neutral	33 kV
Lightning Impulse withstand voltage (kV-p)	1,050	650	250	170
Power frequency withstand voltage (kV)	460	275	95	70
Switching Impulse withstand voltage (kV-p)	850	-	-	-

- Others

  - 220 kV and 132 kV arresters

    The 200 MVA transformer shall be planned to be equipped with Lightning arresters for both 220 kV and 132 kV. (See Drawing SS-02)

  - 132/33 kV transformer

    132/33 kV distribution transformer(s) is (are) out of Japanese scope of supply. The space for two (2) sets of transformers is secured in the substation, as per Drawing SS-02.

  - Noise level

    The noise level in project site is classified as "Indutrial area".

    Day (6:00-22:00) : 70 dBA

    Night (22:00-6:00) : 60 dBA

    Note) Noise Levels of Transformers

    Based on Mabibo Substation Layout Plan (Preliminary) (Drawing SS-02), noise levels were studied and it was found that when the four transformers are in rated operation, approximately 10 dBA of attenuation is expected at the site boundary on the National Transportation Institute side. Thus, in order to comply with the regulatory limit (60 dBA) at the site boundary, the transformers themselves should be designed with a noise level of 70 dBA.

  - Oil pit

    An oil pit should be provided for each transformer with oil-water separator pit. The volume of the oil pit should be approximately 50% of the total oil volume of each transformer.

  - Fire wall

    Fire wall(s) should be installed between transformers.

- Local control panel

  Each transformer should have a local control panel to control the cooling fans and others. The panel should be of IP-54 or more.

b) 220/132 kV Switchgear

Gas Insulated Switchgear (GIS) should be applied for both 220 kV and 132 kV switchgear due to very narrow space of project site.

a. Major ratings of 220/132 kV switchgear

Table 2-2-2-5.2 Major ratings of 220/132 kV switchgear

Major Specifications		Unit	220 kV	132 kV
Rated Voltage		kV	245	145
Rated Current	Bus (Bus coupler bay)	A	3,150	3,150
	Transmission line bay	A	2,500	1,250
	Transformer bay	A	1,250	1,250
Rated short-time withstand current		kA	40	31.5
Rated short time		s	3	3
Rated lightning impulse withstand voltage		kV peak	1,050	650
Rated power frequency withstand voltage		kV	460	275

b. 220 kV switchgear

➢ One (1) set of 220 kV Transmission line bay for Kinyerezi power station, one (1) set comprising of;-
  - One (1) set of Double busbar
  - One (1) set of Bus side Disconnecting Switch (DS) with Earthing Switch (ES)
  - One (1) set of Bus side DS
  - One (1) set of Circuit Breaker (CB)
  - One (1) set of Line side DS with ES
  - One (1) set (five (5) cores per phase) of Current Transformer (CT)
  - One (1) set of Voltage Transformer (VT) with Isolating device
  - One (1) set of Lightning Arrester (LA)
  - One (1) set of Cable Head (CHD)
  - One (1) panel of Local Control Cubicle (LCC)

  Note) The Tanzania National Grid Code (Network Code Bypass Circuit Use of the "Bypass Circuit": Section 4.4.2) states that a "bypass circuit" is to be provided for the purpose of maintenance and inspection of the circuit breakers. However, even if there is a problem with the 220 kV circuit at Mabibo substation, since a bypass circuit from Kinerezi power plant to Ilala substation through Ubungo substation can be secured, the bypass circuit will not be installed.

- Two (2) sets of 220/132 kV Transformer bay, one (1) set comprising of;-
  - One (1) set of Double busbar
  - One (1) set of Bus side DS with ES
  - One (1) set of Bus side DS
  - One (1) set of CB
  - One (1) set of Line side DS with ES
  - One (1) set (four (4) cores per phase) of CT
  - One (1) set of CHD
  - One (1) panel of LCC

- One (1) set of 220 kV Bus Coupler bay, comprising of;-

  One (1) set of Double busbar

  Two (2) sets of DS with ES

  One (1) set of CB

  One (1) set (four (4) cores per phase) of CT

  Two (2) sets of VT with Isolating devices

  One (1) panel of LCC

Note) The space for the following three (3) bays should be secured for future expansion.

  - One (1) bay for 220 kV transmission line
  - Two (2) bays for 220/132 kV transformers

c. 132 kV Switchgear

- Four (4) sets of 132 kV Transmission line bay for each 2 sets of Ubungo and Ilala feeders, one (1) set comprising of;-
  - One (1) set of Double busbar
  - One (1) set of Bus side DS with ES
  - One (1) set of Bus side DS
  - One (1) set of CB
  - One (1) set of Line side DS with ES
  - One (1) set (four (4) cores per phase) of CT
  - One (1) set of VT with Isolating device
  - One (1) set of LA
  - One (1) set of CHD
  - One (1) panel of LCC

- Two (2) sets of 220/132 kV Transformer bay, one (1) set comprising of;-
  - One (1) set of Double busbar
  - One (1) set of Bus side DS with ES
  - One (1) set of Bus side DS

- One (1) set of CB
- One (1) set (four (4) cores per phase) of CT
- One (1) set of CHD
- One (1) panel of LCC

➢ One (1) set of 132 kV Bus Coupler bay, comprising of;-
- One (1) set of Double busbar
- Two (2) sets of Bus side DS with ES
- One (1) set of CB
- One (1) set (four (4) cores per phase) of CT
- Two (2) sets (six (6) phases) of VT with Isolating devices
- One (1) panel of LCC

Note) The space for the following eight (8) bays should be secured for future expansion.
- Four (4) bays for 132 kV transmission lines
- Two (2) bays for 220/132 kV transformers
- Two (2) bays for 132/33 kV distribution transformers

d. On-site withstand voltage test of 220/132 kV gas insulated switchgear

The dielectric test on site of 220 kV and 132 kV GIS should be conducted at an operating voltage for 30 minutes in accordance with IEC standard (IEC 62271-203 Annex C.3.2.3). The field partial discharge measurement test on site of 220 kV GIS shall be conducted by operating voltage (phase to ground) in accordance with IEC standard (IEC 62271-203 10.2.101.2.3).

c) Necessary equipment and materials for 220/132 kV outdoor switchyard

a. 220/132 kV Lightning Arresters (LA) and Cable heads (CHD)
- For 220 kV Kinyerezi transmission line bay
- For 132 kV transmission line bays for Ubungo and Ilala substations (total 4 bays)

Note) The LA and CHD should be installed under 220 kV and 132 kV dead end towers, respectively.

b. Supporting structures for Las and CHD

c. 220/132 kV conductor, their fittings and other necessary materials for installation

d. Drainage pumps for cable pit and materials and equipment required to install the drainage pumps (wiring materials, conduit, and other necessary items)

e. Other necessary materials

d) 33 kV switchgears

33 kV switchgear should be installed to supply power inside the substation, fed from the

tertiary windings of two 200 MVA transformers and connected to an auxiliary transformer. 33 kV switchgear should be installed in the electrical room, with space for future expansion.

- Indoor type, SF6 gas insulated metal enclosed type
- Rated voltage：36 kV
- Rated current：1,250 A（Busbar）

The 33 kV switchgear is comprising of;-

- Two (2) panels for Incoming circuit-1 (from 2 x 200 MVA transformer tertiary)
- One (1) panel for 33/0.4 kV auxiliary transformer No.1
- One (1) panel for 33 kV VT
- One (1) panel for Incoming circuit-2 (from 33 kV distribution line around Mabibo substation)
- One (1) panel (for cable connection) for 33/0.4 kV auxiliary transformer No.2

e) Control and protection

The control and protection equipment should apply to IEC 61850 “Communication networks and systems for power utility automation” and enable to control and protect the whole substation equipment.

a. 220/132 kV Transmission lines

- Bay control unit (BCU)
- Protection relays

The following figure shows the existing protection system.

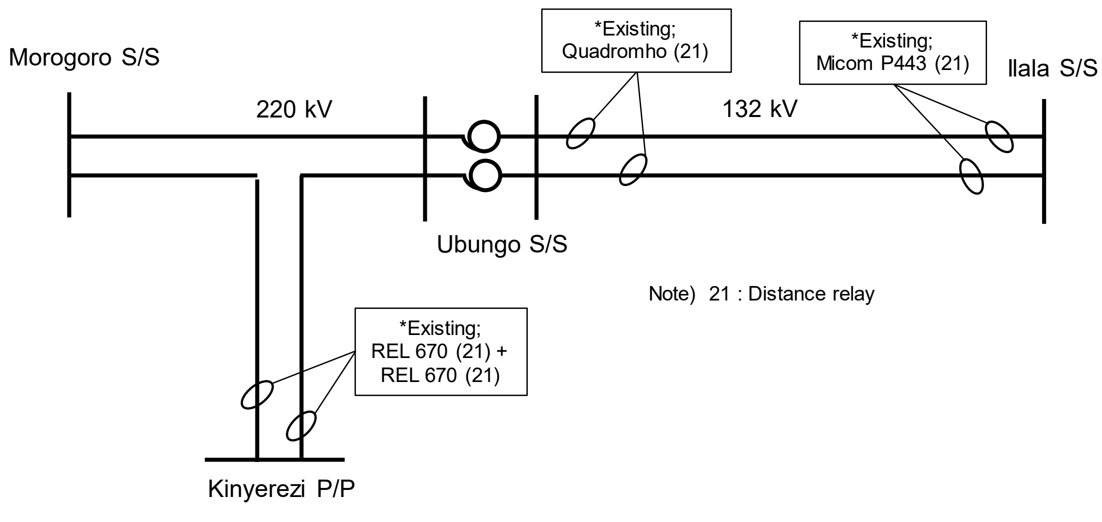


Figure 2-2-2-5.1 Existing protection system

Table 2-2-2-5.3 220 kV protection system (Present)

Substation	Remote substation	Main protection 1	Main protection 2
Kinyerezi power station	220 kV Ubungo substation	REL 670 (ABB) Distance protection and remote protection	REL 670 (ABB) Distance protection and remote protection

Table 2-2-2-5.4 132 kV protection system (Present)

Substation	Remote substation	Main protection
Ubungo substation	Ilala substation	Quadromhon (Quadromho) Distance protection
Ilala substation	Ubungo substation	Micom P443 Distance protection (with Current differential protection element, not-in-use due to no current differential protection element at Ubungo substation)

According to the request of TANESCO, the line differential protection system through optical fiber cable and the distance protection system should be supplied as a main protection system at Mabibo substation because of the short distance transmission lines and a requirement of high speed of auto-reclosing system. The same differential protection relays for remote stations (Kinyerezi power station, Ubungo substation and Ilala substation) should be supplied by Japan side as well. However, the relays at remote stations should be installed by Tanzania side under supervision of Japanese contractor. For the communication of the line current signals for differential relays, one (1) pair of fiber optic cores should be utilized exclusively for each transmission line protection relay set. See the drawing below.

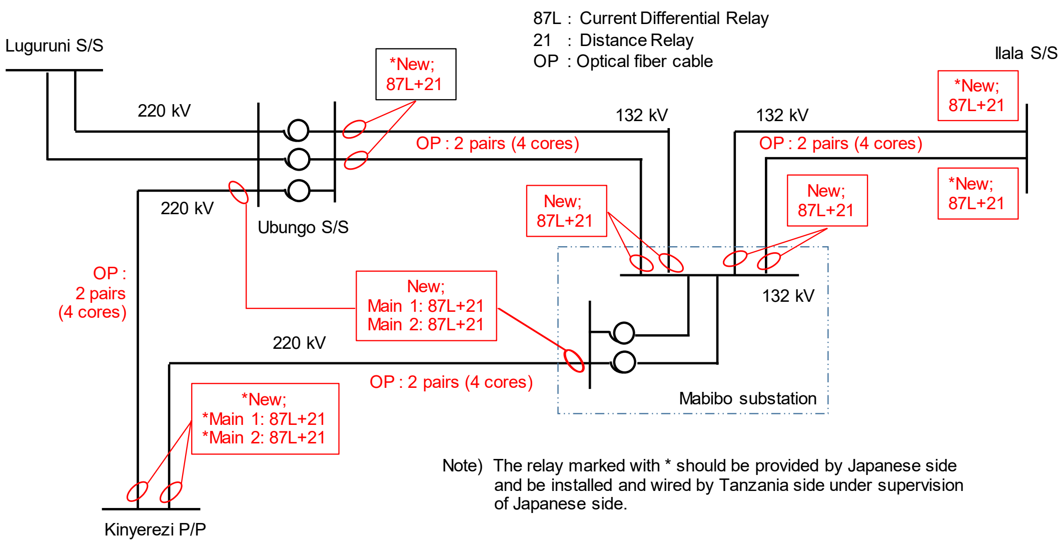


Figure 2-2-2-5.2 Transmission line protection system around Mabibo substation

b. 200 MVA transformer bays

- BCU

- On-load tap changing control
- Protection relays (Transformer current differential protection, Grounding relays and other relays)

c. 220 kV bus coupler bay
- BCU
- Protection relays (220 kV bus protection, Grounding relays and other relays)

d. 132 kV bus coupler bay
- BCU
- Protection relays (220 kV bus protection, Grounding relays and other relays)

f) Metering panel

The metering panel(s) includes eight (8) sets of TANESCO's standard Watt hour meter (Wh meter) for 220/132 kV transmission feeders. TANESCO's standard Wh meter should be supplied by TANESCO and installed by Japanese contractor at site. The class of CT for Wh meter should be 0.2.

- 220 kV Transmission line bay : 1 meter
- 132 kV Transmission line bay : 4 meters
- 200 MVA transformer bay : 2 meters (132 kV side)

g) SCADA system

a. System
- Server and Client system (Workstation HMI) with bay control unit (BCU) for control and supervising of Mabibo substation. (Standard : IEC 61850)
- Remote Terminal Unit (RTU) and/or gateway system for communication with the existing Grid Control Center (GCC) SCADA system. (Standard : IEC 60870-104)

b. Data collection

All data of the equipment inside the substation shall be collected through BCU, switching-hub unis, etc., utilizing various I/O data in a substation, such as status of 220/132 kV transformers, 220/132 kV switchgear, control and protection devices, power supply units and other local control facilities.

c. Micro SCADA system

Control and monitoring of the substation should be done using the data in the Substation collected data through control and monitoring server installed in the control room.

d. Control and Monitoring
- Measurement and display: Voltage, current, active power, reactive power, etc. of all 220 kV, 132 kV and 33 kV circuits
- Monitoring: Position indications of 220 kV, 132 kV and 33 kV equipment, alarms on the transmission lines, transformers and other information of the

substation

- Operation: Open/close operation of 220 kV, 132 kV and 33 kV switchgear at Workstation (The operations shall also be able to done at BCU ends)

e. Workstation

Workstations are set at the Operation's desk in the control room, where equipment control and monitoring can be done.

- Two (2) sets of Operator's Workstation
- Two (2) sets of Printers for log, various measurements, alarms, etc.
- Optical fiber cable, LAN cable and other necessary materials for Mabibo Substation control, monitoring and communication system
- Control voltage : 230 V AC (Uninterruptible power supply)

h) Communication system

The communication system consists of the following equipment.

- SDH/multiplexer
- Router
- PABX equipment with telephone sets
- Splicing boxes for optical fiber cables (24c)
- Communication cables including optical fiber cables, network cables etc. for the substation inside
- Conduits for communication cables, connectors, accessories and other necessary materials

i) Substation power supply system

a. AC power supply system

- Two (2) sets of Auxiliary transformer; 400 kVA
- 400/230 V AC distribution panel(s)

  Note: The auxiliary transformer capacity (400 kVA) should be decided at the time of implementation stage.
  In consideration of future reactor(s) installation, the space for voltage regulator facilities for auxiliary power supply is secured.

b. DC power supply system

- 110 V DC charger (Dual charger system)
- 110 V DC batteries (Valve regulated lead acid (VRLA) type or equivalent); 500 Ah (tentative)

  Note: The battery capacity should include the one for UPS system. The capacity (500 Ah) should be decided at the time of implementation stage according to the actual 110 V DC loads.
- 110 V DC supply panel

- 48 V DC charger (Single charger)
- 48 V DC batteries (VRLA type or equivalent); 100 Ah (tentative)

  Note: The capacity (100 Ah) should be decided at the time of implementation stage according to the actual 110 V DC loads.
- 48 V DC supply panel

c. Uninterruptible power supply (UPS) system

- Inverter panel (110 V DC to 230 V AC)
- 230 V AC supply panel

  Note: Batteries of 110 V DC system above should be used for UPS system.

j) 220/132/33 kV power cables (XLPE cable)

a. 220 kV cables

- 220 kV dead end tower to 220 kV switchgear
- 220 kV switchgear to 200 MVA transformer

b. 132 kV cables

- 200 MVA transformer to 132 kV switchgear
- 132 kV switchgear to 132 kV dead end tower

c. 33 kV cables

- 200 MVA transformer to 33 kV switchgear
- 33 kV switchgear to Auxiliary transformer

d. Cable heads for power cables

- Cable heads for power cables of item a, b and c above and other necessary accessories and materials

k) Low voltage power and control cables

Necessary low voltage power and control cables and necessary accessories for connection

l) Substation grounding system

The grounding system should be in accordance with IEEE standard 80 (2000) or equivalent international standards.

- Grounding conductor, grounding rod and other necessary materials
- Lightning rod and/or overhead grounding wires should be applied for whole substation area.

(2) Ubungo substation (Expansion)

Due to a new 220 kV transmission line between Kinyerezi power station and Ubungo substation, new one (1) bay of 220 kV transmission line should be expanded at Ubungo 220 kV switchyard.

・ At present, since there is no available space at the 220 kV switchyard for expansion, the space is to be newly developed by Tanzania side for a single 220 kV transmission line bay.

- Since, at present, there are 132 kV overhead transmission lines for Factory Zone III (2 lines) and Symbion Power Plant (1 line) above the space to be expanded, these lines (3 lines in total) will be converted to underground cables by Tanzania side.

- It was found that high-pressure gas piping for the Songas power plant is buried in the space where the lines are to be extended. It was agreed to decide later whether to relocate this piping or to consider a foundation for the equipment that takes this piping into account, including the work assignment.

- A control panel for additional 220 kV transmission line should be installed in the existing control room. A local control panel should also be installed at the switchyard to enable the monitoring and control of the additional line. The control panel to be installed in the existing control room should be equipped with a TANESCO standard Wh meter to measure the watt-hour of the newly added 220 kV transmission line. The Wh meters should be supplied by TANESCO and installed by the Japan side at site.

- A protection panel for one additional 220 kV transmission line should be installed in the existing relay room. For details of the protection functions, please refer to 3-2-2-4 (1) 5) Control and Protection Facilities. In addition, the secondary circuit of the current transformer to be newly installed for busbar protection should be connected to the existing 220 kV busbar protection panel. Verification of the bus bar protection system shall be within the scope of Tanzania side.

- A network switch in order to connect to the existing server (SYS-600) should be provided as a communication facility. The modification of the existing SCADA system and GCC system at Ubungo substation will be on Tanzania side.

a) Comm on specifications

- Rated voltage : 245 kV
- Rated current
  - Circuit Breaker : 3,150 A
  - Othe equipment : 2,500 A
- Rated short-time withstand current
  : 40 kA – 3 sec.

- One (1) set of equipment for one (1) bay is comprising of;
  - One (1) set of Main bus side DS
  - One (1) set of Bypass DS (Transfer bus side)
  - One (1) set of CB
  - One (1) set of Line side DS with ES
  - One (1) set (five (5) cores per phase) of CT
  - One (1) set of CVT (3 phases)
  - One (1) set of LA (3 phases)

- One (1) set of Local control panel
- One (1) set of the following materials

  Dead-end tower for transmission lines

  Steel structures for bus conductors

  Bus conductors and the branch conductors, and their connectors

  Supporting insulators

  Supporting structures for the equipment

  Grounding materials (to be connected to existing grounding grid)

  Other necessary materials

b) Control and protection equipment

- Control panel for new 220 kV transmission line (including BCU, Multi-meter, Wh meter and other necessary devices) in the exsisting control room
- Protection panel for new 220 kV transmission line (including Current differential relay and other necessary devices) in the existing relay room
- AC/DC power supply box (wall-mounted type) in the existing electrical room (power supply room)
- Connection works of CT secondary circuit in the existing 220 kV busbar protection panel
- Other necessary materials (cables, terminals, etc.)

See the following preliminary drawings in detail.

- ➢ SS-07 : Single Line Diagram (Ubungo 220 kV S/S) (preliminary)
- ➢ SS-08 : Layout Plan (Ubungo) (preliminary)
- ➢ SS-09 : System Configuraion Diagram (Ubungo S/S) (preliminary)
- ➢ SS-10 : Layout Plan of Control Building (Ubungo) (preliminary)
- ➢ SS-11 : Section Drawing for New Kinyerezi Line (Ubungo S/S) (preliminary)
- ➢ SS-12 : Communication Network around Mabibo Substation (preliminary)

(3) Kinyerezi power station (Replacement)

The equipment in two (2) x 220 kV transmission line bays should be replaced with new ones with the following ratings, due to increase the capacity of 220 kV transmission lines to Ubungo and Mabibo substations.

・ Common specifications

- Rated voltage : 245 kV
- Rated current : 2,500 A
- Rated short-time withstand current

  : 40 kA – 3 sec.

・ One (1) set of equipment for one (1) bay to be replaced is comprising of;

- One (1) set of Bus-1 side DS
- One (1) set of Bus-2 side DS

- One (1) set of Bypass DS
- One (1) set of CB
- One (1) set of CB Line side DS
- One (1) set of CT (for three phases)
- One (1) set of Line side DS with ES
- One (1) set of branch conductor and their connectors
- One lot of Supporting insulators for new branch conductors

・ Since the Line Traps are no more use, they should be removed.

・ Existing CVT and LA can be used as they are, since they have no relation to current rating.

・ The existing facilities as mentioned below should be used even the new equipment is replaced.
  - Foundations of the equipment
  - AC/DC power supply
  - Control and protection circuits
  - Secondary wirings for all power, control, protection and all other circuits

・ The following works should be done by TANESCO due to the change of CT ratio.
  - Adjustment of SCADA system in the power plant
  - Replacement and settings of transmission line relays under supervision of Japan side
  - Adjustment of Watt-hour meters
  - Interlock test of whole substation (The tests of equipment itself should be done by Japan side)

The details of the design should be shown in the following reference drawings.

➢ SS-05 : Single Line Diagram (Kinyerezi GPP)
➢ SS-06 : Layout Plan (Kinyerezi GPP)
➢ SS-12 : Communication Network around Mabibo Substation (preliminary)

(4) Communication network

1) Existing system

The figure below shows the existing installation of communication cables (optical cables).

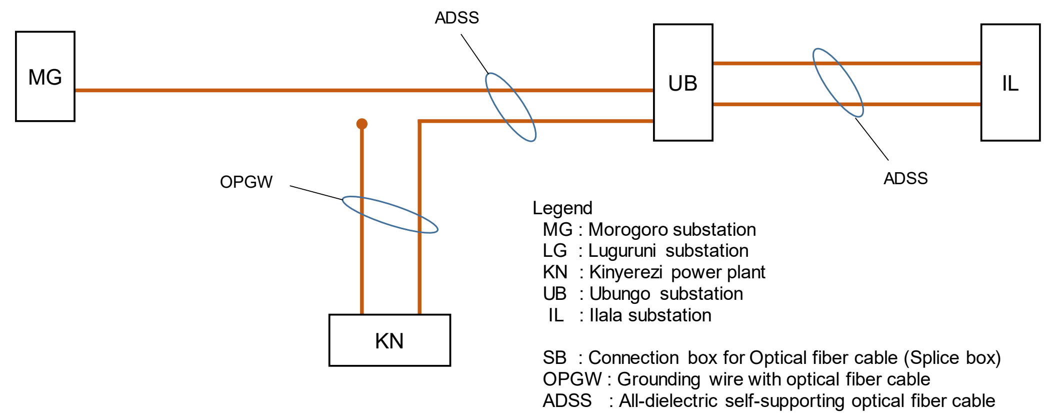


Figure 2-2-2-5.3 Existing OP Cable Network

2) Plan details

Regarding communication within the network in TANESCO, two types of communication media are installed, in principle, to be prepared for emergencies. Therefore, in Kinyerezi power station, in addition to optical fiber cable communications, power line carrier (PLC) equipment is also installed. However, as a result of discussions with TANESCO, it was found that if multiple communication routes could be secured, it would be possible to use only optical cable communication. Thus, it is planned to secure multiple communication routes for the communication network related to Mabibo substation.

- ✓ Step 0: Construction of Luguruni substation by TANESCO
- ✓ Step 1: Relocation of the existing ADSS cables by TANESCO

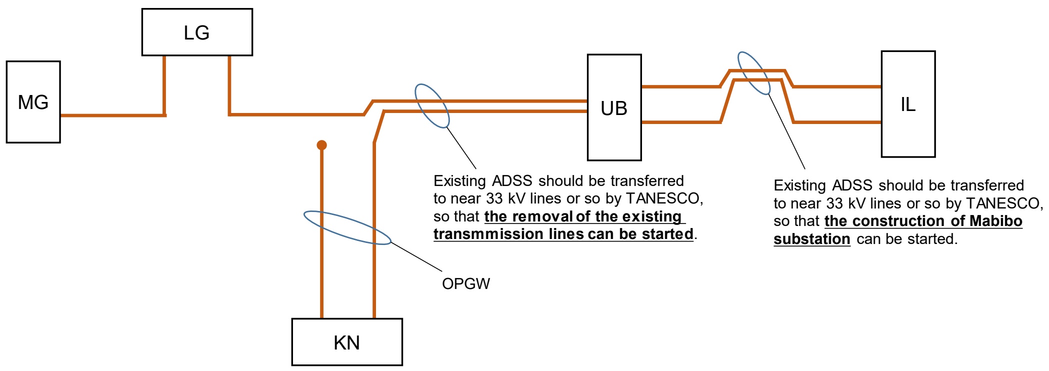


Figure 2-2-2-5.4 Implementation procedure for OP Cable Installation: Step 1

- ✓ Step 2: Installation of OPGW by Japan side

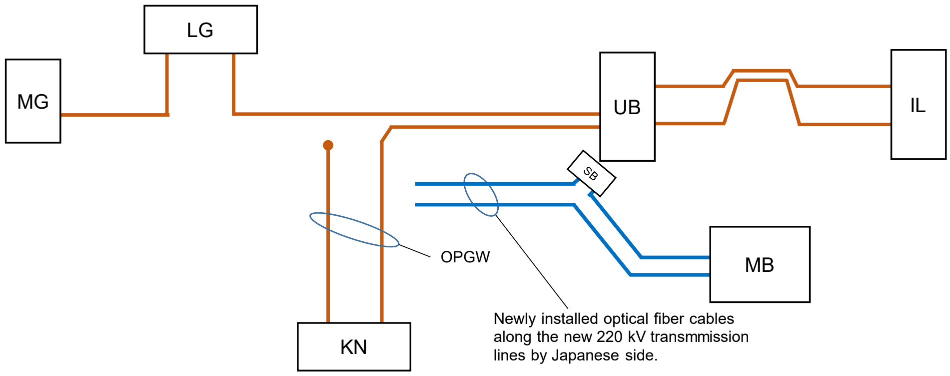


Figure 2-2-2-5.5 Implementation procedure for OP Cable Installation: Step 2

- ✓ Step 3: Connection of optical fiber cables by TANESCO

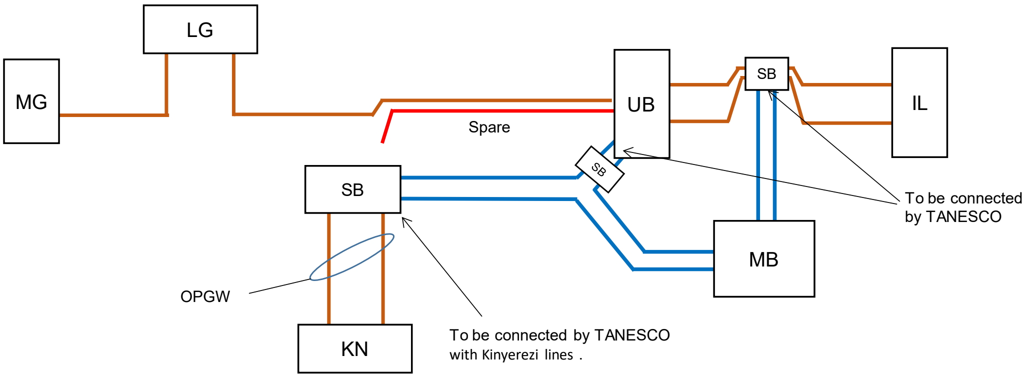


Figure 2-2-2-5.6 Implementation procedure for OP Cable Installation: Step 3

(5) Basic plan for 220 kV transmission line

1) Transmission facility planning

A new 220 kV transmission line between Kinyerezi power station (π branch) and Mabibo substation will be constructed. Therefore, the location of the new tower will basically be in the vicinity of the existing tower location, and borehole tests will be conducted at all tower locations.

Transmission line routes were investigated for the construction of three new 220 kV transmission lines between Kinyerezi power station (T-off) and Ubungo substation, and two new 220 kV transmission lines between Ubungo substation and Mabibo substation (only one line connected). A new three-circuit tower will be built between Kinyerezi power station (T-off) and Ubungo substation, and a new two-circuit tower will be built between Ubungo substation and Mabibo substation.

The basic policy is that the new transmission line will use the existing Right of Way (ROW) and the new tower will be constructed using the location where the existing tower stands. The removal of the existing towers will be carried out by TANESCO (Tanzania side) prior to the construction by the Japan side.

For power transmission lines, consider the existing power lines to which they are to be connected, and consider the details in the table below.

Table 2-2-2-5.5 Electric power transmission lines

Section	Ubungo substation from π branch		Ubungo substation to Mabibo substation
Access point	Two lines from the π branch to Ubungo substation (for connection to the transmission line from Kinyerezi power station)	One circuit from the π branch to Ubungo substation (for connection between Morogoro substation and Ubungo substation)	Two lines from Ubungo substation to Mabibo substation (for connecting Ubungo substation and Mabibo substation)
Number of lines	3 lines		2 lines (only 1 line connected)
Power cable	Bluejay（Wire size：603mm^2）duplex conductor	Bluejay（Wire size：603mm^2）single conductor	Bluejay（Conductor size：603mm^2）duplex conductor
Other	This section will be constructed with a 3-circuit tower. The length is approximately 7 km.		Only one line will be procured and installed by the Japan side. The other line will be connected by TANESCO after TANESCO expands Ubungo substation further in the future. Therefore, only partial procurement will be carried out by the Japan side. The length of the line is approximately 2 km.

2) Electrical Conditions of Transmission lines

Table 2-2-2-5.6 Electrical Conditions of Transmission lines

Items	Design Value
Right of Way (ROW)	- 220 kV T/L for triple circuits: 40m width (20m +20m) - 220 kV T/L for double circuits: 40m width (20m +20m) - 132 kV T/L for double circuits: 30m width (15m +15m)
Height of conductor	
General area (m)	220 kV:8 m, 132 kV:6.7 m
Waterway (m)	220 kV:10 m, 132 kV:7 m
Railway	220 kV:13.0 m, 132 kV:9.0 m
to Road crossing (m)	220 kV:8.5 m, 132 kV:8.0 m
Shield angle for Lightning	Less than 30 degree
Minimum nominal specific creepage distance	31 mm/kV

(6) Requirements for 220 kV Transmission Line

Specification for 220 kV Transmission Line is shown as follows.

Table 2-2-2-5.7 Specification for 220 kV Transmission Line

No	Item	Specification
TL-1	3 circuits (ccts) dead end tower for T-off point (Type3D-1)	1. Tower 1) Standard：IEC, EN or equivalent 2) Material：Hot rolled steel

No	Item	Specification
		3) Number of Circuit：3 4) Foundation：Pad or Chimney, Reinforced Concrete 2. Earthing ground 1) Specification : earthing wires, earthing lines, earthing rods, connection materials, etc. 3. Plate, etc. 1) Specification：Number plates, danger plates, etc. 4. Anti-climbing device 1) Specification：Detachable type to steel tower legs, steel, etc. 5. Lifting device for maintenance 1) Specification：Step bolts, steel, etc.
TL-2	3 ccts suspension tower	1. Tower 1) Standard：IEC, EN or equivalent 2) Material：Hot rolled steel 3) Number of Circuit：3 4) Foundation：Pad or Chimney, Reinforced Concrete 2. Earthing ground 1) Specification : earthing wires, earthing lines, earthing rods, connection materials, etc. 3. Plate, etc. 1) Specification：Number plates, danger plates, etc. 4. Anti-climbing device 1) Specification：Detachable type to steel tower legs, steel, etc. 5. Lifting device for maintenance 1) Specification：Step bolts, steel, etc.
TL-3	3 ccts tension tower	1. Tower 1) Standard：IEC, EN or equivalent 2) Material：Hot rolled steel 3) Number of Circuit：3 4) Foundation：Pad or Chimney, Reinforced Concrete 2. Earthing ground 1) Specification : earthing wires, earthing lines, earthing rods, connection materials, etc. 3. Plate, etc. 1) Specification：Number plates, danger plates, etc. 4. Anti-climbing device 1) Specification：Detachable type to steel tower legs, steel, etc. 5. Lifting device for maintenance 1) Specification：Step bolts, steel, etc.
TL-4	3 ccts dead end tower	1. Tower 1) Standard：IEC, EN or equivalent 2) Material：Hot rolled steel 3) Number of Circuit：3 4) Foundation：Pad or Chimney, Reinforced Concrete 2. Earthing ground 1) Specification : earthing wires, earthing lines, earthing rods, connection materials, etc. 3. Plate, etc. 1) Specification：Number plates, danger plates, etc. 4. Anti-climbing device 1) Specification：Detachable type to steel tower legs, steel, etc. 5. Lifting device for maintenance 1) Specification：Step bolts, steel, etc.
TL-5	3 ccts dead end tower for Ubungo substation	1. Tower 1) Standard：IEC, EN or equivalent 2) Material：Hot rolled steel 3) Number of Circuit：3

No	Item	Specification
		4) Foundation：Pad or Chimney, Reinforced Concrete 2. Earthing ground 1) Specification : earthing wires, earthing lines, earthing rods, connection materials, etc. 3. Plate, etc. 1) Specification：Number plates, danger plates, etc. 4. Anti-climbing device 1) Specification：Detachable type to steel tower legs, steel, etc. 5. Lifting device for maintenance 1) Specification：Step bolts, steel, etc.
TL-6	2 ccts dead end tower	1. Tower 1) Standard：IEC, EN or equivalent 2) Material：Hot rolled steel 3) Number of Circuit：2 4) Foundation：Pad or Chimney, Reinforced Concrete 2. Earthing ground 1) Specification : earthing wires, earthing lines, earthing rods, connection materials, etc. 3. Plate, etc. 1) Specification：Number plates, danger plates, etc. 4. Anti-climbing device 1) Specification：Detachable type to steel tower legs, steel, etc. 5. Lifting device for maintenance 1) Specification：Step bolts, steel, etc.
TL-7	2 ccts suspension tower	1. Tower 1) Standard：IEC, EN or equivalent 2) Material：Hot rolled steel 3) Number of Circuit：2 4) Foundation：Pad or Chimney, Reinforced Concrete 2. Earthing ground 1) Specification : earthing wires, earthing lines, earthing rods, connection materials, etc. 3. Plate, etc. 1) Specification：Number plates, danger plates, etc. 4. Anti-climbing device 1) Specification：Detachable type to steel tower legs, steel, etc. 5. Lifting device for maintenance 1) Specification：Step bolts, steel, etc.
TL-8	2 ccts dead end tower	1. Tower 1) Standard：IEC, EN or equivalent 2) Material：Hot rolled steel 3) Number of Circuit：2 4) Foundation：Pad or Chimney, Reinforced Concrete 2. Earthing ground 1) Specification : earthing wires, earthing lines, earthing rods, connection materials, etc. 3. Plate, etc. 1) Specification：Number plates, danger plates, etc. 4. Anti-climbing device 1) Specification：Detachable type to steel tower legs, steel, etc. 5. Lifting device for maintenance 1) Specification：Step bolts, steel, etc.
TL-9	Overhead line facilities	1. Overhead line 1) Type：Aluminum conductor steel reinforced （ACSR/AC） 2) Number of conductors：Double conductors and Single conductor 3) Size：603mm^2 (Bluejay)

No	Item	Specification
		2. Line spacer 3. Jumper spacer 4. Damper 5. Clamp 6. Armor rod 7. Others
TL-10	Shield wire and optical fiber cable	1. Shield wire and optical fiber cable（OPGW） 1) Number of fiber：24 Cores 2. Damper 3. Clamp 4. Armor rod 5. Splice box for OPGW 6. Others
TL-11	Insulator	1. Insulator 2. Arc horn 3. Others

(7) Basic plan for 132 kV transmission line

1) Transmission facility planning

The facility planning of 132 kV transmission is to interconnect the existing 132 kV Ubungo – Ilala line with Mabibo substation.

2) Electrical Conditions of 132 kV Transmission lines

Refer to Table 2-2-2-5.6.

(8) Requirements for 132 kV Transmission Line

Specification for 132 kV Transmission Line is shown as follows.

Table 2-2-2-5.8 Specification for 132 kV Transmission Line

No	Item	Specification
TL-12	2 ccts dead end tower (for Mabibo substation)	1. Tower 1) Standard：IEC, EN or equivalent 2) Material：Hot rolled steel 3) Number of Circuit：2 4) Foundation：Pad or Chimney, Reinforced Concrete 2. Earthing ground 1) Specification : earthing wires, earthing lines, earthing rods, connection materials, etc. 3. Plate, etc. 1) Specification：Number plates, danger plates, etc. 4. Anti-climbing device 1) Specification：Detachable type to steel tower legs, steel, etc. 5. Lifting device for maintenance 1) Specification：Step bolts, steel, etc.
TL-13	Overhead line facilities	1. Overhead line 1) Type：Concentric Lay Stranded Thermal Resistant Aluminum Alloy Conductors (TACSR) (with Grease) 2) Number of conductors：Single conductor 3) Size：240 mm2 (Hawk) 2. Damper 3. Clamp

No	Item	Specification
		4. Armor rod 5. Others
TL-14	Shield wire	1. Shield wire 2) Size：55 mm^2 2. Damper 3. Clamp 4. Others
TL-15	Insulator	1. Insulator 2. Arc horn 3. Others

(9) Procedures of Project Implementation

In order to reduce outage time as much as possible, it is necessary to carry out the construction of these substations (S/S) and transmission lines (T/L) while switching over the connection of the grid. The steps of these works are shown below.

Abbreviations

MG: Morogoro S/S, LG: Luguruni S/S, UB: Ubungo S/S, MB: Mabibo S/S, IL: Ilala S/S, KN: Kinyerezi power station (PP), —: Energized

Step 0; Current Network

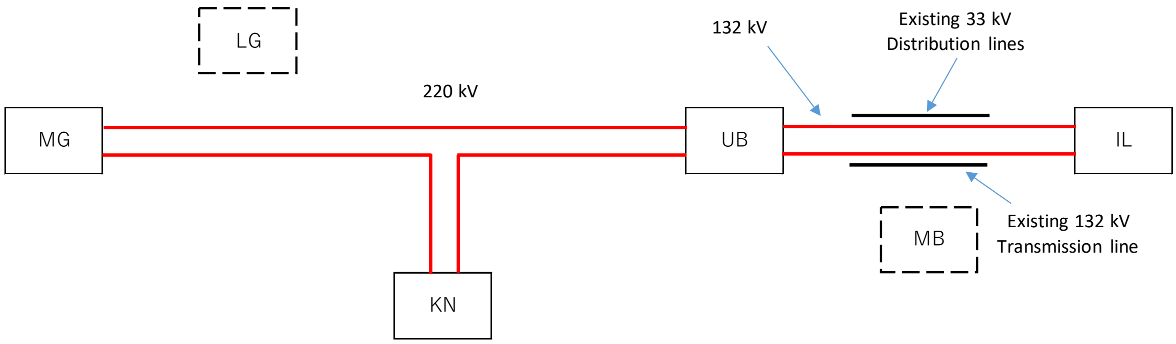


Figure 2-2-2-5.7 Procedures of Project Implementation: Step 0

Step 1. Construction of Ruguruni S/S (by Tanzania side)

Luguruni S/S is constructed by Tanzania side to secure a circuit to deliver the power from Kinyerezi PP toward Ubungo S/S.

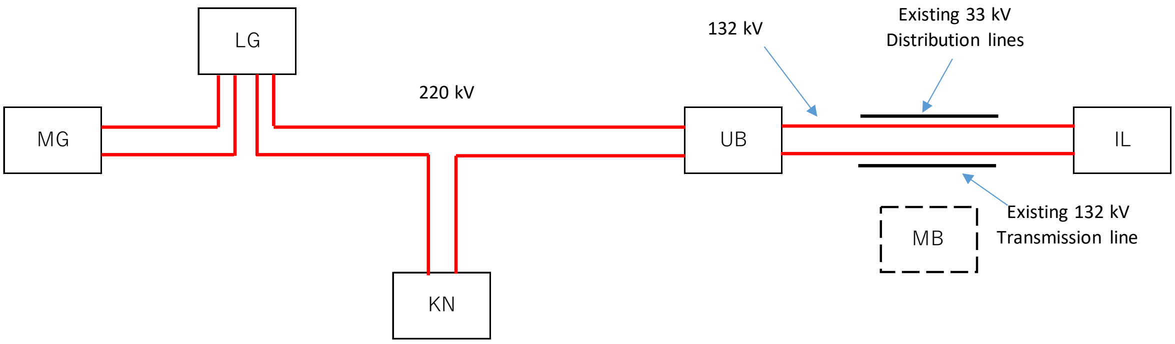


Figure 2-2-2-5.8 Procedures of Project Implementation: Step 1

Step 2a. Works by Tanzania side (1)

The following works should be carried out by Tanzania side to expand 220 kV feeder bay (1 bay) at Ubungo S/S.

- Conversion of 132 kV FZ-III & Simbion overhead lines into 132 kV underground cables
- Relocation of buried high pressure gas piping (pending)
- Development of Ubungo S/S site for 220 kV 1 bay expansion

In addition to the above, the existing 132 kV transmission line and 33 kV distribution lines at the proposed Mabibo S/S site should be removed by Tanzania side.

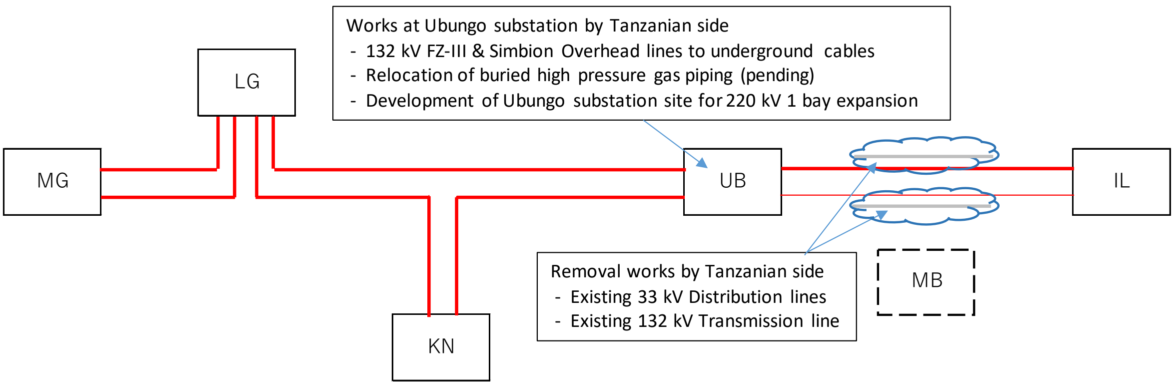


Figure 2-2-2-5.9 Procedures of Project Implementation: Step 2a

Step 2b. Works by Tanzania side (2)

At the T-branch point of the transmission line route from Kinyerezi PP to Ubungo S/S, a bypass circuit tower will be constructed by Tanzania side in order to construct a new triple circuit transmission line from the T-branch point to Ubungo S/S. This will ensure the transmission of power from Kinyerezi PP to Ubungo S/S via Luguruni S/S and allow the removal of the existing 220 kV transmission line (1 line) from T-branch point to Ubungo S/S.

Moreover, at Mabibo S/S site, temporary bypass towers will be installed by Tanzania side to bypass the existing 132 kV T/L over the proposed Mabibo S/S site.

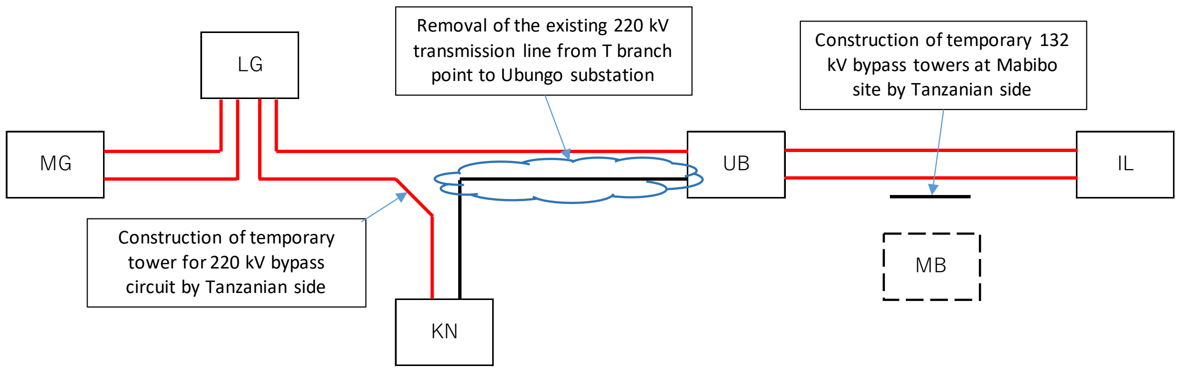


Figure 2-2-2-5.10 Procedures of Project Implementation: Step 2b

Bids of the project can be publicly announced after the completion of the works above.

<u>Step 3a; Temporary 132 kV bypass circuit at Mabibo site (1)</u>

At the proposed Mabibo S/S site, a temporary 132 kV bypass line (Step 2b above) prepared by Tanzania side will be used to temporarily secure power between Ubungo S/S and Ilala S/S on a one circuit basis. (See diagram below)

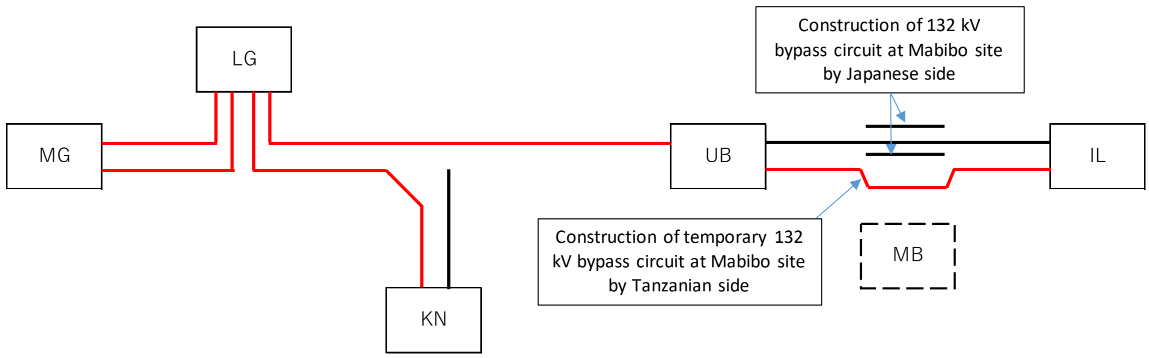


Figure 2-2-2-5.11 Procedures of Project Implementation: Step 3a

<u>Step 3b; Temporary 132 kV bypass circuit at Mabibo site (2)</u>

Thereafter, 132 kV bypass circuits (double circuits) should be constructed by Japan side, and the temporarily installed bypass circuit should be removed by Tanzania side. After this step, the obstruction at the planned Mabibo S/S site is removed and the construction of Mabibo S/S can be started.

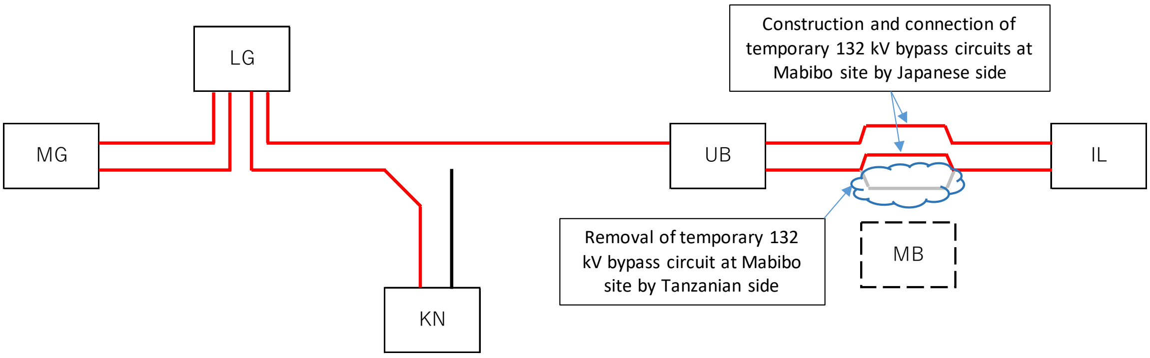


Figure 2-2-2-5.12 Procedures of Project Implementation: Step 3b

<u>Step 4. Construction of Mabibo S/S and other works by Japan side</u>

Having completed up to Step 3 and secured the route from Kinyerezi PP to Ilala S/S through Ubungo S/S, the main works by Japan side of the project can be started, as described below.

- Construction work of Mabibo S/S

  Note) One (1) line of 33 kV distribution line from TANESCO should be connected to Mabibo S/S and be used as a backup for the AC power supply in the substation.
- Expansion work of 1 x 220 kV feeder bay at Ubungo S/S
- Construction work of 220 kV triple circuit T/L from T branch point to Ubungo S/S
- Construction work of 220 kV double circuit T/L from Ubungo S/S to Mabibo S/S

In addition, the main switchgear equipment of the 220 kV Ubungo line at Kinyerezi switchyard should be replaced (1,600 A → 2,500 A), since 220 kV T/L from the Kinyerezi PP to Ubungo S/S is out of service. (Blue line in the figure below)

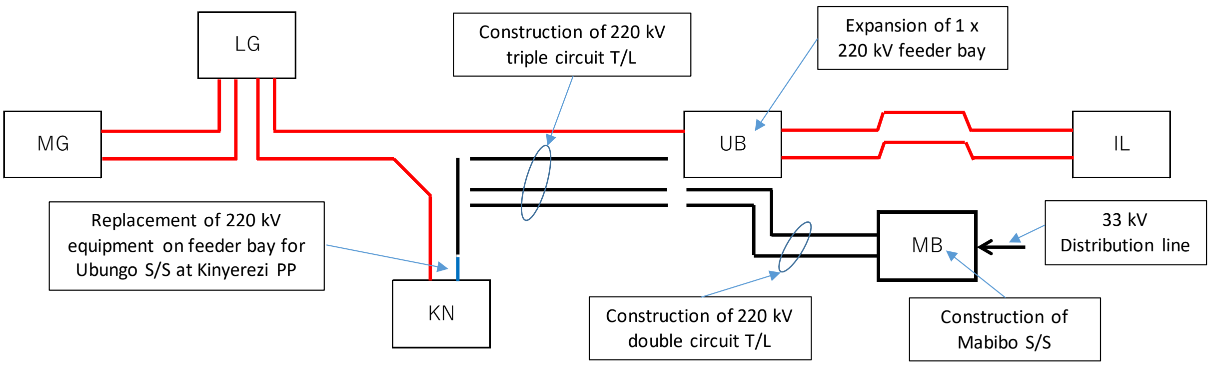


Figure 2-2-2-5.13 Procedures of Project Implementation: Step 4

Step 5. Changeover of the Circuit (temporary)

After the construction of Mabibo S/S and other works are completed in Step 4, a temporary changeover of the Network is performed to restore the bypass circuit at the T-branch point to its original connection, as shown in the figure below, to ensure power transmission from Kinyerezi PP to Ubungo S/S.

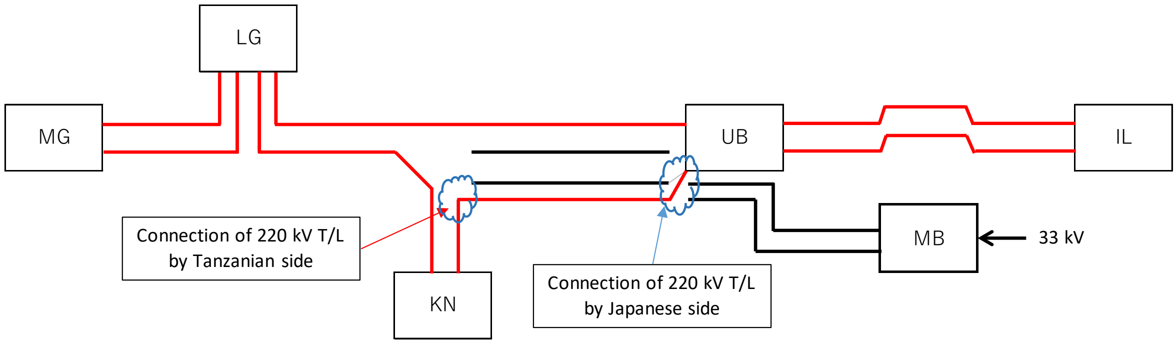


Figure 2-2-2-5.14 Procedures of Project Implementation: Step 5

Step 6a. Preparation works for Final Network (1)

Since the route from Kinyerezi PP to Ubungo S/S has been secured, the bypass circuit from Kinyerezi PP to Luguruni S/S can be shut down and the removal of the bypass towers at the T-branch can be carried out by Tanzania side. At the same time, the main switchgear equipment of Kinyerezi PP switchyard for Luguruni S/S line should be replaced, as same as described in Step 4.

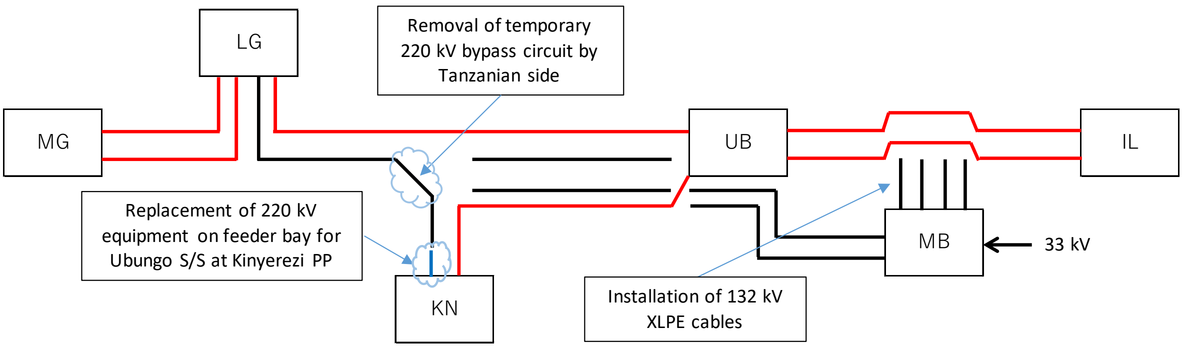


Figure 2-2-2-5.15 Procedures of Project Implementation: Step 6a

In addition, 132 kV XLPE cables should be installed at Mabibo substation to cut in to the 132 kV double circuits between Ubungo S/S and Ilala S/S.

Step 6b. Preparation works for Final Network (2)

The original connection is then made at the T-branch point by Tanzania side. This results in the system shown in the figure below.

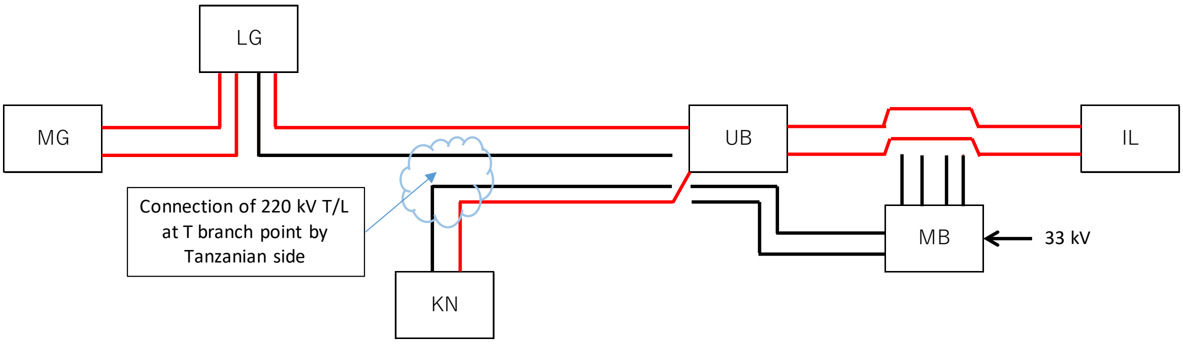


Figure 2-2-2-5.16 Procedures of Project Implementation: Step 6b

Step 7. Changeover to Final Network

As shown in the figure below, the connection at Ubungo S/S should be re-connected to the other line from Kinyerezi PP, and the transmission line that was previously connected to Ubungo S/S should be connected to the transmission line to Mabibo S/S. The transmission line from Luguruni S/S should then be re-connected to the existing 220 kV bay at Ubungo S/S by Tanzania side to form the final network.

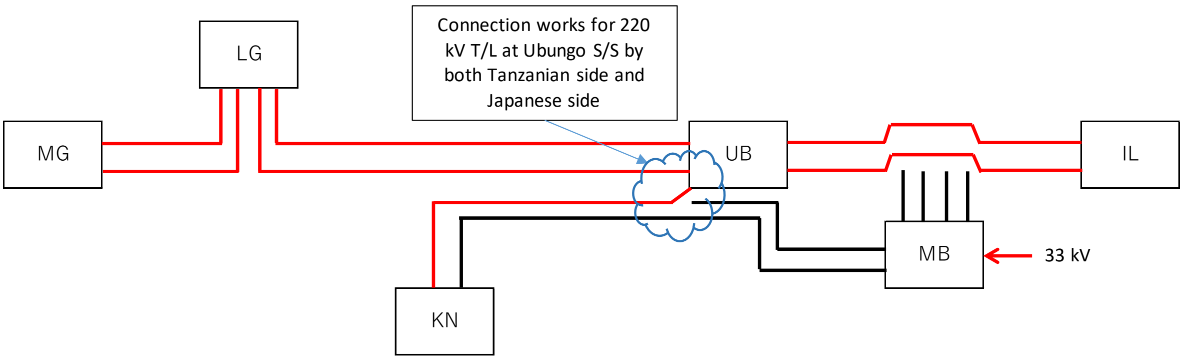


Figure 2-2-2-5.17 Procedures of Project Implementation: Step 7

Step 8. First Energization of Mabibo S/S

After Mabibo S/S has been constructed and all testing has been completed, the first energization of power from the Kinyerezi PP can be done.

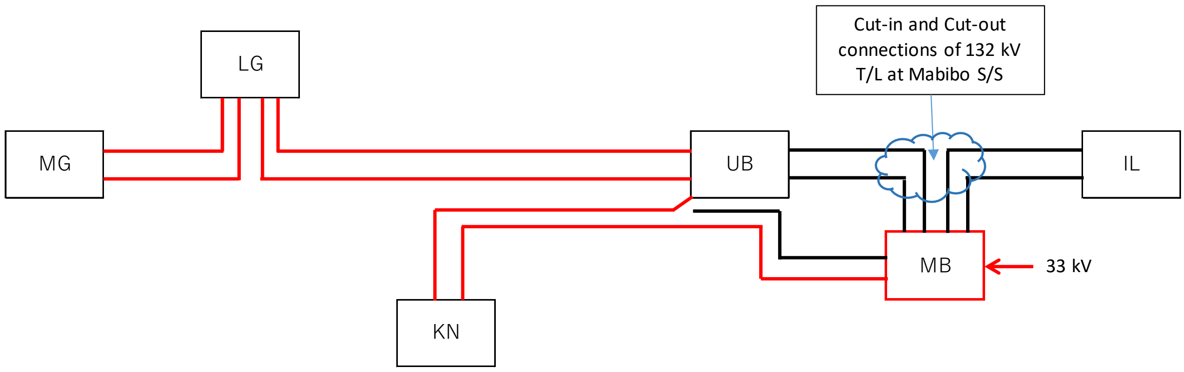


Figure 2-2-2-5.18 Procedures of Project Implementation: Step 8

Step 9. Final connection of 132 kV circuits at Mabibo S/S

The 132 kV cable installed in step 6 should be cut in to the existing 132 kV transmission lines. Consequently, the routes for delivering power from Mabibo S/S to both Ubungo S/S and Ilala S/S can be secured.

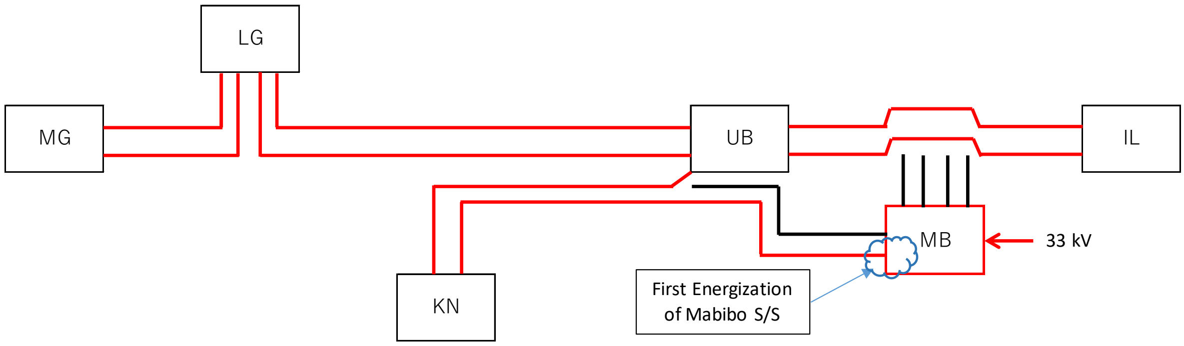


Figure 2-2-2-5.19 Procedures of Project Implementation: Step 9

Step 10. Completed

Finally, 132 kV transmission lines are energized and all works are completed.

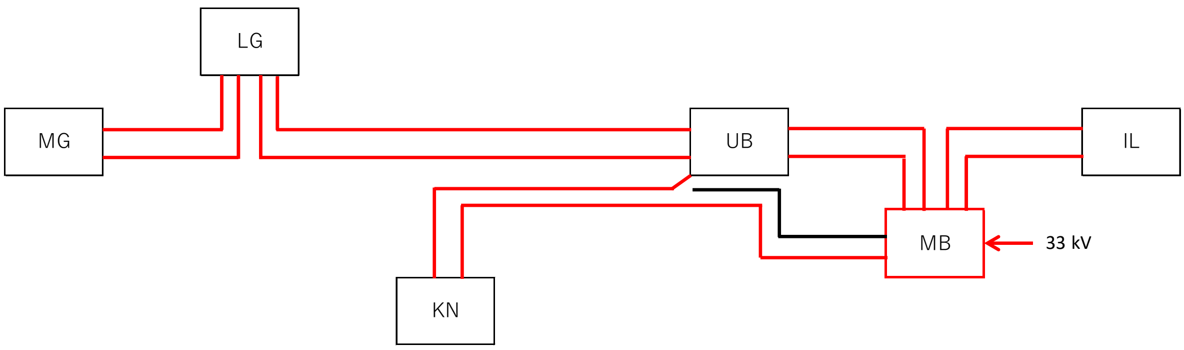


Figure 2-2-2-5.20 Procedures of Project Implementation: Step 10

2-2-3 Outline Design Drawings

The project outline design drawings are given in Appendix-6.

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

As the project will be implemented based on the Japan grant aid cooperative framework, it will be approved by the Japanese Government and commence after an Exchange of Notes (E/N) between the two countries and a Grant Agreement (G/A) between JICA and Tanzania are exchanged. Basic policy and special considerations needed if the project is implemented are given below.

(1) Project Implementing Body

The supervisory responsible agency for implementing the project on Tanzania side is the MOE. The project implementing body responsible for O&M after the facilities go into service is TANESCO. So that the project will progress smoothly, MOE, TANESCO and TANESCO must appoint project representatives to stay in close contact and negotiate with the Japanese consultant and contractor.

The appointed TANESCO project representative must explain project details sufficiently to MOE and TANESCO project staff and project area residents so that they will cooperate with project implementation.

(2) Consultant

Japanese consultants will enter a design and supervision agreement with TANESCO to procure and install equipment for the project, and produce detailed design and supervise construction work related to the project. Along with drafting tender documents, consultants will handle bidding on behalf of TANESCO, the project implementing body.

(3) Contractor

In accordance with Japan grant aid framework, independent Japanese contractors selected by Tanzania through open bidding will build, procure and install equipment for the project.

Contractors will need to continue supplying spare parts, support for failures, and other services after the project is completed, and as such must give due consideration to a post-delivery communication and coordination for equipment and facilities.

(4) Need for Dispatching Engineers

This project is complex, combining construction of substations with civil engineering, construction and installation of substation facilities in Mabibo area, as well as construction work on approximately 9.0 km of 220 kV transmission line and 0.5 km of 132 kV transmission line. Construction will also require coordination with TANESCO, which manages the operation of the transmission/ distribution facilities which need to be linked. With the majority of the work being done concurrently, it is essential that foremen familiar with the Japanese grant aid system be dispatched from Japan to keep management and site guidance for the whole works consistent in terms of scheduling, quality, finished forms and safety management.

2-2-4-2 Implementation Conditions

(1) Tanzania Construction Conditions and Technology Transfers

As explained in Section 2-2-1-4 above, there are multiple general construction and electrical contractors in Dar es Salaam area which can accept orders for laborers, transportation vehicles and construction equipment within Tanzania, as well as facility and transmission line construction work for the project. However, dispatching Japanese engineers is essential in terms of schedule management, quality control and safety management.

(2) Use of Local Equipment and Materials

In Tanzania, while aggregate, cement, rebar and other materials for use in foundation work must be managed for quality and timely delivery, there is much precedent showing that these materials can be procured locally, as well as examples of locally procured material. Thus, in the interest of developing local industries, equipment can be procured locally is to be used to the extent possible when formulating the construction plan. However, as Tanzania relies on imports for the substation facilities and power transmission equipment needed for the project, such equipment will be procured in Japan or another country.

(3) Safety Measures

In Tanzania, with Tanzania having relatively few safety problems and the project being in an urban area, the area has good access and will be easy to monitor. Still, work after sunset is to be avoided, and sufficient care must be taken to prevent equipment theft and ensure the safety of construction staff.

(4) Tax Exemption

The Tanzanian exemption procedure (including VAT) for equipment and materials procured for the Project is as follows: 1) the Contractor requests TANESCO to exempt the materials, 2) TANESCO requests the Ministry of Finance to issue a tax exemption letter via MOE, 3) the Ministry of Finance issues the tax exemption letter to customs, with a tax exemption letter to customs, with a copy issued to MOE and the Contractor. When procured equipment and materials arrive at port in Tanzania, the Contractor is required to attach the above copy of the tax exemption letter with the given shipping documents to be submitted to customs for the tax exemption. Care must be taken that tax exemption delays do not impact project progress.

2-2-4-3 Scope of Works

The Japan side will procure, install, test and adjust the 220/132 kV substation, 220 kV transmission lines and 132 kV distribution lines for the project in the Japanese and Tanzania construction scopes and perform the necessary civil engineering work. Tanzania side will be responsible for site acquisition of the substations, removal of the 220 and 132 kV transmission lines, etc.

2-2-4-4 Consultant Supervision

According to Japan's grant aid system, consultants are to form a project team consistent with the final design and construction supervision based on the spirit of the basic design and smoothly completes the work. This project requires complex work on the substation facilities and transmission lines, with many connections to the existing substation facilities and monitoring based on on-site coordination with TANESCO. As such, the consultant is to station at least one engineer on site to handle overall schedule management, quality control, progress control and safety control during the construction supervision stage. Other engineers will also be dispatched to manage contractor progress with equipment installation, commissioning and adjustments, delivery testing and other work. As necessary, a domestic expert is to witness factory inspections and pre-shipment inspections for equipment manufactured domestically, and also supervise to prevent problems after unloading equipment at the site.

(1) Basic Policy for Construction Management

As basic policy, consultants are to supervise progress such that the work is completed within the given construction period. Along with ensuring equipment is delivered on time up to the quality and finished forms given in the agreement, they are to supervise and advise contractors so that they can perform the work safely at the site. The following are the main points to be kept in mind for construction supervision.

(2) Schedule Management

Consultant management staff will compare actual progress against the work schedule planned at time of contract monthly and weekly so that contractors will keep the delivery schedule given in the contract. If they interpret work to be behind schedule, they will warn contractors and request them to submit and implement plans to get back on schedule, and guide contractors so they can complete the work and deliver equipment within the contract construction period. The following items will be compared between work schedule and project progress:

- Work progress - progress of equipment and material manufacturing and site civil engineering and construction
- Equipment and material transport to site – equipment and materials for substation, power transmission equipment, civil engineering and construction
- Temporary works and readiness of construction machinery
- Productivity and actual numbers of engineers, skilled workers, laborers and other workers

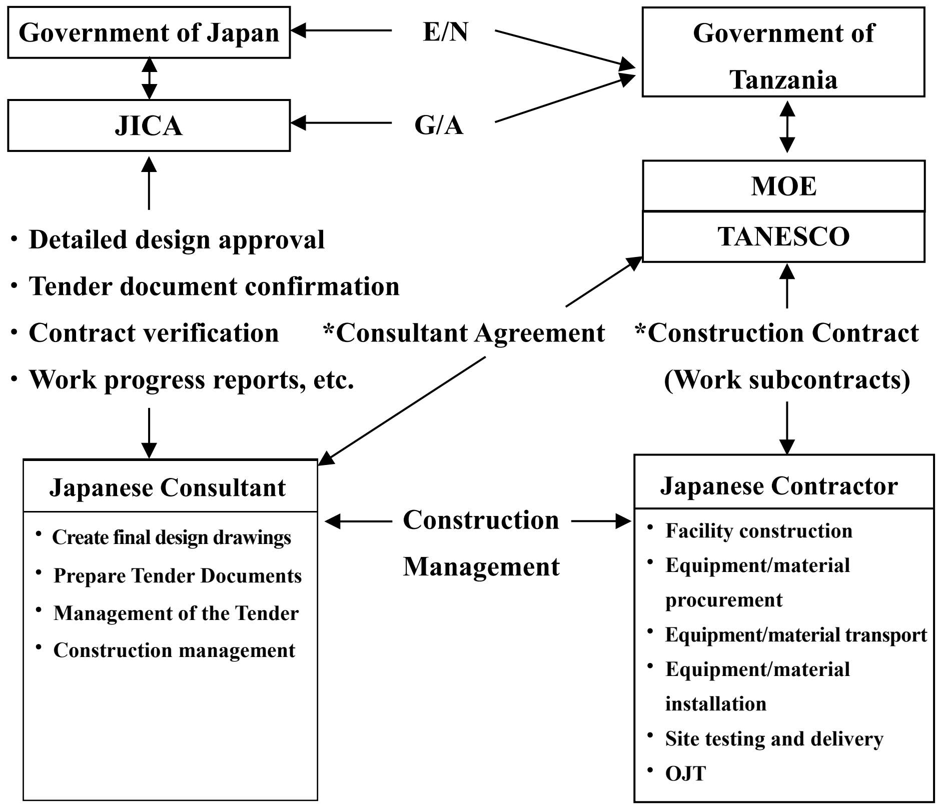
(3) Quality and Work Progress Control

Consultant supervisory staff will consult and work together with the contractor's representative, and manage work safely to prevent any occupational accidents on the site during the construction period or accidents involving third parties. The following actions are to be taken in terms of site safety management:

- Establish safety management regulations and select a safety manager
- Prevent disasters through regular inspection of construction machinery
- Decide a service route for transport machinery and other work vehicles, and ensure safe driving
- Strictly insist workers take advantage of worker benefits and take leave

(4) Overall Relationships concerning Project Implementation

Role correlations for the project, including those during construction supervision, are as shown in Figure 2-2-4-4.1.



*JICA shall verify Consultant Agreement and Construction Contract

Figure 2-2-4-4.1 Project Relation Diagram

(5) Construction Managers

The contractor will procure and deliver equipment and materials for new substation construction work on the existing substation grounds and 220 kV transmission line work, as well as the related civil engineering work. Further, they will subcontract local Tanzania contractors to perform the work. Accordingly, the contractor is required to ensure subcontractors fully comply with the work schedule, quality, finished form and safety measures given in the work contract. To accomplish this, contractors will deploy engineers with experience in similar overseas work to guide and advise local contractors.

Given the scale and details of the substation facility and transmission line work for this project, contractors will preferably station at least the number of engineers given in Table 2-2-4-4.1.

Table 2-2-4-4.1 Engineers to be dispatched by the Contractor

Title of engineers	Number of engineers	Responsibilities	Dispatch period
Inspector 1	1	Confirmation and verification of shop drawings for Transmission equipment, pre-shipping inspection, equipment test, etc.	Drawing approval period
Inspector 2	1	Confirmation and verification of shop drawings for Substation equipment, pre-shipping inspection, equipment test, etc.	Drawing approval period
Local procurement supervisor 1	1	Supervision of all installation works, coordination with related agency, acquisition of approval, equipment and materials procurement management after customs clearance procedures, labor management, accounting, security management	Throughout the construction and installation period
Local procurement supervisor 2	1	Supervision of equipment material for Transmission/distribution, coordination with related agency, acquisition of approval, labor management, accounting, security management	Transmission line works period
Local procurement supervisor assistant	1	Assistance to the Local procurement supervisor	Throughout the construction and installation period

2-2-4-5 Quality Control Plan

Consultant construction supervisory staffs are to supervise and verify that the contractors are maintaining quality, construction and installed forms for equipment procured for the project up to the quality and finished forms given in the contract documents, including technical specifications and detailed design drawings. Staff will request contractors to correct, change or revise the work if quality or finished form is in danger of being compromised.

a) Verify fabrication drawings and specifications for equipment
b) Witness factory inspections for equipment or verify inspections
c) Verify packaging, transportation and temporary placements on site
d) Verify working drawings and installation manual procedures for equipment
e) Verify equipment commissioning, adjustment, testing and inspection reports
f) Supervise site installation of equipment and witness commissioning, adjustments, tests and inspections
g) Verify equipment working drawings, fabrication drawings, and finished forms
h) Verify construction drawings, fabrication drawings, and on-site progress

2-2-4-6 Procurement Plan

As the equipment and materials for the substation facilities to be procured and installed in the project are not manufactured in Tanzania, the substation, switchboard and other power distribution facilities for Tanzania will be procured from mostly European and Japanese sources. While Indian and Chinese products have recently started being introduced into TANESCO substation facilities, Japanese and European equipment are more reliable.

Tanzania companies such as TANESCO, the company who will handle O&M after the project facilities enter service, hold Japanese products in particularly high TANESCO standard. Japanese substation and power transmission/distribution equipment procured in past Japanese grant aid projects is still operating soundly after more than 10 years in service, contributing to this opinion. TANESCO has also come to rely on the benefits of the high quality and follow-up service of Japanese manufacturers throughout the O&M process. Thus, the implementing body TANESCO strongly desire Japanese products to be used for key project equipment.

Given the above, the suppliers for equipment and materials used in this project are as follows.

(1) Locally Procured Equipment and Materials

Construction equipment/materials: Cement, sand, concrete aggregate, concrete roadblocks, brick, rebar, wood, gasoline, diesel, construction vehicles, cranes, trailers and other temporary work equipment/materials.

(2) Equipment and Materials Procured in Japan

1) Substation Facility Equipment and Materials

220 kV switchgears, 132 kV switchgears, DC equipment, etc.

2) Transmission Line Equipment and Materials

220 kV and 132 kV Transmission line equipment and materials: conductors, etc.

(3) Equipment and Materials to be procured from Japan or other DAC and ASEAN countries

220/132/33 kV Transformers, cables, 220 kV and 132 kV Transmission line towers, etc.

2-2-4-7 Operational Guidance Plan

As basic policy, a trainer from the manufacturer will give guidance on initial operation and O&M methods for the equipment procured in the project before the work is completed as OJT and in accordance with the O&M manuals. To keep this guidance plan progressing smoothly, TANESCO must appoint a full-time engineer to attend the OJT and keep close contact with Japanese consultants and contractors. The appointed TANESCO engineer must build up the skill level of staff unable to attend and work to improve TANESCO maintenance abilities. Also, specialist manufacturer engineers of moderate skill level are needed for substation facility operations as well as adjustments and testing for transmission line equipment, so local contractors cannot be used. Engineers must be sent from Japan to fulfill these roles and handle quality control, technical guidance and schedule management.

2-2-4-8 Implementation Schedule

Based on the Japan's Grant Aid Scheme, the Project implementation schedule is given in Figure 2-2-4-8.1.

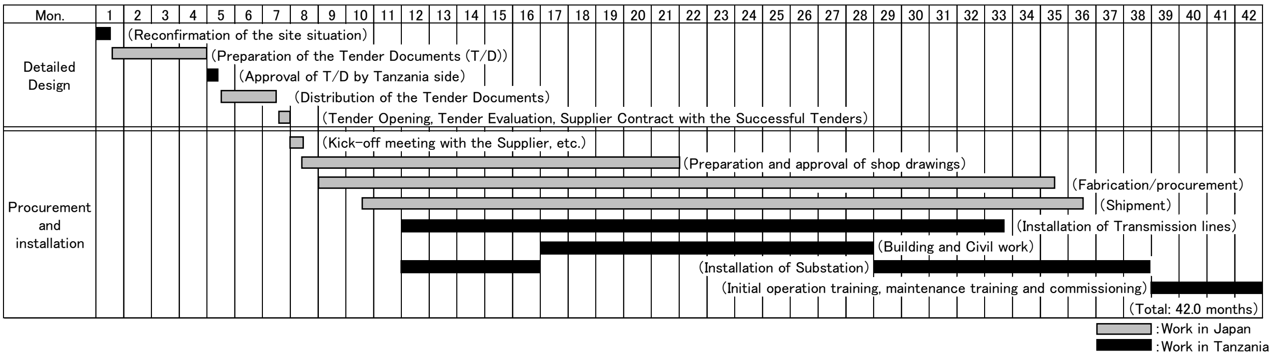


Figure 2-2-4-8.1 Project Implementation Schedule

2-3 Obligations of Recipient Country

Detailed scopes for the Japanese and Tanzania sides are as shown in Table 2-3.1.

Table 2-3.1 Undertakings to be covered by Japan and Tanzania

No.	Work Items	Japan Side		Tanzania Side		Deadline
		Procurement	Installation	Procurement	Installation	
1.	Mabibo substation					
1.1	Before notice of tender					
(1)	Land acquisition, cutting trees and clearance of obstacles			●	●	Including Pan-African gas piping
(2)	Access road to the project sites			●	●	
(3)	Temporary storage yard for equipment and materials			●	●	
1.2	During the Project Implementation					
(1)	Cutting trees and clearance of obstacles (if necessary)			●	●	
(2)	Access road to the project sites (if necessary)			●	●	
(3)	Site leveling (Land development)	●	●			
(4)	Gate and fence (temporary)	●	●			
(5)	Road and parking lot in the site	●	●			
(6)	Building work of the substation (including control room, support structure, steel gantry, foundations and other related work for building)	●	●			
(7)	220 kV switchgear	●	●			
(8)	220/132 kV transformers	●	●			

No.	Work Items	Japan Side		Tanzania Side		Deadline
		Procurement	Installation	Procurement	Installation	
(9)	Auxiliary transformers	●	●			
(10)	132 kV switchgear	●	●			
(11)	33 kV power supply to Mabibo substation site			●	●	- For substation use - Including 33 kV poles, cables, arresters, etc.
(12)	Control and protection equipment	●	●			
(13)	110 V DC battery and charger	●	●			
(14)	48 V DC battery and charger	●	●			
(15)	Uninterruptible Power Supply (UPS)	●	●			
(16)	Communication equipment inside substation	●	●			
(17)	Power cables (XLPE)	●	●			
(18)	Control cables	●	●			
(19)	Grounding works	●	●			
(20)	TANESCO's standard Wh-meter		●	●		
(21)	Protection Relay setting confirmation and change of the substations where the transmission lines from Mabibo substation to be interconnected (Kinyerezi, Ubungo and Ilala substations) *: If replacement of protection relays is necessary, Japan side will procure new relays for existing substations and installation shall be undertaken by Tanzania side, under the supervision of Japan side.	(●)*	(●)*	(●)*	●	
(22)	Modification of SCADA System of GCC and Network Management system for accommodation of Mabibo substation			●	●	
(23)	Spare parts	●				
(24)	Maintenance tools	●				
(25)	Technical training for equipment		●			
1.3	After the Project					
(1)	Gate and fence (Permanent)	●	●			
2	220 kV Transmission line					
2.1	Before notice of tender					
(1)	Land acquisition, cutting trees and clearance of obstacles			●	●	Including removal of gas pipe line, water pipe line, optical cable, distribution line etc.
(2)	Access road to the project sites			●	●	
(3)	Temporary storage yard for equipment and materials			●	●	

No.	Work Items	Japan Side		Tanzania Side		Deadline
		Procurement	Installation	Procurement	Installation	
(4)	To complete Luguruni substation with additional 220 kV bays for 220 kV Kinyerezi – Luguruni line			●	●	
(5)	To shift the 220 kV Kinyerezi – Morogoro line to a temporary tower nearby T-off point (including installation work of the temporary tower) including OPGW and/or ADSS			●	●	Including foundation etc.
(6)	To demolish the existing towers of 220 kV Kinyerezi – Ubungo line (No. 792 - No. 805) including OPGW and/or ADSS			●	●	Including foundation etc.
(7)	Power outage				●	
(8)	Connecting work of 220 kV transmission line (T15) to existing Ubungo substation	●	●	●	●	Including materials, etc. between Ubungo substation and T15
(9)	Connecting work of 220 kV transmission line (T22) to Mabibo substation	● (1 line)	● (1 line)	● (1 line)	● (1 line)	Including materials, etc. between Mabibo substation and T22
2.2	During the Project Implementation					
(1)	Cutting trees and clearance of obstacles (if necessary)			●	●	
(2)	Access road to the project sites (if necessary)			●	●	
(3)	Site leveling (Land development)	●	●			
(4)	Gate and fence (temporary)	●	●			
(5)	Steel towers and foundations	●	●			
(6)	Overhead conductor	●	●			
(7)	Overhead grounding wire (including OPGW)	●	●			
(8)	Connection box for OPGW	●	●			
(9)	Power outage				●	
(10)	Removal work of the existing conductor, grounding wire, accessories, steel tower and foundation etc. (if necessary)				●	
(11)	To shift the 220 kV Kinyerezi – Morogoro line from a temporary tower to newly installed towers			●	●	
2.3	After the Project					
(1)	Fence for a dead end tower (permanent)	●	●			
3.	132 kV Transmission line					
3.1	Before notice of tender					
(1)	Land acquisition, cutting trees and clearance of obstacles			●	●	Including removal of gas pipe line, water pipe line,

No.	Work Items	Japan Side		Tanzania Side		Deadline
		Procurement	Installation	Procurement	Installation	
						optical cable, distribution line etc.
(2)	Access road to the project sites			●	●	
(3)	Temporary storage yard for equipment and materials			●	●	
(4)	To build modular, temporary bypass single circuit 132kV towers near T19 and T20 and string single circuit from T21 to T18 for Ubungo – Ilala 132kV lines to allow the construction of dead end towers and stringing conductors by the Japan side.			●	●	
(5)	Power Outage				●	
3.2	During the Project Implementation					
(1)	Cutting trees and clearance of obstacles (if necessary)			●	●	
(2)	Access road to the project sites (if necessary)			●	●	
(3)	Site leveling (Land development)	●	●			
(4)	Gate and fence (temporary)	●	●			
(5)	Steel towers and foundations (NT19 and NT20)	●	●			
(6)	Overhead conductor	●	●			
(7)	Underground cable (temporary)	●	●			
(8)	ADSS cable (temporary)			●	●	
(9)	Overhead grounding wire	●	●			
(10)	Power outage				●	
(11)	Removal work of the existing conductor, grounding wire, accessories, steel tower and foundation etc. (if necessary)				●	
(12)	Replacement, connection or reconnection of the existing lines (towers, etc.)			●	●	
~~(13)~~	~~To demolish the existing 132 kV conductor between No. 20 and No. 19~~				~~●~~	
(13)	To demolish the existing towers (No. 19) on 132 kV Ubungo – Ilala line	●	●			Including foundation etc.
(14)	Connection of lines from new dead-end tower (No. NT19/ NT20) to the towers (No. 18/No. 20) on 132 kV Ubungo – Ilala line	●			●	
(15)	To demolish modular, temporary bypass single circuit 132 kV towers near NT 19 and NT 20			●	●	
(16)	Technical training for equipment		●			
3.3	After the Project					

No.	Work Items	Japan Side		Tanzania Side		Deadline
		Procurement	Installation	Procurement	Installation	
(1)	Fence for dead end towers (permanent) (if necessary)	●	●			
4.	Ubungo Substation (one bay expansion)					
4.1	Before notice of tender					
(1)	Expansion of 220 kV substation site			●	●	
(2)	To switch the existing 132 kV Factory zone III and Symbion feeders from overhead to underground cables which fall under the expansion area			●	●	
(3)	To divert the existing high pressure gas piping of Songas from the expansion area in order to secure the safety of construction work for 220 kV switchgear expansion			●	●	**Pending**
4.2	During the Project Implementation					
(1)	220 kV switchgear	●	●			
(2)	Equipment test of 220 kV switchgear		●			
(3)	Control and protection equipment	●	●			
(4)	Communication equipment inside substation	●	●			
(5)	Modification of micro SCADA system in Ubungo substation				●	
(6)	Low voltage power and control cables	●	●			
(7)	Grounding works	●	●			
(8)	TANESCO's standard Wh-meter		●	●		
(9)	Protection Relay setting confirmation and change of the substations where the transmission lines from Ubungo substation to be interconnected (Kinyerezi power station) *: If replacement of protection relays is necessary, Japan side will procure new relays for existing substations and installation shall be undertaken by Tanzania side, under the supervision of Japan side.	(●)*	(●)*	(●)*	●	
(10)	Modification of SCADA System of GCC and Network Management system for accommodation of Ubungo additional bay			●	●	
(11)	AC/DC power supply for 220 kV switchgear and new associated panels			●	●	
5.	Substation in Kinyerezi power station (replacement of 220 kV switchgear equipment for 2 x transmission line feeders)					
(1)	220 kV switchgear	●	●			
(2)	Equipment test of 220 kV switchgear		●			
(3)	Adjustment of SCADA system in the power			●	●	

No.	Work Items	Japan Side		Tanzania Side		Deadline
		Procurement	Installation	Procurement	Installation	
	plant (CT ratio needs to be changed)					
(4)	Adjustment of transmission line relay settings and busbar protection *: If replacement of protection relays is necessary, Japan side will procure new relays for Kinyerezi power station and installation shall be undertaken by Tanzania side, under the supervision of Japan side.	(●)*	(●)*	●	●	
(5)	Adjustment of Watt-hour meters (CT ratio needs to be changed)			●	●	
(6)	Interlock test of whole substation			●	●	
6.	Other					
(1)	To bear the cost of fiscal levies such as overload surcharge for transporting heavy equipment, registration fees for Engineers Registration Board (ERB), and Contractors Registration Board (CRB)			●	●	

Notes: Item with sign "●" indicate the country of parties responsible.

2-4 Project Operation Plan

2-4-1 Basic Plan

Proper O&M for the transmission and substation facilities, as well as preservation of their surrounding environments, are essential to improving consumer trust in power supply in the project area and steady power supply management. As such, appropriate preventative maintenance is recommended to reduce the rate of facility accidents and improve trust, safety and efficiency levels. The basic concepts for transmission and substation facility maintenance are shown in Figure 2-4-1.1. Prevention must be the focus for maintenance of equipment and facilities procured, installed and built for the Project.

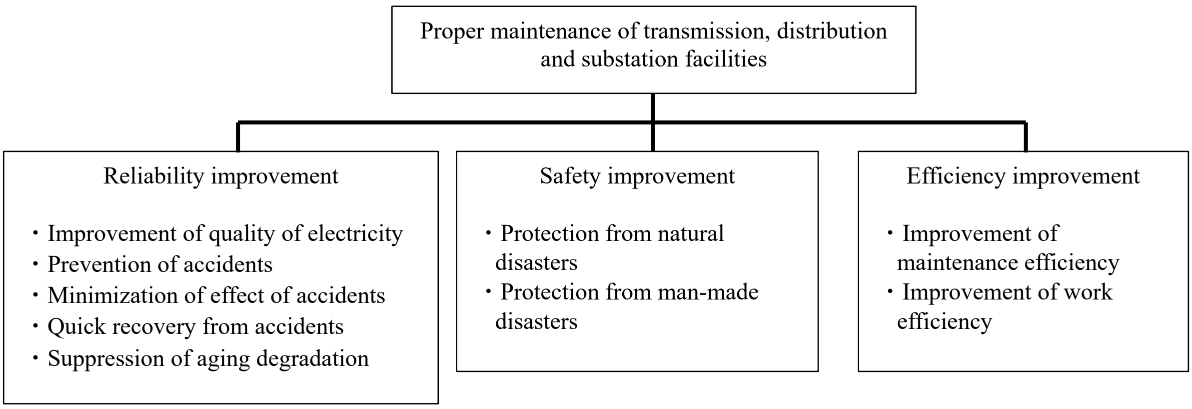


Figure 2-4-1.1 Basic Concepts for Substation and Transmission Facility Maintenance

In the Project, engineers dispatched by the Japanese contractor are planned to train local engineers in O&M for the substation and transmission facilities during installation and the testing and adjustment periods. The fruits of this OJT can be fully reaped by also having the Japan side furnish the necessary spare parts, tools for testing and maintenance, and O&M manuals, and establishing an O&M system after services have started.

2-4-2 Operation and Maintenance Structure

2-4-2-1 Routine Inspection for Substation Facilities and Periodic Inspection Items

The standard regular inspection items for the substation facilities to be procured and installed in the project are given in Table 2-4-2.1. As given in the table, inspections for the above facilities are classified as follows;

1) Daily inspections, which involve a sensory check to detect abnormal heat, sounds and smells from the equipment,
2) Regular inspections, which check equipment for loose bolts, surface dirt or damage on insulation and other energized parts, not checked on daily inspections, and
3) Detailed inspections, which include functional checks of interlock mechanisms between devices, and precision maintenance of instrumentation.

In general, regular inspections are conducted once every one to two years, and detailed inspections are conducted once every four years. Switchboard internal fuses, metering, relays and other components with deteriorating performance, reduced insulation, contact wear or characteristic changes, should be replaced as appropriate on regular and detailed inspections upon confirming component qualities and frequency of use.

Table 2-4-2-1.1 Inspection Items for Standard Facility Equipment

Inspection Items	Details of Inspection (Method)	Daily	Regular	Detailed
Visual Appearance	State of switch indicators and display lights	○	○	
	Abnormal noise and/or smells	○	○	
	Overheat and discoloration of terminal	○	○	
	Cracking, damage or staining of bushings and porcelain	○	○	
	Rust on mounting cases, frame, etc.	○	○	
	Abnormal heat (temperature gauge)	○	○	
	Clamping of bushing terminal (mechanically checked)	○	○	
Operating Devices and Control Panel	Display conditions on measuring instruments	○	○	○
	Indication on operation counters		○	○
	Dampness, rust or staining on operation box or panel		○	○
	Refilling oil, cleaning		○	○
	Clamping of distributing terminals	○	○	○
	Confirmation of switching display status		○	○
	Air or oil leaks		○	○
	Confirmation of pressures (air, etc.) before/after operation		○	○
	Confirmation of operation meter		○	○
	Rust, deformation and/or damage on springs (maintenance)	○	○	○
	Abnormalities of tightening pins		○	○
	Inspection of auxiliary switches and relays (maintenance)		○	○
	Inspection of DC control power source	○		
Measurement and Test	Measurement of insulating resistance		○	○
	Measurement of contact resistance			○

Inspection Items	Details of Inspection (Method)	Daily	Regular	Detailed
	Breakage of heater wires		○	○
	Operation test of relay		○	○

2-4-2-2 Routine Inspection for Transmission Lines and Periodic Inspection Items

In maintaining 220 kV and 132 kV transmission lines, the most important services provided to consumers are routine inspection patrols of facilities for accidents, damage and breakage, and immediate repair of detected problem areas. Preventive measures are also needed, such as trimming trees when they are threatening to come in contact with the power lines and cause grounding faults or other problems. Below are the main points which should be checked for during routine patrols:

1) Distribution line severance
2) Insulator damage
3) Contact between lines and trees or other obstructions
4) Tower damage
5) Tilted towers

2-4-3 Spare Parts Procurement Plan

2-4-3-1 Spare Parts

Spare parts should be selected on the basis of parts which wear and deteriorate with daily operations and must be replaced regularly. The following spare parts are procured for the project, fulfilling quantities needed for one year.

1) Transformers
2) 220 kV Switchgears
3) 132 kV Switchgears
4) Control and Protection equipment
5) Station power supply equipment
6) Communication equipment

2-4-3-2 Spare parts procurement plan

The Japan side plans to procure the minimum required standard spare parts including consumables for one year for the project. These items are given in Table 2-4-3-2.1. Meanwhile, Tanzania side is responsible for preparing a budget for purchasing necessary replacement parts after one year of the completion of the project.

Table 2-4-3-2.1 Lists of Spare Parts

(pc: piece)

Name of Spare Parts	Quantity
1. Transformer	
1.1 220/132 kV Transformer	
(1) Gasket (complete set)	1 set
(2) Buchholz relay set	1 set
(3) Oil temperature indicator (main tank and conservator)	1 pc each
(4) Oil level indicators (main tank and conservator)	1 pc each
(5) Silica gel for Breathers	200%
2. 220 kV Switchgear equipment	
2.1 Gas density meter	1 pc./bay
2.2 Circuit breaker (CB)	
(1) Closing coil	1 pc
(2) Tripping coil	1 pc
(3) Drive mechanism for CB	1 set
(4) Spring charging motor, if applied	1 set
2.3 Disconnecting Switch (DS) and Earthing Switch (ES)	
(1) Drive mechanism	1 set each
(2) Motor	1 pc each
2.4 Overpressure relief	3 sets
2.5 Set of LV equipment (1 set of each type of Relays, MCCB, lamps, push buttons, 10% of terminal blocks)	1 set
3. 132 kV Switchgear equipment	
3.1 Gas density meter	1 pc./bay
3.2 Circuit breaker (CB)	
(1) Closing coil	1 pc
(2) Tripping coil	1 pc
(3) Drive mechanism for CB	1 set
(4) Spring charging motor, if applied	1 set
3.3 Disconnecting Switch (DS) and Earthing Switch (ES)	
(1) Drive mechanism	1 set
(2) Motor	1 pc each
3.4 Overpressure relief	3 sets
3.5 Set of LV equipment (1 set of each type of Relays, MCCB, lamps, push buttons, 10% of terminal blocks)	1 set
4. Control and Protection	
(1) Protection relay (each type)	1 pc each.
(2) Bay control unit (each type)	1 pc each.
(3) Ethernet switch (each type)	1 pc each
(4) MCCB (each type)	1 pc each
(5) Server	1 set
(6) Fuse (each type)	100%
(7) Meter (each type), if applied	1 pc each.
(8) Auxiliary relay (each type)	1 pc each.
(9) Control and selector switch, if any (each type)	1 pc each.
(10) Test block (each type)	1 pc each
5. Substation Power Supply System Equipment	
5.1 AC Distribution Board	
(1) MCCB (each type)	1 pc each.
(2) Indicating lamp, if any (each type)	100%
(3) Fuse (each type)	100%
(4) Meter (each type)	1 pc each.
(5) Terminal block (3 phases of each size)	1 pc each
5.2 DC Distribution Board	

Name of Spare Parts	Quantity
(1) MCCB (each type)	1 pc each.
(2) Indicating lamp, if any (each type)	100%
(3) Fuse (each type)	100%
(4) Meter (each type)	1 pc each.
(5) Terminal block (2 (P-N) of each type)	1 pc each
5.3 Battery and Charger	
(1) Battery	2 cells each.
(2) Electrolyte for spare batteries	1 lot
(3) Control Card and diode module	1 pc each.
(4) MCCB (each type)	1 pc each
(4) Indicating lamp, if any (each type)	100%
(5) Fuse (each type)	100%
(6) Meter (each type)	1 pc each.
5.4 Uninterruptible power supply system	
(1) Pulse generator	1 pc each.
(2) Thyristor stack	1 pc each.
(3) MCCB (each type)	1 pc each.
(4) Indication lamp (each type)	100%
(5) Fuse (each type)	100%
(6) Meter (each type)	1 pc.each.
6. Communication	
(1) Multiplexer	1 set

Table 2-4-3-2.2 Lists of Maintenance Tools

Maintenance Tool	Quantity
1. Gas filling device	1 set
2. Gas leak detector	1 set
3. Voltage detector for 220/132 kV use	2 set

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

The total cost of the Project will be (confidential) until the verification of the Contractor/Supplier Contract is done.

2-5-2 Operation and Maintenance Cost

TANESCO operates and maintains the existing substations and transmission lines in the project site. TANESCO will be responsible for the operation and maintenance of the substations and transmission lines to be newly constructed in the Project after the commissioning. The four offices such as Kinondoni North office, Ilala office etc. are responsible for operation and maintenance of power facilities in Dar es Salaam. Kinondoni South Office will be mainly responsible for the maintenance of the new substations and transmission lines of the Project after the commissioning. New employment shall be required for Mabibo substation, which will be newly constructed by the Project. The new transmission lines would be handled by the same regional office with the current staff.

Also note that the spare parts and consumables given in Table 2-4-3-2.1 must be stocked at all times in order to operate the new substation properly. This shall require regional offices to budget roughly 0.7 million US dollars (3% of equipment costs) if necessary. Costs for repair and maintenance of TANESCO was roughly 73.7 million US dollars in 2018, and the budget shall cover the O&M costs for the new substation of the Project.

Chapter 3 Project Evaluation

Chapter 3 Project Evaluation

3-1 Preconditions

Acquisition of land for substations, compensation for occupation of land under transmission lines, acquisition of environmental permits for the implementation of projects subject to cooperation, and measures against power outages among others, are preconditions for project implementation, which are outlined below. Tanzania side is proceeding with the necessary procedures, and has experience with Japan's grant aid for similar transmission and distribution facilities in the past. However, it is necessary to monitor so as not to proceed with that procedures again during the implementation stage of the Project.

(1) The land for 220 kV and 132 kV transmission lines is basically used for construction within the existing ROW, but it will be necessary to expropriate part of the private land. Tanzania side will need to obtain ownership permits for the planned construction site from public authorities.

(2) Tanzania side have to obtain permission from the City Planning Department of Dar es Salaam City and land owners for the portion using the right of way (ROW) on the planned route of the 220 kV transmission line.

3-2 Necessary Inputs by Tanzania side

(1) Before the tender announcement

[General]

a) Completion of Environmental Assessment and Issue of EIA Certificate of Authorization

b) Preparation and Implementation of ARAP

c) Land acquisition, cutting trees and clearance of obstacles

d) Access road to the project sites

e) Temporary storage yard for equipment and materials

f) Power outage

[220 kV Transmission line (From Kinyerezi Power Plant (T-off point) to Mabibo Substation)]

g) To complete the construction of Luguruni substation with additional 220 kV bays for Kinyerezi – Luguruni 220 kV transmission lines

h) To shift the 220 kV Kinyerezi – Morogoro line to a temporary tower nearby T-off point (including installation work for the temporary tower) including OPGW and/or ADSS

i) To demolish the existing towers of 220 kV Kinyerezi – Ubungo line (No. 792 - No. 805) including OPGW and/or ADSS

[132 kV Transmission Line (From Ubungo substation to Ilala substation)]

j) To build a modular, temporary bypass single circuit 132 kV tower near T19 and T20 and string a single circuit from T20 to T18 for Ubungo – Ilala 132 kV lines to allow the construction of dead end towers and stringing of conductors by the Japanese side

[Ubungo Substation]

k) Expansion of 220 kV substation site

l) To switch the existing 132 kV Factory zone III and Symbion feeders from overhead to underground cables which fall under the expansion area

m) To divert the existing high pressure gas piping of Songas from the expansion area in order to secure the safety of construction work for 220 kV switchgear expansion (Pending)

(2) During the costruction period

[Mabibo Substation]

a) To schedule both power and communication network shutdown required for construction works for the Project, and implement in timely manner. The Tanzania side shall also manage any issue concerning the shutdown including related procedures, and compensation and grievances from customers.

b) To provide the setting list of protection relays related to the Project for coordination of value setting with new relays to be supplied under the Project. The setting value change at the existing substations where the transmission lines connected from Mabibo substation shall be conducted by the Tanzania side, and necessary tests and their records shall be presented to Japan side.

c) Modification of SCADA System in Grid Control Center (GCC) and Network Management system for accommodation of Mabibo Substation.

d) Modification of the communication system for protection system in the Kinyerezi power plant for Mabibo substation

e) To provide TANESCO's standard Watt hour meters for 220/132 kV transmission lines. The meters will be fitted on metering panels on site by Japan side. (The panel will also be supplied by Japan side)

- 220 kV feeders : 1 piece
- 132 kV feeders : 4 pieces
- Transformer bay : 2 pieces (132 kV side)

(Total 7 pieces)

f) 33 kV power supply to Mabibo Substation site (for inside substation use)

[220 kV Transmission line (From Kinyerezi Power Plant (T-off point) to Mabibo Substation)]

g) To shift the 220 kV Kinyerezi – Morogoro line from a temporary tower to newly installed towers

[132 kV Transmission Line (From Ubungo substation to Ilala substation)]

h) Connection of lines from the new dead-end tower (No. NT19/ NT20) to the towers (No. T18/No. T20) on the 132 kV Ubungo – Ilala line

i) Re-routing of existing ADSS cables between No. T18 and No. T20

j) To demolish modular, temporary bypass single circuit 132 kV towers near NT19 and NT20

k) Removal work of the existing conductor, grounding wire, accessories, steel tower and foundation etc.

[Ubungo Substation]

l) AC/DC power supply for 220 kV switchgear and new associated panels

m) To provide one (1) set of TANESCO's standard Watt hour meter for 220 kV transmission line (Kinyerezi). The meter will be fitted on its new control panel on site by Japan side (New control panel will be provided by Japan side).

(3) After the Project

a) To monitor environmental and social impacts during the operation with an adaptive management approach.

3-3 Important Assumptions

The external conditions assumed for the project to achieve and sustain its results are as follows:

(1) For the overall goal

- National policy on regional electrification does not change
- The government and economy remain stable.

(2) For project objectives

- O&M is performed on a continuous basis.
- Fees are continuously collected, and government support continues.
- Facility security is maintained

(3) For expected outcomes

- Power generation facilities produce sufficient power.
- The O&M plan is implemented.
- Residents (or the government) can cover the connection fees and electricity charges.

3-4 Project Evaluation

3-4-1 Relevance

As shown below, relevance for this cooperation project is judged to be high as it helps to achieve Tanzanian national energy and power policies, and brings benefits to the public facilities and lower-income households in the target area.

(1) Urgency

Power will be developed mainly to ensure the following:

1) Having capacity to supply power that meets demand
2) Supply reliability (reducing power downtime, etc.) improved by ensuring reserve supply capacity
3) Power quality improved by improving power system structure, etc

Of the above points, 1) is the most urgent as it is the underlying factor for stable power supply.

Power from Kinyerezi power station through 220 kV transmission line between Kinyerezi power station – Mabibo substation is mainly supplied to Dar es Salaam. Operation of Mabibo substation is planned for February 2027, but early operation is necessary because the demand of Ubungo substation is increasing rapidly.

(2) Benefit

Electric power is absolutely essential as energy for the self-reliant, sustainable socioeconomic growth of a nation. Particularly in urban areas, home to government agencies and head offices of the companies which support the national economy, power development projects are one of the most important in economic infrastructure development for helping to establish a secure, efficient power distribution network.

The Project will improve electric power distribution in Dar es Salaam, Tanzania as it faces serious power system problems caused by supply capacity shortage due to recent rapid economic growth. The enhancement of supply capacity for power distribution facilities, which is currently insufficient, is a fundamental solution to the loss of opportunities due to disrupted supply and is thus highly beneficial.

Considering other donor projects such as those of AfDB, the facility capacity of the Project accounts for Approxmately 32 percent of total facility capacity in the target year for project evaluation in 2030, as shown in the below formula.

(Project facility 400 MVA)÷
(Project facility 400 MVA＋reinforced existing facility 840 MVA)＝approx. 32%

The power distribution facility to be developed in the Project is expected to supply 32 percent of power produced to assist socioeconomic activities in Dar es Salaam in the target year for project evaluation in 2030. The Project will benefit approximately 32 percent of economic activities in the area, which is very high in terms of cost-benefit ratio for the amount of aid.

(3) Operation and Maintenance Capabilities

Despite its struggles with large-scale capital investments such as the current cooperation project, TANESCO does have a certain level of technical capacity in system operations and has steadily handled O&M for the national transmission network.

Since Tanzania has already introduced power facilities such as 220/132 kV substations and the skills required for operation methods, system protection functionality and other O&M issues do not greatly exceed the technical levels required for equipment that has been used in the country, although the internal structure of the switchgear and other equipment to be introduced may differ from traditional ones.

As such, manufacturer technicians will be used for O&M technology transfers, offering guidance on initial and standard operation based on the characteristics, features and specifications of the equipment. Assuming that the technology transfer of differing operation methods for each delivering manufacturer goes smoothly, there should be no issues in terms of O&M capabilities on Tanzania side for the delivered equipment.

(4) Project to Contribute to Upper-Level Plans

Tanzania formulated its ENERGY SECTOR STRATEGIC PLAN 2012/13-2017/18 in October 2014. For the development plan, Mabibo substation in the Project, with the capacity of 200 MVA ×2 units, is deemed to be essential for achieving the upper-level plan. It is estimated to contribute approximately 32 % of the overall distribution facility capacity in Dar es Salaam (=400 MVA (project facility capacity) ÷ 1,280 MVA total facility capacity in Dar es Salaam) in the target year for project evaluation of 2030.

(5) Consistency with Japan's Grant Aid Policy

The contents and schedule of the Project are achievable in the scheme of a Grant Aid Project as major equipment will be sourced from Japan and the Project will be completed within the timeframe of the E/N. Therefore, the Project can be implemented with no special difficulty.

3-4-2 Effectiveness

The impacts expected from the implementation of the Project are as follows.

(1) Quantitative Impacts

Quantitative Impacts are shown in Table 3-4-2.1.

Table 3-4-2.1 Quantitative Impacts

Outcome Indicator	Base Value (2020 Current Value)	Target Value (2030) (3 years after the completion of the Project)	
		Without the Project	With the Project
1. 220/132 kV Transformer facility capacity (MVA)*1	770	840	1,240
2. Load factor of 220 kV transmission line between Kinyerezi power station and Ubungo substation (load flow / rated capacity) (%)*2	–	217 (Overloaded)	75 (Stable)
3. Transformer load factor in Ubungo substation (%)*3	–	209 (Overloaded)	113 (Overloaded)

*1 Indicate facility capacity of 220/132 kV substation in Dar es Salaam

*2 Based on 2-2-2-3 Power system analysis results. Ubungo substation is the exsiting substation powering to Dares Salaam city, and provide power from Kinyreizi power station. Also, it indicates the maximum value of the load factor of 220 kV transmission line between Kinyerezi power station and Ubungo substation.

*3 Described as an indicator after distribution load allocated. (Maximum demand / Facility capacity)

(2) Qualitative Impacts (Whole Project)

Qualitative Impacts are shown in Table 3-4-2.2.

Table 3-4-2.2 Qualitative Impacts

Present Status and Problems	Project Countermeasures (Grant Aid Project)	Extent of Project Effects and Improvement
1. With frequent power outage and voltage drops caused by aging equipment for transmission, distribution and substation system and overload operation, Dar es Salaam has the following issues. 1-1 Hindered industrial and economic development. 1-2 Operation of public welfare facilities, especially healthcare facilities, is affected.	Procurement and installation of the following equipment in Dar es Salaam city: - 220/132/33 kV substation 400 MVA＝200 MVA×2 banks - 220 kV tranmission equipment ・ Overhead line (Approx. 9.0 km) and steel towers (22) - 132 kV tranmission equipment ・ Overhead line (Approx. 0.5 km) and steel towers (2)	Stable power supply will revitalize industries and economic activities in Dar es Salaam, improve stable operation of public welfare facilities and healthcare services and the living environment of local residents in Dar es Salaam (Approx. 7.40 million people)
2. The power demand in Dar es Salaam has been rapidly increasing. However, there are frequent power interruptions and power losses caused by the deterioration and overload of the transmission and distribution facilities.	Same as the above	With 220/132/33 kV substation and 220 kV transmission line, the project reduces dependence on the Ubungo substation for power supply. Also, the project alleviates the risk of unstable power supply and power loss.
3. Dar es Salaam has serious problems such as unstable power supply and power shortages, which interferes with economic activity. Also, the 220/132 kV substation is not easy to construct due to the land limitations.	A Gas Insulated Switchgear is introduced.	Introduction of Gas Insulated Switchgear helps minimize required installation space for construction.

3-4-3 Suspension of the work for design and cost estimation on the Project

In this preparatory study, the JICA study team held discussions with Tanzanian government officials, conducted a site survey, and made a design outline. Based on the results of this survey, the estimated cost was calculated, which greatly exceeded the initial estimate due to the following reasons.

- The transmission line route is located in a mountainous area, raising construction costs and making it is difficult to rearrange the towers, causing an increase in the number of towers needed.
- Regardless of efforts made to minimize costs by procuring main transformers, control/protection equipment, transmission equipment, and other equipment from a third country, the Project was not able to reach the initial estimate.

Given the above, the Government of Japan decided not to implement the Project for a grant aid. Thus, the work for design and cost estimation is not carried out in this preparatory survey.

Appendices

1. Member List of the Study Team

1. Member List of the Study Team

First Field Survey

Name	Assignment	Organization
Eiji Wakamatsu	Team Leader	Japan International Corporation Agency
Tadaaki Fukushima	Technical Advisor	Japan International Corporation Agency
Haruka Nakagawa	Planning Management	Japan International Corporation Agency
Kyoji Fujii	Chief Consultant/ Transmission and Substation Planning	Yachiyo Engineering Co., Ltd.
Kenji SAKEMURA	Substation Facilities	West Japan Engineering Consultants, Inc...
Koichi Uchida	Power Flow Analysis	Yachiyo Engineering Co., Ltd.
Mikiko IWAGO	Coordinator	Yachiyo Engineering Co., Ltd.

Second Field Survey

Name	Assignment	Organization
Kyoji Fujii	Chief Consultant/ Transmission and Substation Planning	Yachiyo Engineering Co., Ltd.
Mitsuharu Nakagawa	Deputy Chief Consultant / Transmission Facilities	Yachiyo Engineering Co., Ltd.
Kenji SAKEMURA	Substation Facilities	West Japan Engineering Consultants, Inc.
Koichi Uchida	Power Flow Analysis	Yachiyo Engineering Co., Ltd.
Kazuo Iiyama	Environmental and Social Consideration	Yachiyo Engineering Co., Ltd.
Kyohei KUROHANE	Procurement Planning / Cost Estimation	Yachiyo Engineering Co., Ltd.
Mikiko IWAGO	Coordinator	Yachiyo Engineering Co., Ltd.

Third Field Survey

Name	Assignment	Organization
Toru KOBAYAKAWA	Team Leader	Japan International Corporation Agency
Kazuki SEKI	Technical Advisor	Japan International Corporation Agency
Kyoji Fujii	Chief Consultant/ Transmission and Substation Planning	Yachiyo Engineering Co., Ltd.
Mitsuharu Nakagawa	Deputy Chief Consultant / Transmission Facilities	Yachiyo Engineering Co., Ltd.
Kenji SAKEMURA	Substation Facilities	West Japan Engineering Consultants, Inc..
Keiichiro Ohashi	Protection, Control & Monitoring Facilities 1	West Japan Engineering Consultants, Inc..
Taro NAKAMURA	Protection, Control & Monitoring Facilities 2	West Japan Engineering Consultants, Inc..
Hisayuki Yamamoto	Facility Planning / Natural Condition	Yachiyo Engineering Co., Ltd.
Kosei Ito	Procurement Planning / Cost Estimation	Yachiyo Engineering Co., Ltd.
Kyohei KUROHANE	Procurement Planning / Cost Estimation	Yachiyo Engineering Co., Ltd.
Kazuo Iiyama	Environmental and Social Consideration	Yachiyo Engineering Co., Ltd.
Mikiko IWAGO	Coordinator	Yachiyo Engineering Co., Ltd.

Fourth Field Survey

Name	Assignment	Organization
Kyoji Fujii	Chief Consultant/ Transmission and Substation Planning	Yachiyo Engineering Co., Ltd.
Mitsuharu Nakagawa	Deputy Chief Consultant / Transmission Facilities	Yachiyo Engineering Co., Ltd.
Kenji SAKEMURA	Substation Facilities	West Japan Engineering Consultants, Inc..

Keiichiro Ohashi	Protection, Control & Monitoring Facilities 1	West Japan Engineering Consultants, Inc..
Taro NAKAMURA	Protection, Control & Monitoring Facilities 2	West Japan Engineering Consultants, Inc..
Mikiko IWAGO	Coordinator	Yachiyo Engineering Co., Ltd.

2. Survey Schedule

2. Study Schedule

Tabel 1 Schedule for First Field Survey

<table>
<tr><td rowspan="2"></td><td colspan="2" rowspan="2">DATE</td><td>JICA/ Africa Division</td><td colspan="3">JICA</td><td colspan="4">Consultant</td></tr>
<tr><td>Obe</td><td>Technical Advisor
Tadaaki Fukushima</td><td>Team Leader
Eiji Wakamatsu</td><td>Planning Management
Haruka Nakagawa</td><td>Chief Consultant/ Transmission and Substation Planning
Kyoji Fujii</td><td>Substation Facilities
Kenji SAKEMURA</td><td>Coordinator
Mikiko IWAGO</td><td>Power Flow Analysis
Koichi Uchida</td></tr>
<tr><td>1</td><td>2019/3/12</td><td>Tue</td><td></td><td colspan="3"></td><td colspan="4">23:50-5:50+ Haneda →Doha [QR813]</td></tr>
<tr><td>2</td><td>2019/3/13</td><td>Wed</td><td></td><td colspan="3"></td><td colspan="4">9:00-15:30 Doha → Dar es Salaam [QR1347]</td></tr>
<tr><td>3</td><td>2019/3/14</td><td>Thu</td><td colspan="4">18:30-19:30 Policy meeting (videoconference)</td><td colspan="4">09:00-10:00 Courtesy call on JICA Tanzania office
12:30-13:30 Policy meeting (videoconference)
PM Courtesy call on TANESCO</td></tr>
<tr><td>4</td><td>2019/3/15</td><td>Fri</td><td rowspan="3"></td><td colspan="3" rowspan="2"></td><td colspan="4">Site Survey
- New transmission line route and Mbrahaci substation site
- Kinyerezi Power Plant
- Information collection (1) Power demand, (2) Transmission and substation construction planning, (3) Power system analysis</td></tr>
<tr><td>5</td><td>2019/3/16</td><td>Sat</td><td colspan="3">Project Site Survey
- New transmission line route and Mbrahaci substation site</td><td>Modification of power system model</td></tr>
<tr><td>6</td><td>2019/3/17</td><td>Sun</td><td colspan="3">23:50-5:50+ Haneda →Doha [QR813]</td><td colspan="3">Documentation, intra-group discussions, electricity demand forecasting</td><td>Modification of power system model</td></tr>
<tr><td>7</td><td>2019/3/18</td><td>Mon</td><td>23:50-5:50+ Haneda → Doha [QR813]</td><td colspan="3">9:00-15:30 Doha → Dar es Salaam [QR1347]
17:00 Discussions with JICA Tanzania office</td><td colspan="4">Information collection (1) Power demand, (2) Transmission and substation construction planning, (3) Power system analysis
17:00 Discussions with JICA Tanzania office</td></tr>
<tr><td>8</td><td>2019/3/19</td><td>Tue</td><td>9:00-15:30 Doha → Dar es Salaam [QR1347]
・Team meeting</td><td colspan="7">AM:
- Courtesy call on TANESCO
- Site Survey(New transmission line route and Mbrahaci substation site)
PM:
- Discussions with TANESCO (1) Policy and direction for DSMP renewal, (2) Overall plan for Mubrahqachi substation</td></tr>
<tr><td>9</td><td>2019/3/20</td><td>Wed</td><td colspan="8">AM: Discussions with TANESCO (1) Policy and direction for DSMP renewal, (2) Overall plan for Mubrahqachi substation
PM (evening): Discussions with World Bank (1) Kinyerezi-Ubungo project, (2) Dodoma T/L D/L project</td></tr>
<tr><td rowspan="2">10</td><td rowspan="2">2019/3/21</td><td rowspan="2">Thu</td><td>AM: Discussions with TPDC
- MOFP or MOE (if available in DSM)
- Consultation with TANESCO (if both MOFP and MOE cannot be discussed in DSM)</td><td colspan="7">AM: Discussions with TANESCO (1) Policy and direction for DSMP renewal, (2) Overall plan for Mubrahqachi substation</td></tr>
<tr><td colspan="2">PM: Discussions with TANESCO (regarding Mtwara and Dodoma matters)</td><td colspan="6">PM
Report to JICA Tanzania office
Report to the Embassy of Japan in Tanzania</td></tr>
<tr><td>11</td><td>2019/3/22</td><td>Fri</td><td colspan="4">06:05-07:15 Dar es Salaam→Mtwara [PW 400]
- Site Survey(power plant and three related infrastructures in Mtwara, Lindi substation)</td><td colspan="4">17:20-23:55 Dar es Salaam → Doha [QR1348]</td></tr>
<tr><td>12</td><td>2019/3/23</td><td>Sat</td><td colspan="4">07:45-08:55 Mtwara-Dar es Salaam
-Documentation</td><td colspan="4">01:55-17:55 Doha → Narita [QR806]</td></tr>
<tr><td>13</td><td>2019/3/24</td><td>Sun</td><td colspan="4">07:00-08:30 Dar es Salaam-Dodoma
-Site Survey(Transmission and distribution lines at Dodoma)</td><td colspan="4" rowspan="4"></td></tr>
<tr><td>14</td><td>2019/3/25</td><td>Mon</td><td colspan="4">TANESCO Discussions with Dodoma, MOE, MOFP, TARURA
Dodoma-Dar es Salaam</td></tr>
<tr><td>15</td><td>2019/3/26</td><td>Tue</td><td colspan="4">AM: Consultation with TANESCO HQ (to be carried out if necessary depending on the outcome of the consultation)
PM: Report to JICA Tanzania office
17:20-23:55 Dar es Salaam-Doha [QR1348]</td></tr>
<tr><td>16</td><td>2019/3/27</td><td>Wed</td><td colspan="4">01:55-17:55 Doha → Narita [QR806]</td></tr>
</table>

Tabel 2 Schedule for Second Field Survey

<table>
<tr><th rowspan="2">No</th><th rowspan="2" colspan="2">DATE</th><th colspan="7">Consultant</th></tr>
<tr><th>Chief Consultant/ Transmission and Substation Planning
Kyoji Fujii</th><th>Procurement Planning / Cost Estimation
Kyohei KUROHANE</th><th>Environmental and Social Consideration
Kazuo Iiyama</th><th>Deputy Chief Consultant / Transmission Facilities
Mitsuharu Nakagawa</th><th>Substation Facilities
Kenji SAKEMURA</th><th>Coordinator
Mikiko IWAGO</th><th>Power Flow Analysis
Koichi Uchida</th></tr>
<tr><td>0</td><td>2019/7/30</td><td>Tue</td><td colspan="3"></td><td></td><td>Trip {Fukuoka 16:00 – Haneda/Tokyo 17:45 by JL320}</td><td colspan="2"></td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">2019/7/31</td><td rowspan="2">Wed</td><td colspan="4">Trip {Haneda/Tokyo 00:01 – Doha 5:40 by QR813}</td><td>Trip {Narita/Tokyo 22:20 – Doha 03:20 by QR807}</td><td colspan="2">Trip {Haneda/Tokyo 00:01 – Doha 5:40 by QR813}</td></tr>
<tr><td colspan="7">Trip {Doha 08:45 – Dar es Salaam 16:55 by QR1357}</td></tr>
<tr><td>2</td><td>2019/8/1</td><td>Thu</td><td colspan="7">10:00 Courtesy call at JICA Tanzania office</td></tr>
<tr><td>3</td><td>2019/8/2</td><td>Fri</td><td colspan="7">10:00 Visit to TANESCO
11:00 Site survey (potential new 132/33kV substation site)</td></tr>
<tr><td>4</td><td>2019/8/3</td><td>Sat</td><td colspan="7">Organization of materials, team meeting</td></tr>
<tr><td>5</td><td>2019/8/4</td><td>Sun</td><td colspan="7">Organization of materials, team meeting</td></tr>
<tr><td>6</td><td>2019/8/5</td><td>Mon</td><td colspan="3">14:30 Courtesy call and discussion with TANESCO</td><td>09:00 Survey of transmission route and discussion with TANESCO transmission staff
14:30 Courtesy call and discussion with TANESCO</td><td colspan="3">14:30 Courtesy call and discussion with TANESCO</td></tr>
<tr><td>7</td><td>2019/8/6</td><td>Tue</td><td colspan="3">09:00 Site survey with TANESCO substation personnel (potential new 132/33kV substation site)
12:00 Meeting with TANESCO power plant representative</td><td>09:00 Transmission route survey and discussion with TANESCO transmission staff</td><td colspan="2">09:00 Site survey with TANESCO substation personnel (potential new 132/33kV substation site)
12:00 Meeting with TANESCO power plant representative</td><td>Power Flow Analysis</td></tr>
<tr><td>8</td><td>2019/8/7</td><td>Wed</td><td colspan="6">10:00 Meeting with TANESCO substation representative
11:30 Meeting with TANESCO SGR Project staff</td><td>Power Flow Analysis</td></tr>
<tr><td>9</td><td>2019/8/8</td><td>Thu</td><td colspan="6">09:00 Site survey (Lugruni substation and large hospital to be supplied)
12:00 Site survey (Kinyerezi power plant)</td><td>Power Flow Analysis</td></tr>
<tr><td>10</td><td>2019/8/9</td><td>Fri</td><td colspan="2">09:00 Site Survey (DCC)
13:00 Site survey (existing 33/11kV Mubrahaci substation)</td><td>09:00 Meeting with NEMC (EIA, RAP)
13:00 Meeting with University of Dar es Salaam (EIA, RAP)</td><td colspan="2">09:00 Site Survey (DCC)
13:00 Site survey (existing 33/11kV Mubrahaci substation)</td><td>10:30 Meeting with CSI construction (unit price for earthwork)</td><td>Power Flow Analysis</td></tr>
<tr><td>11</td><td>2019/8/10</td><td>Sat</td><td colspan="7">Organization of materials, team meeting</td></tr>
<tr><td>12</td><td>2019/8/11</td><td>Sun</td><td colspan="7">Organization of materials, team meeting</td></tr>
<tr><td>13</td><td>2019/8/12</td><td>Mon</td><td colspan="7">Organization of materials, team meeting</td></tr>
<tr><td rowspan="2">14</td><td rowspan="2">2019/8/13</td><td rowspan="2">Tue</td><td colspan="7">08:00-08:30 Report to JICA Tanzania office
12:00-13:30 M/D Discussions with TANESCO</td></tr>
<tr><td colspan="4">Trip {Dar es Salaam 18:05 – Doha 00:10 by QR1357}</td><td>Organization of materials</td><td colspan="2">Trip {Dar es Salaam 18:05 – Doha 00:10 by QR1357}</td></tr>
<tr><td>15</td><td>2019/8/14</td><td>Wed</td><td colspan="4">Trip {Doha 02:10 – Narita/Tokyo 18:40 by QR806}</td><td>Trip {Dar es Salaam 18:05 – Doha 00:10 by QR1357}</td><td colspan="2">Trip {Doha 02:10 – Narita/Tokyo 18:40 by QR806}</td></tr>
<tr><td>16</td><td>2019/8/15</td><td>Thu</td><td colspan="4"></td><td>Trip {Doha 02:00 – Seoul 16:55 by QR858}
Trip {Seoul 18:35 – Fukuoka 19:55 by KE781}</td><td colspan="2"></td></tr>
</table>

Tabel 3 Schedule for Third Field Survey

	DATE		JICA		Consultant							
			Team Leader Toru KOBAYAKAWA	Technical Advisor Kazuki SEKI	Chief Consultant/ Transmission and Substation Planning Kyoji Fujii	Procurement Planning / Cost Estimation Kyohei KUROHANE	Coordinator Mikiko IWAGO	Deputy Chief Consultant / Transmission Facilities Mitsuharu Nakagawa	Substation Facilities / 'Protection, Control & Monitoring Facilities 2 Kenji SAKEMURA/ Taro NAKAMURA	Protection, Control & Monitoring Facilities 1 Keiichiro Ohashi	Facility Planning / Natural Condition, Procurement Planning / Cost Estimation Hisayuki Yamamoto / Kosei Ito	Environmental and Social Consideration Kazuo Iiyama
1	2019/10/26	Sat						Trip {Haneda/Tokyo 23:50 – Doha 06:10 by QR813}				
2	2019/10/27	Sun						Trip {Doha 08:00 – Dar es Salaam 15:50 by QR1357}				
3	2019/10/28	Mon						・Meeting with TANESCO ・Site Survey(Mabibo Substation)				
4	2019/10/29	Tue						・Site Survey(Transmission line route)				
5	2019/10/30	Wed			Trip {Haneda/Tokyo 23:50 – Doha 06:10 by QR813}			・Site Survey (Transmission line route)	Trip {Fukuoka 19:00 – Haneda/Tokyo 20:30 by JL328} Trip {Haneda/Tokyo 23:50 – Doha 06:10 by QR813}			
6	2019/10/31	Thu			Trip {Doha 08:00 – Dar es Salaam 15:50 by QR1357}		Trip {Doha 08:00 – Dar es Salaam 15:50 by QR1357}	・Meeting with TANESCO ・Site Survey(near Ubungo substation) ・Meeting with consultant for construction of Ubungo intersection flyover	Trip {Doha 08:00 – Dar es Salaam 15:50 by QR1357}			
7	2019/11/1	Fri			Courtesy call to JICA Tanzania office 'Courtesy call to TANESCO Meeting with TANESCO							
8	2019/11/2	Sat			・Preparation of documents ・Team meeting	・Meeting with potential subcontractors for topographical and geological survey ・Preparation of documents ・Team meeting	・Site Survey - Makumbusho Substation - New City Center Substation - Irara Substation ・Preparation of documents ・Team meeting	・Meeting with potential subcontractors for topographical and geological survey ・Preparation of documents ・Team meeting	・Site Survey - Makumbusho Substation - New City Center Substation - Irara Substation ・Preparation of documents ・Team meeting			
9	2019/11/3	Sun			・Preparation of documents ・Team meeting							
10	2019/11/4	Mon			・Data analysis、Team meeting ・Meeting with TANESCO (Appointments, scheduling, telecommunications)							
11	2019/11/5	Tue			・Site Survey(Mabibo Substation and Kinyerezi Power Plant)					Trip{Fukuoka 20:00 – Haneda/Tokyo 21:35 by JL330}	Trip {Haneda/Tokyo 23:50 – Doha 06:10 by QR813}	
					Meeting with potential subcontractors for topographical and geological survey			・Preparation of documents ・Team meeting				
12	2019/11/6	Wed			Meeting with TANESCO					Trip {Haneda/Tokyo 23:50 – Doha 06:10 by QR813} Trip{Doha 08:00 – Dar es Salaam 15:50 by QR1357}	Trip {Doha 08:00 – Dar es Salaam 15:50 by QR1357}	
					・Meeting with CSI construction (topographical and geological survey)		・Meeting with TANROADS and TANESCO ・Meeting with Gasco and TANESCO	・Preparation of documents ・Team meeting	・Preparation of documents ・Team meeting			
13	2019/11/7	Thu			・Team meeting ・Meeting with Pana Africa ・Visit to TPDC ・Visit to DAWASA	・Team meeting ・Site Survey(Transmission lines around Ubungo substation) ・Site Survey(T-off circumference transmission line)	・Team meeting ・Site Survey(Mabibo Substation) ・Site survey and meeting with CSI construction ・Visit to TPDC ・Visit to DAWASA	・Team meeting ・Site Survey (Transmission lines around Ubungo substation) ・Site Survey (T-off circumference transmission line)	・Meeting with TANESCO(Substations and telecommunications) ・Site Survey(T-off circumference transmission line)		・Team meeting ・Site Survey(Mabibo Substation) ・Site survey and meeting with CSI construction ・Site Survey(T-off circumference transmission line)	・Team meeting ・Site Survey(Transmission lines around Ubungo substation)
14	2019/11/8	Fri			・Information Collection at TANESCO NCC ・Visit to Songas ・Team meeting	・Meeting with TANESCO (Environmental and social considerations) ・Data analysis ・Team meeting	・Data analysis ・Team meeting ・Preparation of documents ・Meeting with TANESCO (Construction)	・Data analysis ・Team meeting ・Field report preparation	・Site Survey (Mabibo Substation)		・Data analysis ・Team meeting ・Preparation of documents ・Meeting with TANESCO (Construction)	・Meeting with TANESCO(Environmental and social considerations)
15	2019/11/9	Sat	Trip {Haneda/Tokyo 23:50 – Doha 06:10 by QR813}		Preparation of documents, Draft MD, Field Report (Draft), Team meeting							・Gathering information from Pugu Hill Nature Center
16	2019/11/10	Sun	Trip {Doha 08:45 – Dar es Salaam 16:55 by QR1357}		Preparation of documents, Draft MD, Field Report (Draft), Team meeting							
17	2019/11/11	Mon	・Meeting at JICA Tanzania office ・Meeting with TANESCO, JICA and survey team ・Site Survey (new RoW around Ubungo substation)			**	・Meeting at JICA Tanzania office ・Meeting with TANESCO, JICA and survey team ・Site Survey (new RoW around Ubungo substation)	Field report preparation	Field report preparation	・Field Report ・Site Survey (new RoW around Ubungo substation)	・Data analysis ・Team meeting ・Preparation of documents ・Site survey with TANESCO (Mabibo Substation)	・Site Survey (new RoW around Ubungo substation) Environment Department meeting
18	2019/11/12	Tue	Trip { Dar es Salaam 9:15 - Dodoma 10:30 by PW600} ・Meeting with TANESCO HQ			Meeting regarding Field Report	・Site survey with CSI construction	・Site Survey(Transmission line route)			・Site survey with CSI construction	Field report preparation
19	2019/11/13	Wed	Trip {Dodoma 07:30 - Dar es Salaam 08:30 by TC109}			・Site Survey(Mabibo Substation)	・Site Survey (Lugruni Substation)	・Data collection in DAWASA, TPDC, PANAFRICAN, SONGAS ・Field Report Creation	・Site Survey (Mabibo Substation) ・Site Survey(Kinyerezi power plant switchgear)		・Site Survey and Geological Survey (in the presence of TANESCO) ・Meeting with TANESCO(Construction)	・Site check with TANESCO Environmental Department (Mabibo, Ubungo)
			Trip {Dar es Salaam 14:00 - Mwanza 16:10 by PW492}		・Meeting with TANESCO							
20	2019/11/14	Thu	Trip {Mwanza 10:50 - Dar es Salaam 13:00 by PW 491}		・Meeting with TANESCO	・Information gathering at NCC ・Site survey (Ubungo substation expansion area)			・PANAFRICAN and Existing Gas Pipeline Survey	・Site Survey (Ubungo Substation expansion area)	・Hearing from local consultants (SRCONSULT)	・Site Survey (Ubungo Substation expansion area)
21	2019/11/15	Fri	・Report to JICA Tanzania office ・Report to the Embassy of Japan Trip{Dar es Salaam 16:30 – Dubai 23:01 by EK726}			**	・Attend geological survey by CSI construction (transmission route)		・Meeting with TANESCO(Substations and telecommunications)		・Attend geological survey by CSI construction (transmission route) ・Meeting with Bureau of Meteorology	Meeting with TANESCO Environmental Department
22	2019/11/16	Sat	Trip {Dubai 02:55 – Narita/Tokyo 17:20 by EK}		Preparation of documents, Draft MD, Field Report (Draft), Team meeting				・Site Survey (Ubungo Substation) ・Data collection (Ubungo substation archives)			
23	2019/11/17	Sun			Preparation of documents, Draft MD, Field Report (Draft), Team meeting							
24	2019/11/18	Mon			・Discussions with TANESCO (MD and Field Report)		・Weather Information Payment	・Discussion with TANESCO (MD and Field Report)				
							Trip {Dar es Salaam 17:00 – Doha 23:10 by QR1357}	・Field Report Preparation	Trip {Dar es Salaam 17:00 – Doha 23:10 by QR1357}			・Meeting for re-consignment of environmental survey
25	2019/11/19	Tue			・Meeting with TANESCO(Maintenance of existing transmission line RoW) ・Site Survey(RoW of existing transmission line)	・Meeting with TANESCO(Maintenance of existing transmission line RoW) ・Site Survey(RoW of existing transmission line)	Trip {Doha 01:55 – Narita/Tokyo 17:45 by QR806}	・Data collection from DAWASA, PANAFRICAN, SONGAS ・Meeting with TANESCO	Trip {Doha 01:55 – Narita/Tokyo 17:45 by QR806} (Sakemura) Trip {Doha 02:10 – Seoul 16:40 by QR858} (Nakamura) Trip {Seoul 18:15 – Fukuoka 19:35 by OZ136} (Nakamura)	Trip {Doha 01:55 – Narita/Tokyo 17:45 by QR806}		・Meeting with TANESCO(Maintenance of existing transmission line RoW) ・Site Survey(RoW of existing transmission line)
26	2019/11/20	Wed			16:00 Discussions with TANESCO (MD and Field Report)	Trip {Dar es Salaam 17:00 – Doha 23:10 by QR1357}		Trip {Dar es Salaam 17:00 – Doha 23:10 by QR1357}	Trip {Haneda/Tokyo 09:10 – Fukuoka 11:10 by JL311} (Sakemura)	Trip {Haneda/Tokyo 09:10 – Fukuoka 11:10 by JL311}		TANESCO prepares materials for re-consignment discussions
27	2019/11/21	Thu			Trip {Dar es Salaam 17:00 – Doha 23:10 by QR1357}	Trip{Doha 01:55 – Narita/Tokyo 17:45 by QR806}		Trip {Doha 01:55 – Narita/Tokyo 17:45 by QR806}				TANESCO prepares materials for re-consignment discussions
28	2019/11/22	Fri			Trip{Doha 01:55 – Narita/Tokyo 17:45 by QR806}							・TANESCO discusses re-consignment ・Site Survey (new substation, new RoW in the vicinity, transmission lines)
29	2019/11/23	Sat										Compilation of reports
30	2019/11/24	Sun										Trip {Dar es Salaam 18:05 – Doha 00:10 by QR1357}
31	2019/11/25	Mon										Trip {Doha 01:55 – Narita/Tokyo 17:45 by QR806}

Tabel 4 Schedule for Fourth Field Survey

	DATE		Consultant						
			Chief Consultant/ Transmission and Substation Planning Kyoji Fujii	Deputy Chief Consultant / Transmission Facilities Mitsuharu Nakagawa	Substation Facilities Kenji SAKEMURA	Protection, Control & Monitoring Facilities 1 Keiichiro Ohashi	Protection, Control & Monitoring Facilities 2 Taro NAKAMURA	Surveyor Mr. Takahashi	Coordinator Mikiko IWAGO
1	2020/2/5	Wed	Trip {Addis Ababa 09:45 – Dar es Salaam 12:35 by ET0865}	Trip {Narita/Tokyo 20:40 - Addis Ababa 07:40 by ET0673}	- Staying in Tanzania from Jan. 26th for Dodoma Project		Trip {Fukuoka 20:35 - Seoul/Incheon 22:00 by OZ135}	Trip {Narita/Tokyo 20:40 - Addis Ababa 07:40 by ET0673}	Trip {Narita/Tokyo 20:40 - Addis Ababa 07:40 by ET0673}
2	2020/2/6	Thu	Preparation of Meeting Materials 17:30 Team Meeting	Trip {Addis Ababa 10:30 - Dar es Salaam 13:20 by ET0805} 17:30 Team Meeting	- Staying in Tanzania from Jan. 26th for Dodoma Project		Trip {Seoul/Incheon 00:35 - Doha 05:15 by QR859} Trip {Doha 07:55 - Dar es Salaam 16:20 by QR1357} 17:30 Team Meeting	Trip {Addis Ababa 10:30 - Dar es Salaam 13:20 by ET0805} 17:30 Team Meeting	Trip {Addis Ababa 10:30 - Dar es Salaam 13:20 by ET0805} 17:30 Team Meeting
3	2020/2/7	Fri	- Courtesy Call to TANSCO and discussion	- Courtesy Call to JICA Tanzania Office - Courtesy Call to TANSCO and discussion - Measurement of existing 220kV Ubungo Substation			- Site survey at Mabibo Substation site and 220kV Ubungo Substation expansion area - Courtesy Call to TANSCO and discussion - Measurement of existing 220kV Ubungo Substation		
4	2020/2/8	Sat	- Measurement of existing 220kV Ubungo Substation			Trip {Fukuoka 20:35 - Seoul/Incheon 22:00 by OZ135} Trip {Seoul/Incheon 23:50 - Dubal 05:05 by EK323}	- Measurment of outside of existing Ubungo Substation - Measurment of Ubungo Flyover - Measurement of existing 220kV Ubungo Substation		
5	2020/2/9	Sun	Data Analysis			Trip {Dubai 10:30 - Dar es Salaam 15:00 by EK725}	Data Analysis		
6	2020/2/10	Mon	- Meeting with TANESCO Transmission Engineers	- Meeting with TANESCO Transmission Engineers - Measurment of Ubungo Flyover	- Meeting with TANESCO Transmission Engineers - Measurement of existing 220kV Ubungo Substation			- Measurment of existing 220kV Ubungo Substation - Measurment of Ubungo Control Center - Measurment of Ubungo Flyover	- Measurment of existing 220kV Ubungo Substation - Site Survey of Luguruni Substation - Measurment of Ubungo Flyover
7	2020/2/11	Tue	- Joint Survey with Songas - Joint Survey with TPDC - Joint Survey with DAWASA	- Joint Survey with Songas - Meeting with CSI construction - Meeting with TANESCO - Joint Survey with DAWASA	- Measurment of existing 220kV Ubungo Substation - Joint Survey with Songas - Meeting with TANESCO Communication Engineers			- Measurment of existing 220kV Ubungo Substation - Meeting with CSI construction - Measurment of Mabibo Substation Site	
8	2020/2/12	Wed	- Meeting with Eng. Amos - Data Analysis	- Site Survey with CSI construction - Data Analysis	- Measurement of existing 220kV Ubungo Substation - Data Analysis			- Site Survey with CSI construction - Data Analysis	- Data Analysis
9	2020/2/13	Thu	- Site Survey with CSI construction - Data Analysis	- Data Analysis	- Meeting with TANESCO Communucation Engineer and Substation Engineer - Meeting with Luguruni Substation Project Manager - Confirm the drawings of draft existing 220kV Ubungo switchyard - Existing communication network			- Measurment inside Battery Room - Data Collection around Ubungo Substation - Data Analysis Trip {Dar es Salaam 16:45 - Addis Ababa 19:25 by ET0804}	
			★PM Discussion on Field Report # 1 Discussion on Transmission, Substation and Communication etc. with TANESCO technical team 1						
10	2020/2/14	Fri	Transmission Route Survey	Transmission Route Survey	Meeting with TANESCO Communucation Engineer and Substation Engineer			Trip {Addis Ababa 22:35 – Narita/Tokyo 19:40 by ET0672}	Trip {Addis Ababa 22:35 – Narita/Tokyo 19:40 by ET0672}
			★PM Discussion on Field Report # 2 Discussion on Transmission, Substation and Communication etc. with TANESCO technical team 2						
11	2020/2/15	Sat	Data Analysis Drafting Field Report						
12	2020/2/16	Sun	Data Analysis Drafting Field Report						
13	2020/2/17	Mon	★AM Discussion on Field Report # 3 Finalization of Field Report						
14	2020/2/18	Tue	10:00 Report to JICA Tanzania Office						
			Trip {Dar es Salaam 16:45 – Addis Ababa 19:25 by ET0804}	Trip {Dar es Salaam 16:45 - Addis Ababa 19:25 by ET0804}	Trip {Dar es Salaam 16:30 - Dubai 23:05 by EK726}	Trip {Dar es Salaam 16:30 - Dubai 23:05 by EK726}	Trip {Dar es Salaam 17:30 - Doha 23:40 by QR1357} Trip {Doha 02:10 - Seoul/Incheon 16:40 by QR858}		
15	2020/2/19	Wed	Trip {Addis Ababa 22:35 – Narita/Tokyo 19:40 by ET0672}	Trip {Addis Ababa 22:35 – Narita/Tokyo 19:40 by ET0672}	Trip {Dubai 03:30 - Seoul/Incheon 16:50 by EK322} Trip {Seoul/Incheon 18:15 - Fukuoka 19:35 by OZ136}	Trip {Dubai 03:30 - Seoul/Incheon 16:50 by EK322} Trip {Seoul/Incheon 18:15 - Fukuoka 19:35 by OZ136}	Trip {Seoul/Incheon 18:15 - Fukuoka 19:35 by OZ136}		

[Abbreviations] (alphabetical order)

DCC	: Dar es Salaam City Council
DSM	: Dar es Salaam
EIA	: Environmental Impact Assessment
JICA	: Japan International Cooperation Agency
M/D	: Minutes of Discussion
MOE	: Ministry of Energy
MOFP	: Ministry of Finance and Planning
RAP	: Rwanda Environment Management Agency
RoW	: Right of Way
TANESCO	: Tanzania Electric Supply Company Ltd.
TPDC	: Tanzania Petroleum Development Corporation

3. List of Parties Concerned in the Recipient Country

3. List of Parties Concerned in the Recipient Country

Tanzania Electric Supply Company Ltd. (TANESCO)

Eng. Isaac A. Chanji	Acting Deputy Managing Director (Transmission)
Eng. Amos J. Kaihula	Acting Senior Manager (Transmission)
Eng. Ernest Nzemya	Plant Manager (Kinyerezi Power Plant)
Eng. Nemes Didas	Zonal Principal Transmission Engineer – South West Highlands Zone
Eng. Richard Mwanja	Transmission Engineer
Eng. Francis Mlelwa	Transmission Engineer
Eng. Michael Mbwana	Electrical Workshop
Eng. Moses Holela	Mechanical Engineer
Eng. Rajab Mruma	Planning Engineer
Mr. Nyango J. Nyango	Security Officer
Eng. Daudi Ludobo	System Control Engineer
Eng. Enock P. Njau	Light Current Engineer
Eng. Neema L. Mushi	Principal Transmission Engineer
Eng. Nassor Mulika	Environmental Officer
Eng. Leo Mwakatobe	Principal Distribution Engineer
Eng. Theodory Bayona	Senior Manager Sales & Marketing
Eng. Hussqin Swalehe	Substation Engineer
Eng. Deogratias Msaki	Principal Electrical Engineer
Eng. Abdallah Chikoyo	Ag. Manager Projects (Generation)
Eng. Herbert Msangi	Protection Engineer
Eng. Walter Jacob	PRINCE 2 Practitioner / Principal Telecommunication Engineer
Eng. Jaffari Msuya	Power System Engineer
Eng. Elvis Temu	Distribution Engineer
Eng. Beatrice Munishi	DP Engineer Distribution
Ms. Anastasia Lina	Sociologist
Mr. Ombeni Mustta	Sociologist
Mr. Jasphet Odordo	Accountant
Eng. Zakaria Mgalama	Manager (Transmission)
Eng. Heimrad Nnunduma	Principal Civil Engineer
Eng. John Nkomola	Transmission Engineer
Eng. Emmanuel Vegula	Transmission Engineer
Eng. Deogratius Mariwa	Manager (protection, substation, communications)
Eng. Peter Lucas	Principal Engineer (High Power), Head of Project,

	Luguruni Substation
Eng. Abraham Lyimo	High Power Engineer
Eng. Evodius Rweyemamu	Communication Engineer
Eng. Mohamed Yahaya	Communication Engineer
Eng. Fausta Manga	Protection Engineer
Eng. Elizabeth Kabadi	Principal Architect
Eng. Dismas Mgani	Architect
Mr. Tluway Sappa	Environment
Eng. Edmured Mgina	surveyor
Eng. Stanslaus Simbila	Power Plant Manager (Kinyerezi Power Plant)

Tanzania Electric Supply Company Ltd. (TANESCO) DCC, Kinondoni North Office

Eng, Alex P. Kalanje	Manager
Mr. Ajuaye Jeggo	Principal Operation Engineer
Mr. Regina Myulla	Principal SCADA Engineer
Mr. Esther N. Mushi	Principal Telecommunication Engineer

LEPOROGO, Soosung, Africa Constructing (3 companies JV)

Mr. Erick Graham Chatwin	supervisor

PANAFRICAN

Mr. John Samwel	Downstream Stakeholder Relations

Tanzania Petroleum Development Corporation (TPDC)

Mr. Fidelis D. Mkiramweni	Civil Engineer

Tanzania Meteorological Authority

Mr. Omari Hamisi	None

CSI Construction

Mr. Moh'd A. Versi	Managing Director
Mr. Juzer Kassamali	Contracts Manager
Mr. Vijay Kumar	Accountant
Mr. J. A. Czunyi	Sales Manager

SR Consult

Mr. Gautam Chavda	Architect
Mr. Shabbir Rajbhai	Architect

Saifee Structural Engineers

Mr. Muslim Hassuji	Structural Engineer

National Environmental Management Council (NEMC)

Ms. Glory J. Kombe	EIA professional

Ms. Lilian Lukambuzi	EIA professional

Institute of Resource Assessment (IRA) in the University of Dar es Salaam

Prof. H. Sosovele	Professor

World Bank (WB)

Dr. Richard H. Hosier	Senior Energy Specialist, Africa Energy GEE08
Dr. Kabir Malik	**Senior Economist, Energy & Extractives**
Mr. Mbuso Gwafila	Sr. Energy Spec
Mr. Fehes Eoen	Sr. Energy Spec

JICA Tanzania Office

Mr. Naofumi Yamamura	Chief Representative
Mr. Satoru Matsuyama	Senior Representative
Mr. Hayakazu Yoshida	Representative
Ms. Rosina Apolei	Assistant Program Officer

4. Minutes of Discussion（MD）

Minutes of Discussions
on the Preparatory Survey for the Project for
Reinforcement of Supply from Kinyerezi Power Station to Ubungo Substation
in Dar es Salaam in the United Republic of Tanzania

In response to the request from the Government of the United Republic of Tanzania (hereinafter referred to as "Tanzania"), Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Survey Team for the Outline Design (hereinafter referred to as "the Team") of the Project for Reinforcement of Supply from Kinyerezi Power Station to Ubungo Substation (hereinafter referred to as "the Project") to Tanzania. The Team held a series of discussions with the officials of the Government of Tanzania and conducted a field survey. In the course of the discussions, both sides confirmed the main items described in the attached sheets.

Dodoma, 25th March 2019

Mr. Eiji Wakamatsu
Team Leader, Preparatory Survey Team
Japan International Cooperation Agency
Japan

Dr. Eng. Tito E. Mwinuka
Managing Director
Tanzania Electric Supply Company Limited
The United Republic of Tanzania

Witness

Dr. Hamisi H. Mwinyimvua
Permanent Secretary
Ministry of Energy
The United Republic of Tanzania

ATTACHMENT

1. **Objective of the Project**
   The objective of the Project is to reinforce the power supply to Dar es Salaam by reinforcing transmission networks and substation(s) between Kinyerezi Power Station and Ubungo and/or Mburahati substations, thereby contributing to the improvement of economic activities and the civic life of Dar es Salaam.

2. **Title of the Preparatory Survey**
   The original title of the project was "Project for Reinforcement of Supply from Kinyerezi Power Station to Ubungo Substation in Dar es Salaam." Both sides agree to change the title once they agree on the scope of the project.

3. **Project site**
   Both sides confirmed that the sites of the Project are located in Dar es Salaam, which is shown in Annex 1. Both sides agreed to decide on the specific Project sites of the Projects during the second visit of the JICA Survey Team in June 2019.

4. **Responsible authority for the Project**
   Both sides confirmed the authorities responsible for the Project are as follows:
   4-1. The Tanzania Electric Supply Company Limited (TANESCO) will be the executing agency for the Project (hereinafter referred to as "the Executing Agency"). The Executing Agency shall coordinate with all the relevant authorities to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be managed by relevant authorities properly and on time. The organization charts are shown in Annex 2.
   4-2. The line ministry of the Executing Agency is the Ministry of Energy (MOE). The Ministry of Energy shall be responsible for supervising the Executing Agency on behalf of the Government of Tanzania.

5. **Procedures and Basic Principles of Japanese Grant**
   5-1. The Tanzanian side agreed that the procedures and basic principles of Japanese Grant as described in Annex 3 shall be applied to the Project.
   5-2. The Tanzanian side agreed to take necessary measures described in Major Undertakings to be taken by the Government of Tanzania (Annex 4) for smooth implementation of the Project. The contents of the Annex 4 will be elaborated and refined during the Preparatory Survey and be agreed in the mission dispatched for explanation of the Draft Preparatory Survey Report in November 2019. The contents of Annex 4 will eventually be used as an attachment to the

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Grant Agreement.

6. Schedule of the Survey

6-1. JICA dispatched the first mission team to Tanzania in March 2019.

6-2. JICA will dispatch the second mission team to Tanzania in June 2019.

6-3. JICA will prepare a draft Preparatory Survey Report and dispatch the third mission team to Tanzania in order to explain its contents around November 2019.

6-4. Appraisal of the Project will be given by the government of Japan and JICA, and approval will be given by the Japanese Cabinet. The submission of the Project to the Cabinet of Japan is planned to be around February 2020.

6-5. After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be signed between the government of Japan and the government of Tanzania to make an official pledge for assistance, which is followed by the conclusion of Grant Agreement (hereinafter referred to as "the G/A") between JICA and the Tanzanian side to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Tanzanian side, and procurement conditions.

6-6. If the contents of the draft Preparatory Survey Report are accepted and the undertakings for the Project are fully agreed by the Tanzanian side, JICA will finalize the Preparatory Survey Report around March 2020.

6-7. The above schedule is tentative and subject to change.

7. Environmental and Social Considerations

7-1. The Tanzanian side confirmed to give due environmental and social considerations during implementation, and after completion of the Project, in accordance with the JICA Guidelines for Environmental and Social Considerations (April, 2010).

7-2. The Project is categorized as "B" from the following considerations:

The project is not considered to be a large-scale power transmission and distribution lines involving large-scale involuntary resettlement, large-scale logging, or submarine electrical cables, not located in a sensitive area, and has none of the sensitive characteristics under the JICA guidelines for environmental and social considerations (April 2010). Therefore, it is not likely to have a significant adverse impact on the environment.

The Tanzanian side confirmed to conduct the necessary procedures concerning the environmental assessment (including stakeholder meetings, Environmental Impact Assessment (EIA) /Initial Environmental Examination (IEE) and information disclosure, etc.) and make EIA/IEE report of the Project. The EIA/IEE approval shall be received from the responsible authorities and submitted to JICA by June 2020.

7-3. For the Project that will result in involuntary resettlement, the Tanzanian side confirmed to prepare a Resettlement Action Plan (RAP)/Abbreviated Resettlement Action Plan (ARAP)

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and make it available to the public. In addition, the Tanzanian side confirmed to provide the affected people with sufficient compensation and/or support in accordance with RAP/ARAP, which is based on JICA Guidelines for Environmental and Social Considerations (April, 2010), in a timely manner.

8. Other Relevant Issues

8-1. Discussion of different options of the Project

Both sides discussed different options of the Project and made preliminary technical assessment of each option. They then agreed to narrow down the options to two options (Alternatives 4 and 5 in Annex 5). The Japanese side will run a load flow analysis of the options as soon as it receives relevant data from the Tanzanian side.

Meanwhile, the Tanzanian side will conduct a preliminary route survey for a transmission line from Kinyerezi power station to Luguruni substation site which is proposed by alternatives 4 and 5 in Annex 5. In case the Tanzanian side finds that there is a large number of expected resettlement, then both sides will consider the feasibility of a third option. Based on the preliminary technical assessment, the next candidate to be studied will be the "Requested" option. If the Japanese side comes up with a better contingency plan, then it will recommend it to the Tanzanian side.

During the second field survey scheduled in June 2019, the Japanese side will explain the results of the analysis to the Tanzanian side, along with an evaluation of the options and a recommended option for the Project. If both sides agree with the recommended option, the Tanzanian side will begin the Environmental and Social Impact Assessment to be concluded and reported to JICA before June 2020.

8-2. Preliminary transmission line route survey

As stated above, the Tanzanian side will conduct a preliminary route survey for a transmission line from Kinyerezi power station to Luguruni substation site which is proposed by alternatives 4 and 5 in Annex 5. The survey shall determine a tentative transmission line route and the location of angle towers, and identify tentative number of houses to be affected by the acquisition of ROW (Right of Way). The results of the survey shall be submitted to JICA by before June 2019.

8-3. Major undertakings to be taken by the Tanzanian side

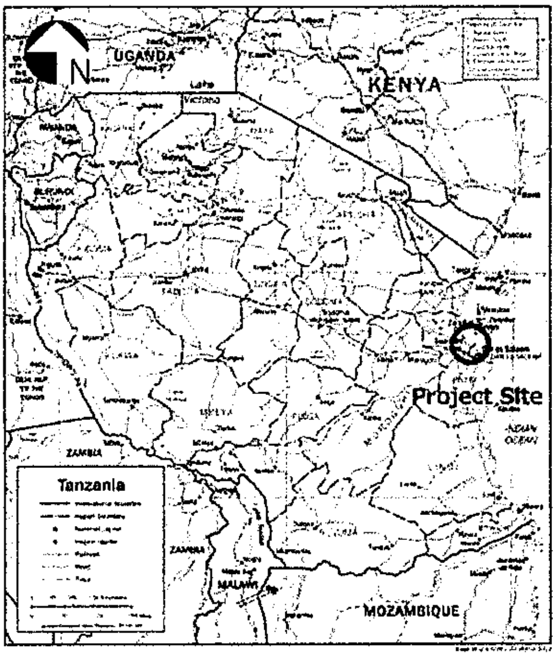
The JICA Survey Team explained that based on the Basic Principles of Japanese Grant Aid (Annex 3), for smooth and proper implementation of the Project, the Tanzanian side is required to undertake necessary measures including land acquisition. It shall also ensure that customs duties, internal taxes and other fiscal levies which may be imposed in Tanzania with respect to the purchase of the Products and/or the Services to be exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

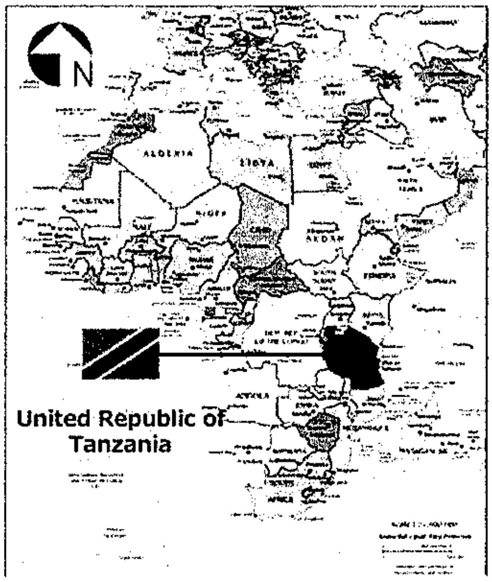
JICA Survey Team requested the Tanzanian side to bear the cost of fiscal levies such as overload surcharge for transporting heavy equipment, registration fees for Engineers Registration Board (ERB), and Contractors Registration Board (CRB). The Tanzanian took note of the request.

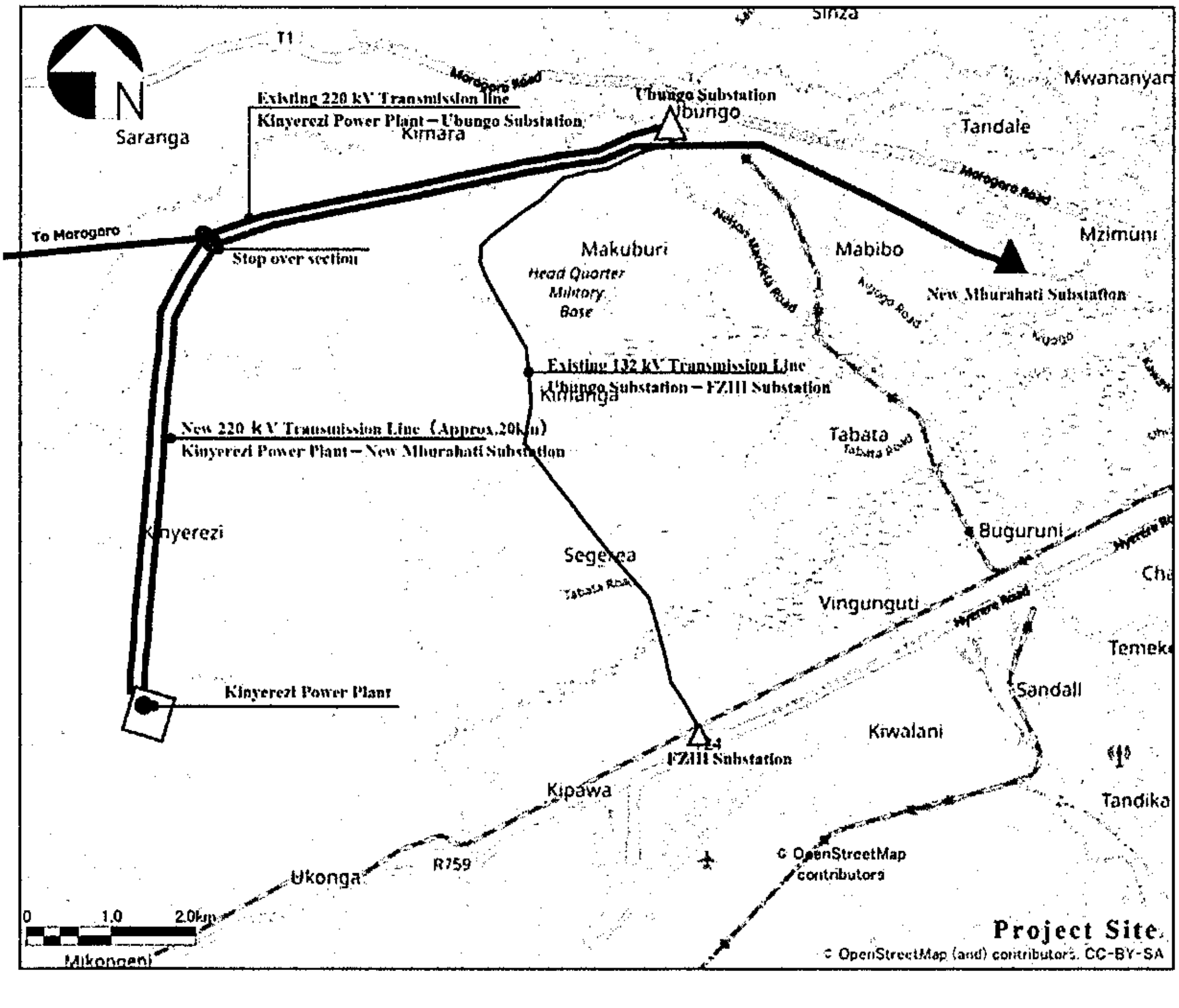
JICA Survey Team also explained the draft matrix for major undertakings to be taken by the Government of Tanzania. It requested to inform JICA on the necessary budget for the Project to be borne by Tanzanian side and budget planning schedule to secure the budget. The Tanzanian side agreed to provide the information to JICA by November 2019.

Annex 1 Project Site (Tentative)
Annex 2 Organization Structure of TANESCO (head office)
Annex 3 Basic principles of Japanese Grant Aid Projects
Annex 4 Major Undertakings to be taken by the Government of Tanzania
Annex 5 Options and preliminary evaluation for the Project

Project Site (Tentative)

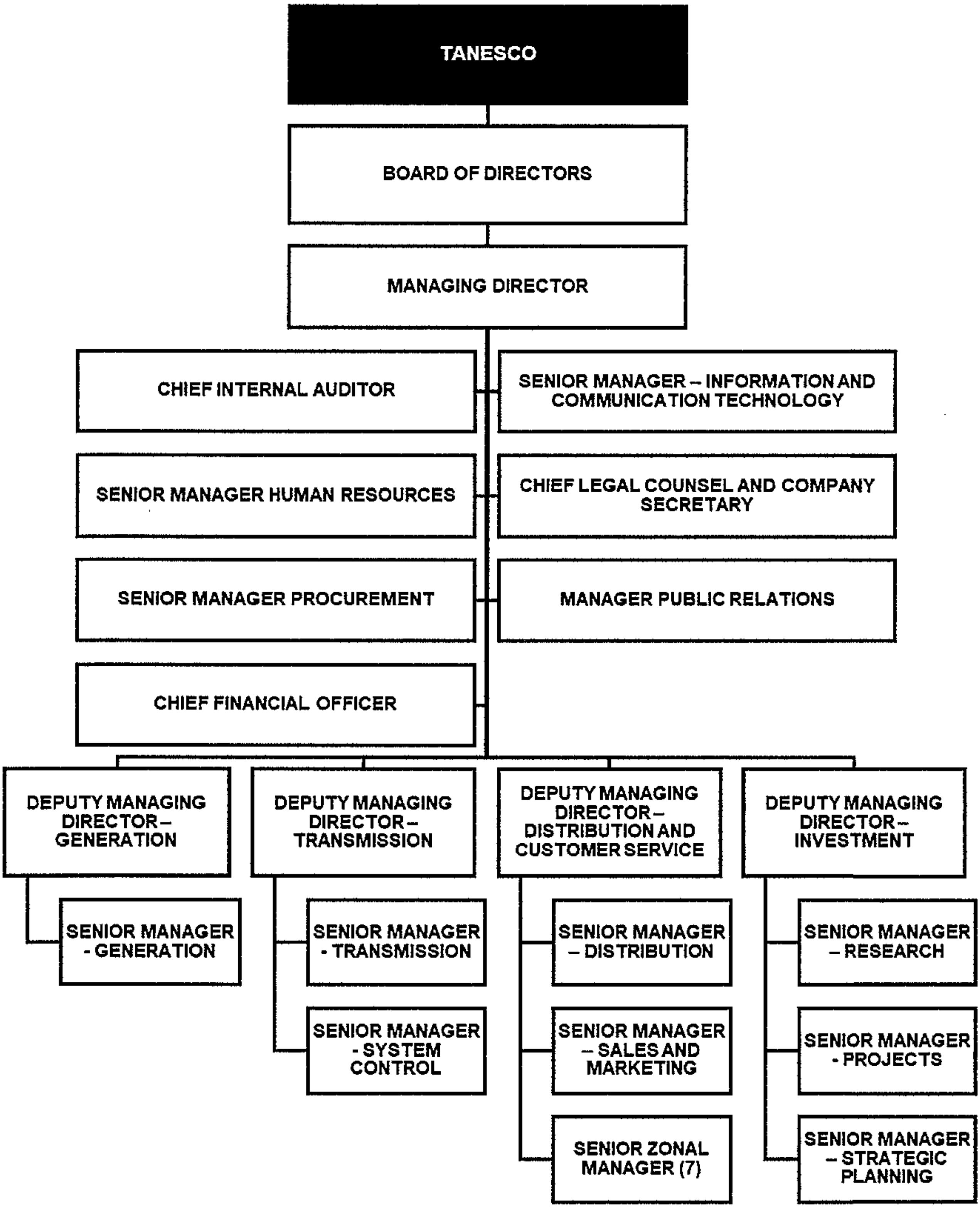






Annex 2

Organization Structure of the Tanzania Electric Supply Company Limited (TANESCO)



Annex 3

JAPANESE GRANT

The Japanese Grant is non-reimbursable fund provided to a recipient country (hereinafter referred to as "the Recipient") to purchase the products and/or services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. Followings are the basic features of the project grants operated by JICA (hereinafter referred to as "Project Grants").

1. Procedures of Project Grants

Project Grants are conducted through following procedures (See "PROCEDURES OF JAPANESE GRANT" for details):

(1) Preparation

- The Preparatory Survey (hereinafter referred to as "the Survey") conducted by JICA

(2) Appraisal

-Appraisal by the government of Japan (hereinafter referred to as "GOJ") and JICA, and Approval by the Japanese Cabinet

(3) Implementation

Exchange of Notes

-The Notes exchanged between the GOJ and the government of the Recipient

Grant Agreement (hereinafter referred to as "the G/A")

-Agreement concluded between JICA and the Recipient

Banking Arrangement (hereinafter referred to as "the B/A")

-Opening of bank account by the Recipient in a bank in Japan (hereinafter referred to as "the Bank") to receive the grant

Construction works/procurement

-Implementation of the project (hereinafter referred to as "the Project") on the basis of the G/A

(4) Ex-post Monitoring and Evaluation

-Monitoring and evaluation at post-implementation stage

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide basic documents necessary for the appraisal of the the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the Recipient necessary for the implementation of the Project.
- Evaluation of the feasibility of the Project to be implemented under the Japanese Grant from a technical, financial,

social and economic point of view.

- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.
- Confirmation of Environmental and Social Considerations

The contents of the original request by the Recipient are not necessarily approved in their initial form. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant.

JICA requests the Recipient to take measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the executing agency of the Project. Therefore, the contents of the Project are confirmed by all relevant organizations of the Recipient based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA contracts with (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the feasibility of the Project.

3. Basic Principles of Project Grants

(1) Implementation Stage

1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the Recipient to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Recipient to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Recipient, and procurement conditions. The terms and conditions generally applicable to the Japanese Grant are stipulated in the "General Terms and Conditions for Japanese Grant (January 2016)."

2) Banking Arrangements (B/A) (See "Financial Flow of Japanese Grant (A/P Type)" for details)

a) The Recipient shall open an account or shall cause its designated authority to open an account under the name of the Recipient in the Bank, in principle. JICA will disburse the Japanese Grant in Japanese yen for the Recipient to cover the obligations incurred by the Recipient under the verified contracts.

b) The Japanese Grant will be disbursed when payment requests are submitted by the Bank to JICA under an Authorization to Pay (A/P) issued by the Recipient.

3) Procurement Procedure

The products and/or services necessary for the implementation of the Project shall be procured in accordance with JICA's procurement guidelines as stipulated in the G/A.

4) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the Recipient to continue to work on the Project's implementation after the E/N and G/A.

5) Eligible source country

In using the Japanese Grant disbursed by JICA for the purchase of products and/or services, the eligible source countries of such products and/or services shall be Japan and/or the Recipient. The Japanese Grant may be used for the purchase of the products and/or services of a third country as eligible, if necessary, taking into account the quality, competitiveness and economic rationality of products and/or services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm, which enter into contracts with the Recipient, are limited to "Japanese nationals", in principle.

6) Contracts and Concurrence by JICA

The Recipient will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be concurred by JICA in order to be verified as eligible for using the Japanese Grant.

7) Monitoring

The Recipient is required to take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and to regularly report to JICA about its status by using the Project Monitoring Report (PMR).

8) Safety Measures

The Recipient must ensure that the safety is highly observed during the implementation of the Project.

9) Construction Quality Control Meeting

Construction Quality Control Meeting (hereinafter referred to as the "Meeting") will be held for quality assurance and smooth implementation of the Works at each stage of the Works. The member of the Meeting will be composed by the Recipient (or executing agency), the Consultant, the Contractor and JICA. The functions of the Meeting are as followings:

a) Sharing information on the objective, concept and conditions of design from the Contractor, before start of construction.

b) Discussing the issues affecting the Works such as modification of the design, test, inspection, safety control and the Client's obligation, during of construction.

(2) Ex-post Monitoring and Evaluation Stage

1) After the project completion, JICA will continue to keep in close contact with the Recipient in order to monitor that the outputs of the Project is used and maintained properly to attain its expected outcomes.

2) In principle, JICA will conduct ex-post evaluation of the Project after three years from the completion. It is required for the Recipient to furnish any necessary information as JICA may reasonably request.

(3) Others

1) Environmental and Social Considerations

The Recipient shall carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the Recipient and JICA Guidelines for Environmental and Social Considerations (April, 2010).

2) Major undertakings to be taken by the Government of the Recipient

For the smooth and proper implementation of the Project, the Recipient is required to undertake necessary measures including land acquisition, and bear an advising commission of the A/P and payment commissions paid to the Bank as agreed with the GOJ and/or JICA. The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the Products and/or the Services be exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

3) Proper Use

The Recipient is required to maintain and use properly and effectively the products and/or services under the Project (including the facilities constructed and the equipment purchased), to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japanese Grant.

4) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient.

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Annex 4

Major Undertakings to be taken by the Government of Tanzania

1. Specific obligations of the Government of Tanzania which will not be funded with the Grant

(1) Before the Tender

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To open a bank account (B/A)	within xx month after the signing of the G/A			
2	To issue an authorization to pay (A/P) to a bank in Japan (the Agent Bank) for the payment to the consultant	within xx month after the signing of the contract			
3	To approve EIA (conditions of approval should be fulfilled, if any) and secure the necessary budget for implementation.	within xx month after the signing of the G/A		xx TZS	
4	To secure Project site and temporary yard.	before start of the construction		xxTZS	
5	To remove and relocate the following facilities. 1) Removal of existing fence and gate 2) Cutting trees at the project site	before start of the construction		xx TZS	
6	To submit Project Monitoring Report (with the result of Detail Design)	before preparation of bidding documents			

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

(2) During the Project Implementation

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the Supplier(s)	within xx month after the signing of the contract(s)			
2	To bear the following commissions to a bank in Japan for the banking services based upon the B/A				
	1) Advising commission of A/P	within xx month after the signing of the contract(s)		xx TZS	
	2) Payment commission for A/P	every payment		xx TZS	
3	To ensure prompt unloading and customs clearance at ports of disembarkation in recipient country and to assist the Supplier(s) with internal transportation therein	during the Project			
4	To accord Japanese nationals and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the country of the Recipient and stay therein for the performance of their work	during the Project			
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be exempted	during the Project			

6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project		xx TZS	
7	1) To submit Project Monitoring Report after each work under the contract(s) such as shipping, hand over, installation and operational training	within one month after completion of each work			
	1) To submit Project Monitoring Report (final)	within one month after signing of Certificate of Completion for the works under the contract(s)			
8	To submit a report concerning completion of the Project	within six months after completion of the Project			
9	To construct access roads 1) Outside the site (if necessary)	3 months before completion of the construction			
10	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the site(s)				
	1) Electricity The distributing line to the site	before start of the construction			
	2) Furniture and Equipment General furniture	1 month before completion of the construction			
11	To take necessary measure for safe construction - traffic control - rope off	during the construction			
12	To implement Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP)	during the construction			
13	To submit results of environmental monitoring to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	during the construction			
14	To implement RAP (livelihood restoration program, if needed)	for a period based on livelihood restoration program		xx TZS	
15	To implement social monitoring, and to submit the monitoring results to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report - Period of the monitoring may be extended if affected persons' livelihoods are not sufficiently restored. Extension of the monitoring will be decided based on agreement between TANESCO and JICA.	- until the end of livelihood restoration program (In case that livelihood restoration program is provided) *- for two years after land acquisition and resettlement complete (In case that livelihood restoration program is not provided)*		xxTZS	

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THE PROJECT FOR REINFORCEMENT OF SUPPLY FROM KINYEREZI POWER STATION TO UBUNGO SUBSTATION (Development of Kynerezi-Mburahati axis)

Comparison of Alternatives

March 2019

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
YACHIYO ENGINEERING CO., LTD.
WEST JAPAN ENGINEERING CONSULTANTS, INC.

Background

- PSMP 2016 Update and DSMP (Dar es Salaam transmission and distribution master plan) proposed the expansion of Ubungo substation as short-term countermeasures to meet the growing demand in the center of Dar es Salaam city.
- Due to the limitation of available space in Ubungo substation, the construction of Mburahati substation was proposed by TANESCO as an alternative measure.
- As for medium to long term perspective, 220kV outer link which connects four numbers of 220/132kV substations was recommended to divert substation load from the center to the outskirts of Dar es Salaam.

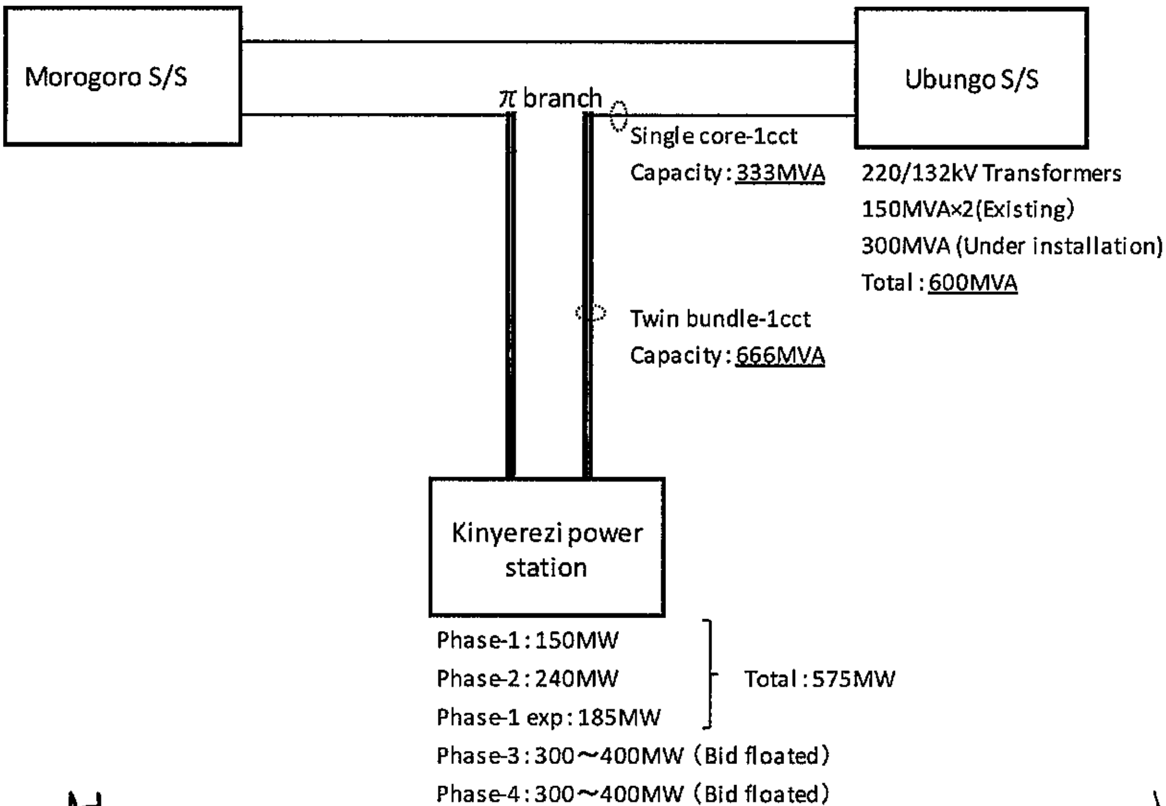
Alternative transmission configurations from Kinyerezi to Mburahati

- Pros and cons of the different configurations as well as the evaluations are shown below. The evaluations are modified after field survey.

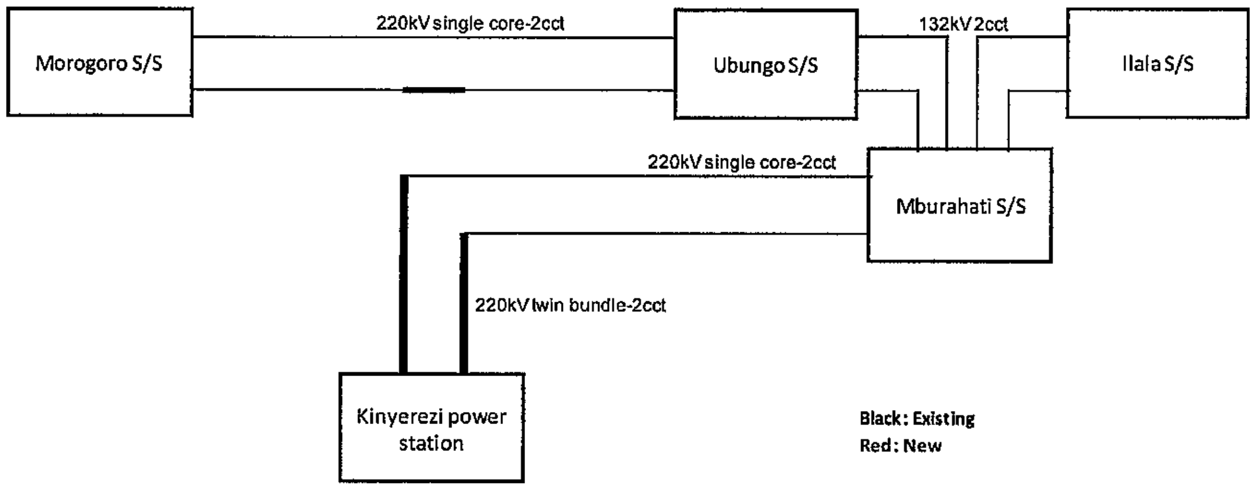
	Requested	Alt-1	Alt-2	Alt-3	Alt-4	Alt-5
Transformer Cost	C	A	B	A	A	C
Transmission line Cost	B	B-	A	B-	C	C
Land constraint at Existing Substation	A	A	A	C	A	A
Ease of ROW acquisition	B	**C-**	A	C	B	B
Power evacuation during construction	B	A	B	B	A	A
Ease of O&M	A	A	A	A	B	A
Reliability	B	A	**C-**	A	A	A
Overall (Points)	23	-	-	20	27 Best	25 2nd Best

[Remarks] A: Better (5 points), B: Moderate (3 points), B-: Moderate (2 points)
C: Worse (1 point), C-: Worst

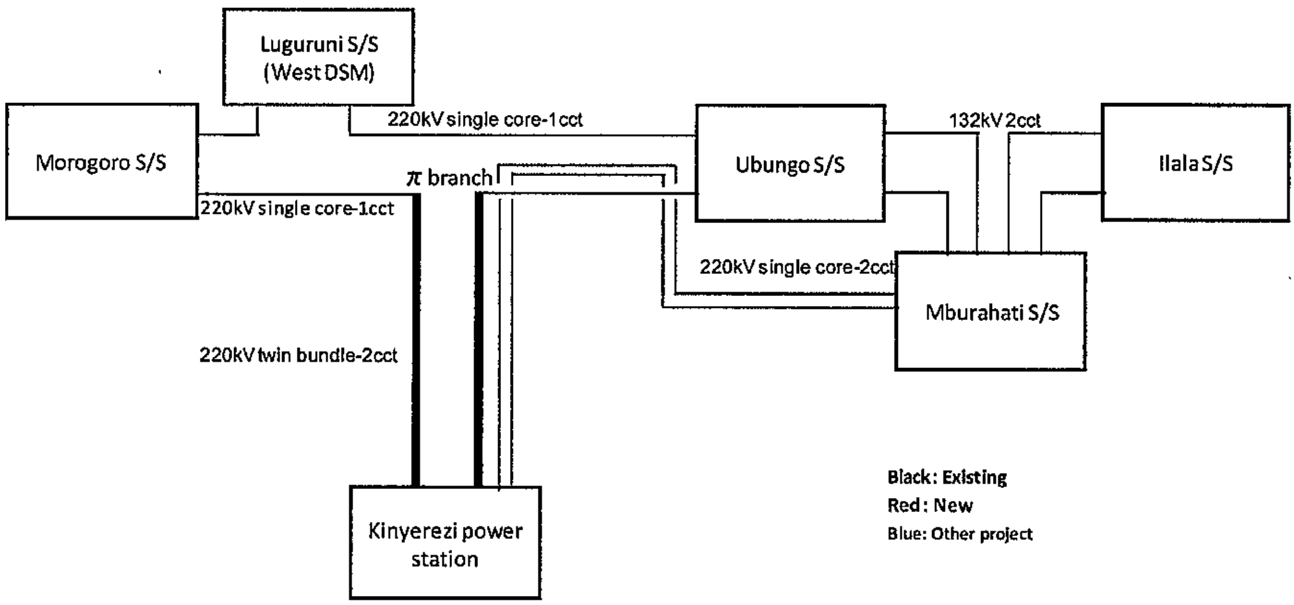
Current configuration



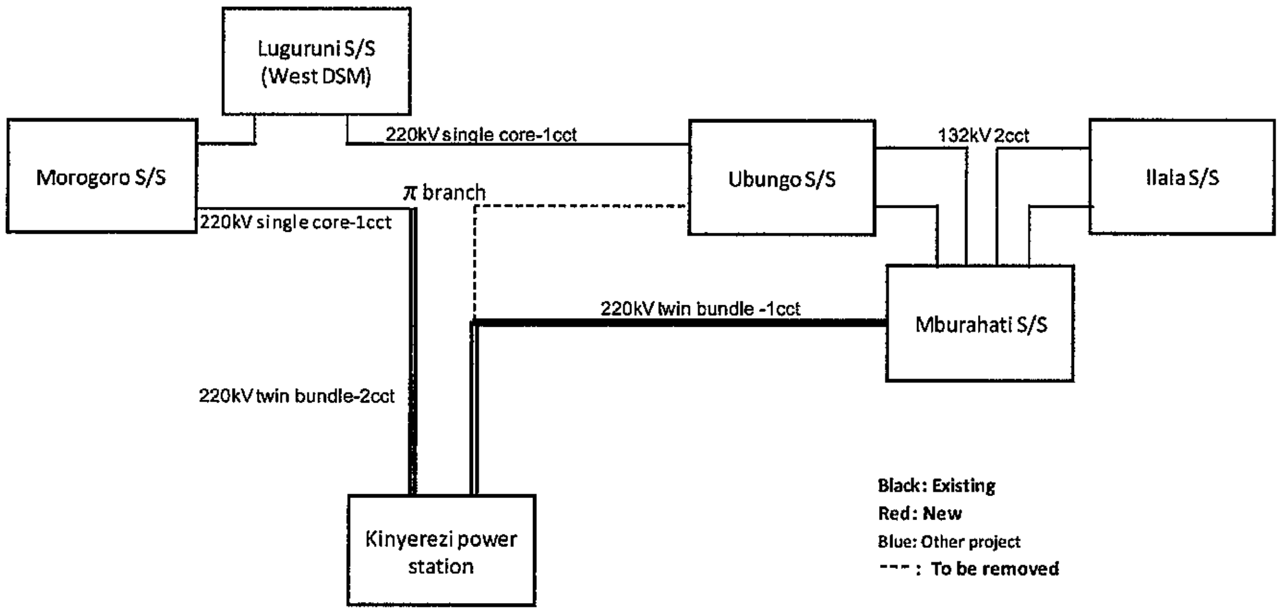
Requested



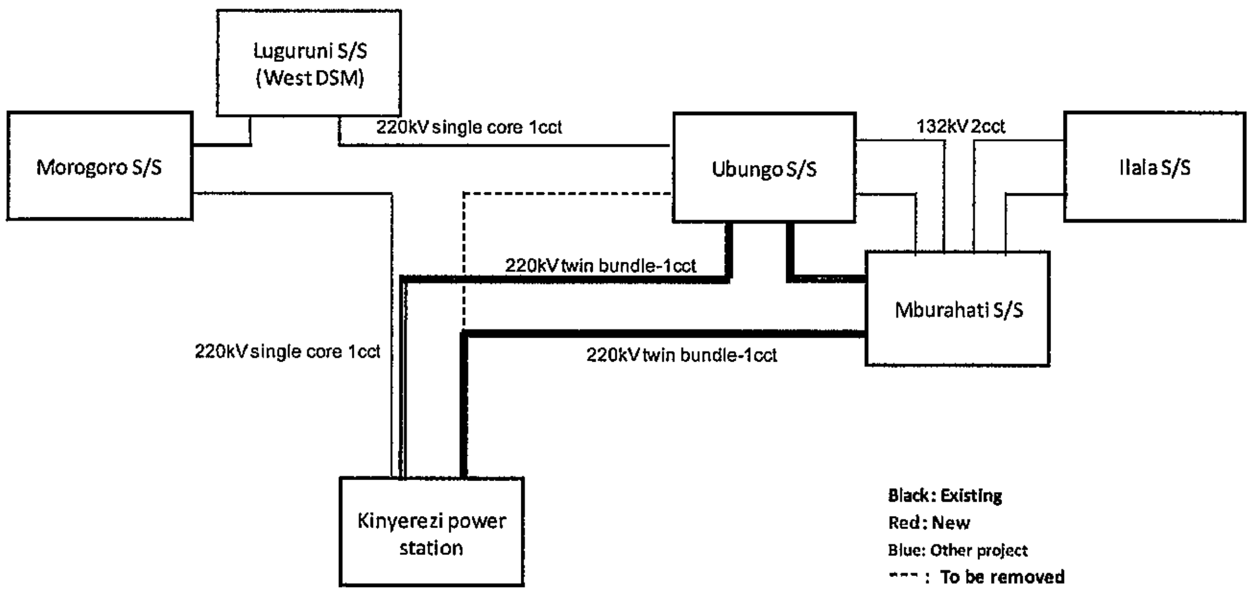
Alternative-1



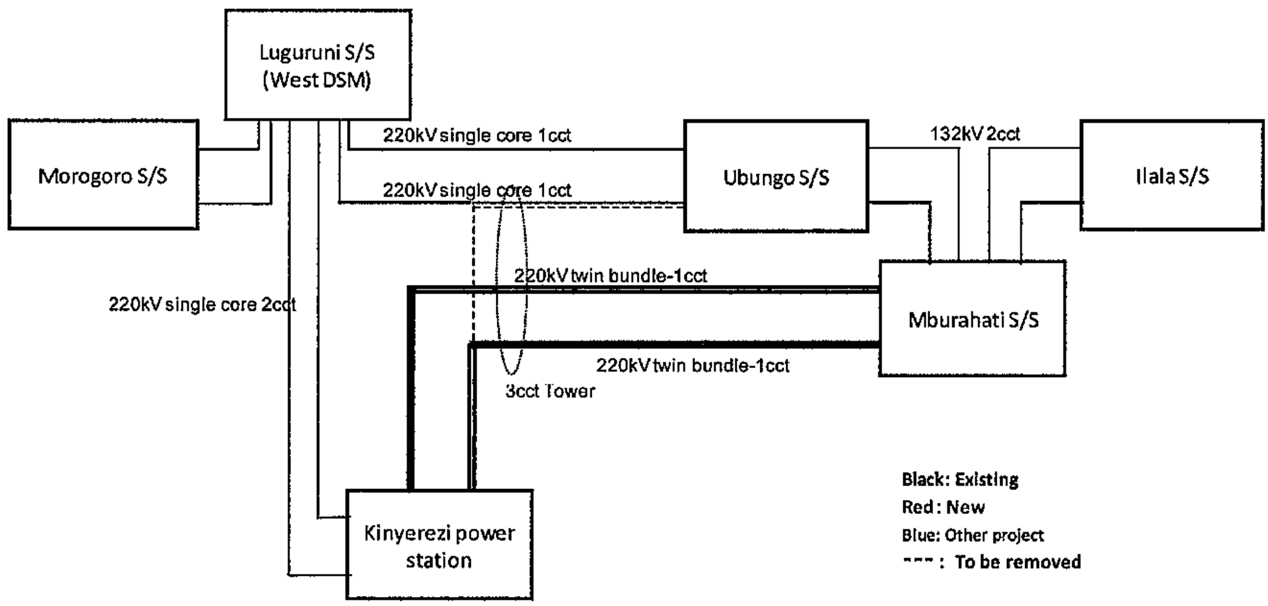
Alternative-2



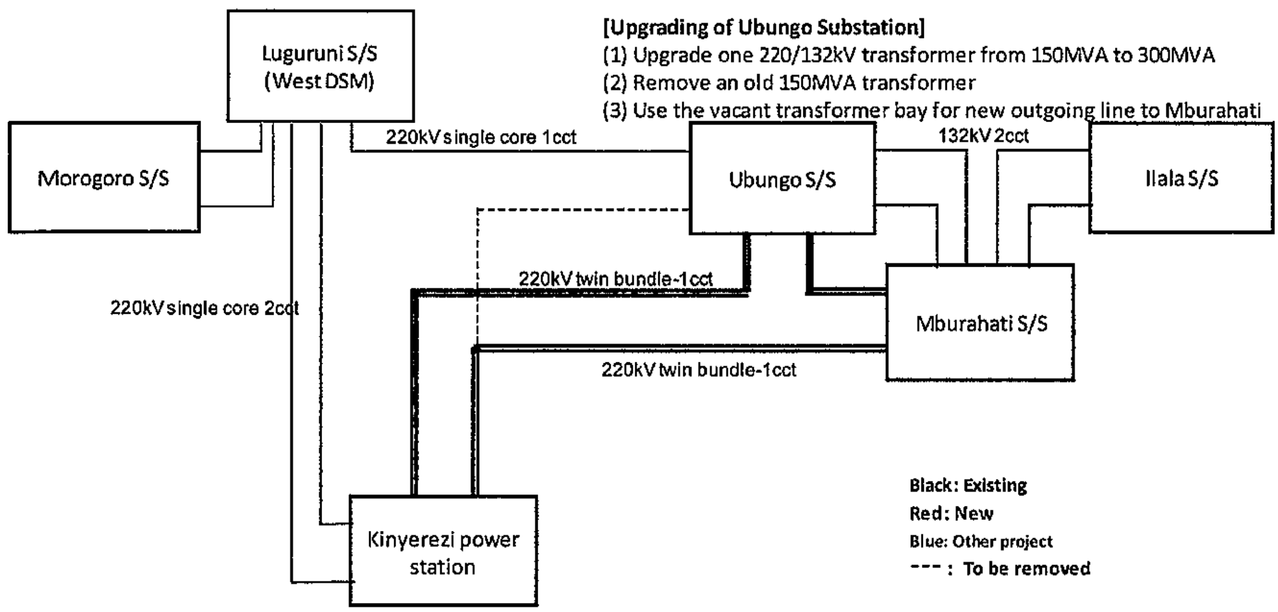
Alternative-3



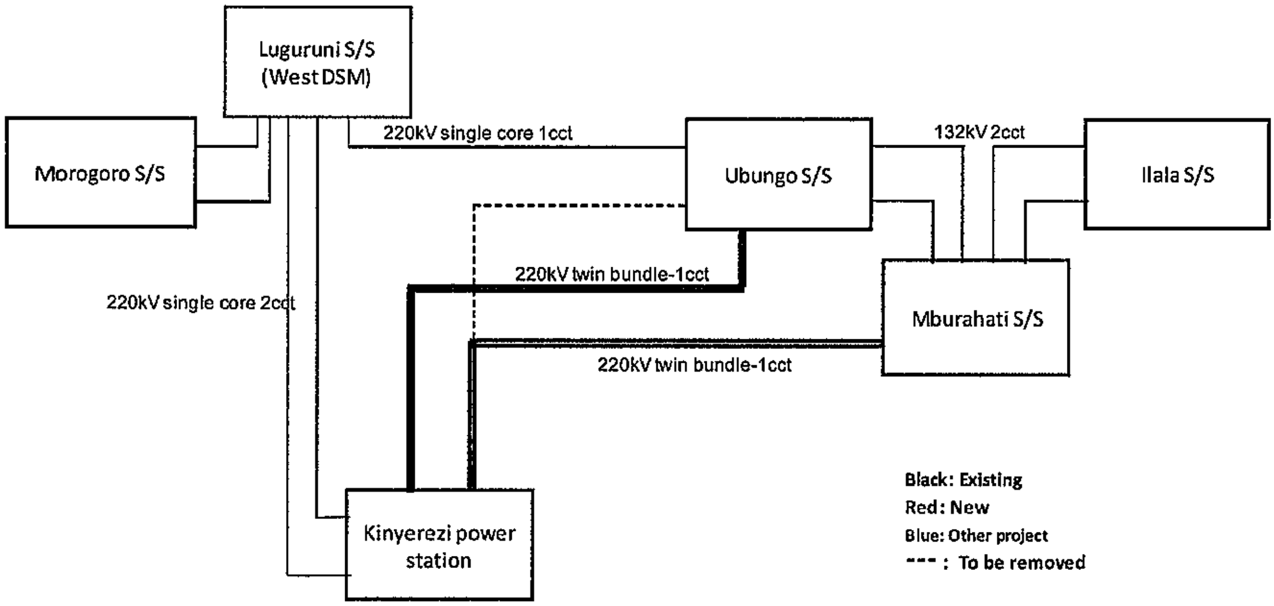
Alternative-4



Alternative-5



Alternative-5’



Comparison of Alt-1, Alt-4 and Alt-5

Items	Alternative-1	Alternative-4	Alternative-5
Transmission line length	About 20km	About 27km	About 27km
Number of houses to be relocated associated to ROW acquisition	About 120 houses	Not counted yet but less number is expected	Not counted yet but less number is expected
Transmission losses	Base	Higher than Alt-1	Higher than Alt-1
Ease of O&M	N/A	Three-circuit tower might cause difficulties in O&M	N/A
Compatibility to future development	N/A	Kinyerezi-Luguruni line can be extended to Bunju (North DSM) to form 220kV outer link	Same as Alternative-4

Conclusion for preliminary analysis

- Alternative-1 is excluded from the candidates because social impacts caused by ROW acquisition is very critical.
- Alternative-2 is excluded from the candidates because reliability issue on this option is critical.
- Alternative-3 will not be studied because of its lower rating
- Thus, JICA Survey Team will conduct load flow analysis on **Alternative-4 and 5** and report the results and a recommended option to TANESCO in the beginning of June 2019. In case TANESCO finds that there is a large number of expected resettlement on these alternatives, then TANESCO and JICA Survey Team will consider the feasibility of a third option. Based on the preliminary technical assessment, the next candidate to be studied will be the "Requested" option.

MINUTES OF DISCUSSIONS

FOR

"THE PROJECT FOR REINFORCEMENT OF SUPPLY FROM KINYEREZI POWER STATION TO UBUNGO SUBSTATION" IN THE UNITED REPUBLIC OF TANZANIA

AGREED UPON BETWEEN

TANZANIA ELECTRIC SUPPLY COMPANY LIMITED (TANESCO)

AND

THE CONSORTIUM OF YACHIYO ENGINEERING CO., LTD. AND WEST JAPAN ENGINEERING CONSULTANT, INC.

Dar es Salaam, 13th August, 2019

藤井 敬治

Kyoji Fujii
Chief Consultant
JICA Preparatory Survey Team
The Consortium of Yachiyo Engineering Co., Ltd. and West Japan Engineering Consultant, Inc.

Isaac A. Chanji
Acting Deputy Managing Director (Transmission)
Tanzania Electric Supply Company Ltd. (TANESCO)

Tanzania Electric Power Company Limited (hereinafter referred to as "TANESCO") and JICA Preparatory Survey Team (hereinafter referred to as "the Team") for the Project for Reinforcement of Supply from Kinyerezi Power Station to Ubungo Substation (hereinafter referred to as "the Project") had series of discussions from the 5th to 13th August 2019 to form a mutual understanding on the outline of design of the captioned Project. In the course of discussions, TANESCO and the Team agreed to record the following items as a conclusion.

1. **Discussion of different options of the Project**

   The Team explained the results of load flow analyses on Alternative-4, 5 and 5' to TANESCO, along with rough cost estimation, an evaluation of the options and a recommended option for the Project as shown in Annex-1. While Alternative-5 was excluded from further consideration due to budgetary limitation, Alternative-4 and 5' were compared to seek the best option. TANESCO preferred Alternative-4 from the view point of system reliability stating that Alternative-5' had only one circuit of transmission line between Ubungo and Morogoro and it was not acceptable.

   The Team also explained that due to the limitation of Japan's grant aid budget allocated for the Project, the construction of 220 kV double circuit transmission lines from Kinyerezi power station to Luguruni substation needs to be undertaken by the Tanzanian side. The Team further mentioned that JICA's assistance policy does not allow it to extend grant aid for the same sector in two consecutive years. Therefore, the Team requested TANESCO to raise fund for the lines. TANESCO agreed to do so but commented that the fund raising might take time because there was no available fund at hand right now and it had to commence the fund raising process from scratch. Considering the circumstances above and the Project is not committed yet, both sides agreed that the Kinyerezi – Luguruni lines should not be a precondition for the approval of the grant.

   Meanwhile, the Team requested TANESCO to complete the Kinyerezi – Luguruni lines before the completion of the Project. TANESCO expressed concerns stating that the Kinyerezi – Luguruni lines might be delayed and not be able to catch up the progress of the Project considering necessary process and time for the fund raising. In order to assess the impact on the transmission system in Dar es Salaam caused by the delay of the Kinyerezi – Luguruni lines, the Team will carry out load flow analyses on Alternative-4 in 2025 without the Kinyerezi – Luguruni lines incorporating the latest progress and plans of transmission system development. Annex-2 shows the cases of studies proposed by the Team with different assumptions of transmission system development.

   TANESCO shall authorize the component, concept and development process of the Project

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internally in consultation with its strategic planning department.

2. **Transmission system development in Dar es Salaam**

The Team explained TANESCO transmission system development plan proposed by DSMP (Dar es Salaam Transmission and Distribution System Master Plan) as shown in Annex-3. Total budget required for the transmission system development in Dar es Salaam is shown in Annex-4. The Team stressed that the Project could not solve all the network constraints in Dar es Salaam and strongly recommended TANESCO to implement the transmission system development projects in line with the DSMP.

TANESCO explained ongoing and planned transmission projects as follows.

[Ongoing project]

(1) 220 kV, 1 circuit Kinyerezi – Morogoro transmission line for SGR (Standard Gauge Railway)

(2) Upgrading of 220/132 kV transformer at Kinyerezi power station from 50 MVA to 2x120 MVA and reinforcement of 132 kV transmission line from Kinyerezi – FZII – Mbagala

(3) Construction of 132/33 kV New Kigamboni (Dege) substation (with 1 x 60 MVA, 132/33 kV transformer) and 132 kV line to New Kigamboni to be branched from Mbagala – Kurasini line

(4) Construction of 220/33kV Luguruni substation

[Planned project]

(1) 400 kV line Somanga – Mkuranga – Kinyerezi and 132 kV line from Mkuranga to New Kigamboni

(2) 400 kV line from Julius Nyerere hydro - New Chalinze - Kinyerezi

(3) 220kV line from Chalinze to Bagamoyo

(4) 132 kV line from Ubungo to Kurasini

3. **Project site for Mburahati Substation**

The Team proposed an alternative site for new 220/132 kV substation instead of Mburahati because of its flat terrain and much less affected houses. Both sides confirmed and agreed that the alternative site for new 220/132 kV substation of the Project is located nearby National Institute of Transport (NIT), close to Mabibo road in Dar es Salaam, which falls on the wayleave of existing 132 kV Ubungo – Ilala transmission lines as shown in Annex-5. TANESCO shall confirm the land ownership of the site, and report it to the Team by the end of October 2019.

4. **Arrangement of joint meeting with TANROAD**

The Team requested TANESCO to coordinate a joint meeting with Tanzania National Roads

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Agency (TANROADS), regarding Ubungo flyover and overload surcharge for transporting heavy equipment, etc. of the Project during the third field survey. TANESCO took note of the request, and shall coordinate the meeting during the third site survey.

[Annexes]

Annex-1 Summary of Analysis in Japan and Recommended Development Plan

Annex-2 Study cases of load flow analyses

Annex-3 Transmission system development plan proposed by DSMP

Annex-4 Budget required for the transmission system development in Dar es Salaam

Annex-5 Project site for new 220/132 kV substation

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THE PROJECT FOR REINFORCEMENT OF SUPPLY FROM KINYEREZI POWER STATION TO UBUNGO SUBSTATION (Development of Kinyerezi-Mburahati axis)

Summary of Analysis in Japan and Recommended Development Plan

August 2019

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

YACHIYO ENGINEERING CO., LTD.

WEST JAPAN ENGINEERING CONSULTANTS, INC.

Summary

- JICA Study Team has conducted load flow analyses on Alternative-4 and 5 which Tanzanian side and JICA mission members jointly narrowed down from various options during the first field survey in March 2019.
- JICA Study Team has come up to a better option derived from Alternative-5, which is named Alternative-5'.
- The results of load flow analyses prove that Alternative-4, 5 and 5' are technically feasible.
- Due to the limitation of Japan's grant budget, one of the components of the Project, i.e., construction of Kinyerezi-Luguruni 220kV transmission lines needs to be undertaken by the Tanzanian side. This line is important to ensure the reliability of power evacuation from Kinyerezi to Ubungo and Morogoro after diverting Kinyerezi's power evacuation lines to Mburahati.
- In addition to the scope of the grant aid project, transmission system development proposed by DSMP is necessary to ensure the capacity and reliability of transmission network in Dar es Salaam.

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Preliminary evaluation of alternatives at the stage of 1st field survey

- Pros and cons of the different configurations as well as the evaluations are shown below at first field survey.

	Requested	Alt-1	Alt-2	Alt-3	Alt-4	Alt-5
Transformer Cost	C	A	B	A	A	C
Transmission line Cost	B	B-	A	B-	C	C
Land constraint at Existing Substation	A	A	A	C	A	A
Ease of ROW acquisition	B	C-	A	C	B	B
Power evacuation during construction	B	A	B	B	A	A
Ease of O&M	A	A	A	A	B	A
Reliability	B	A	C-	A	A	A
Overall (Points)	23	-	-	20	27 **Best**	25 **2nd Best**

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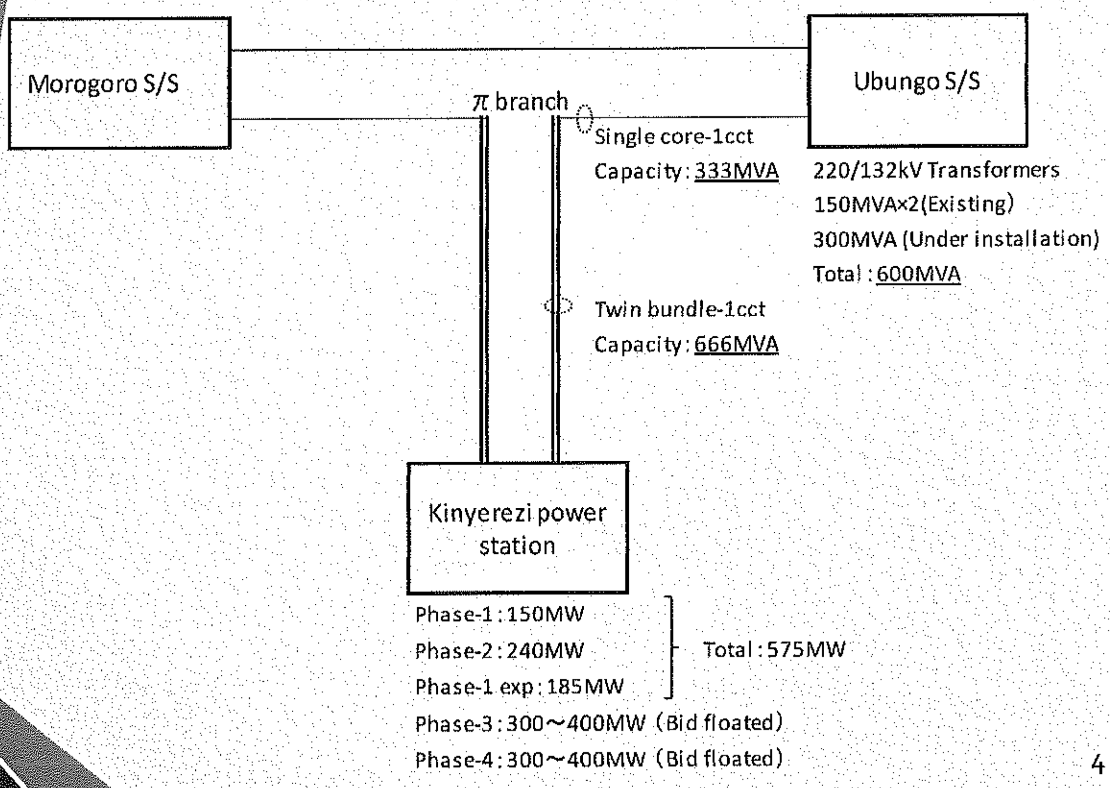
Current configuration



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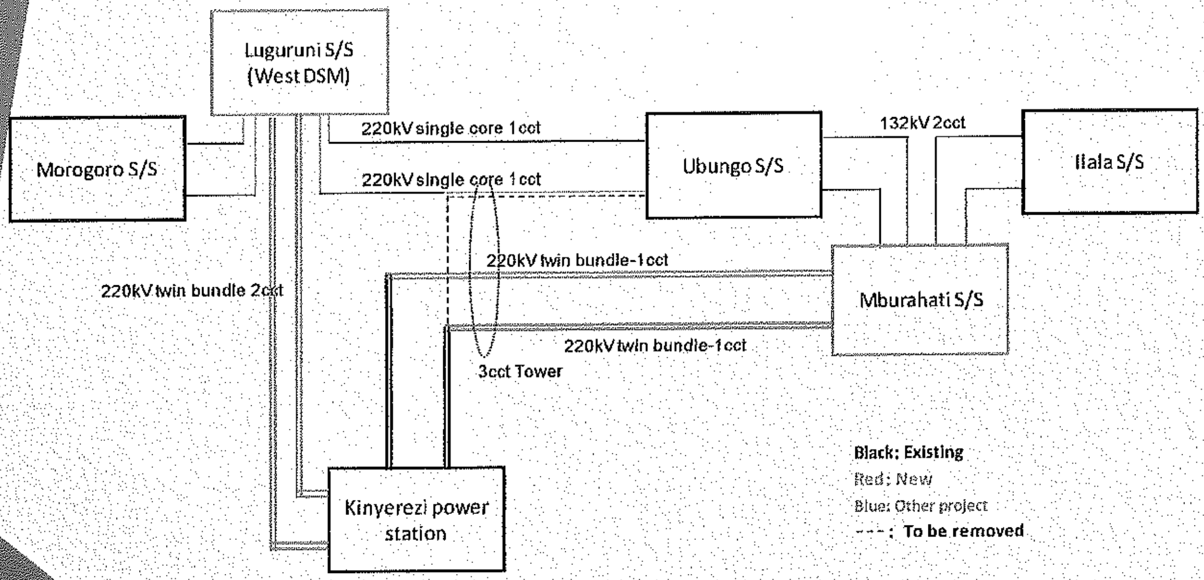
Alternative-4



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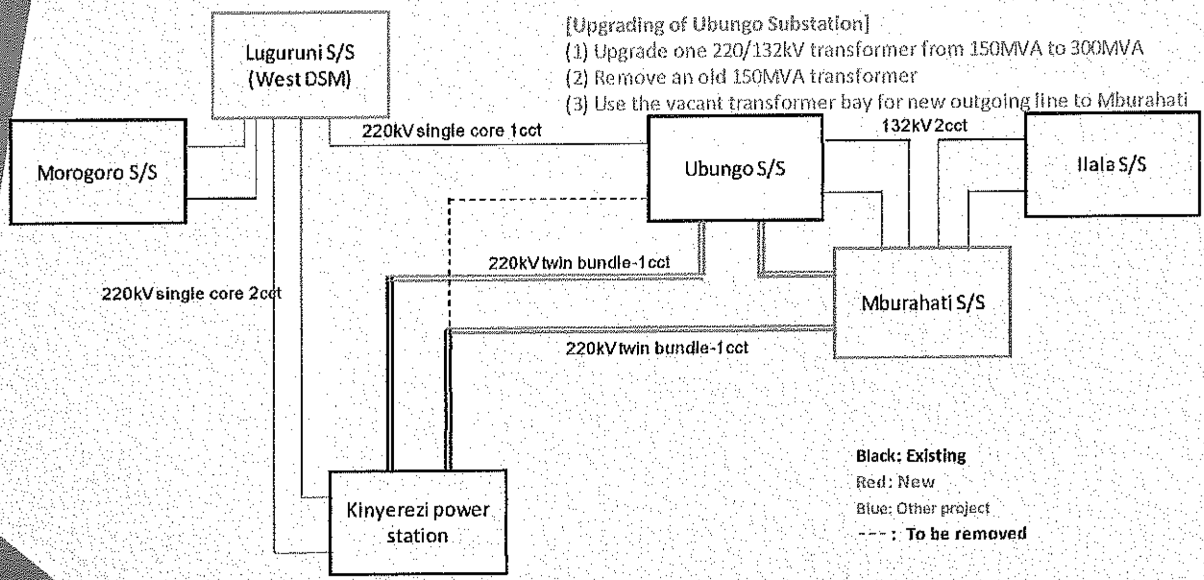
Alternative-5



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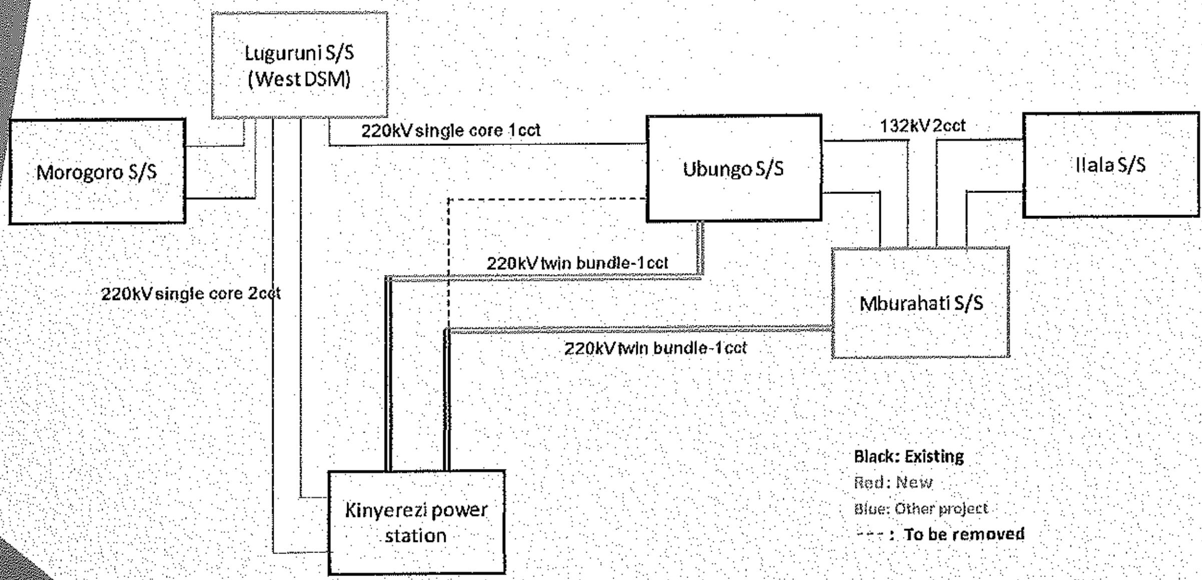
Alternative-5'



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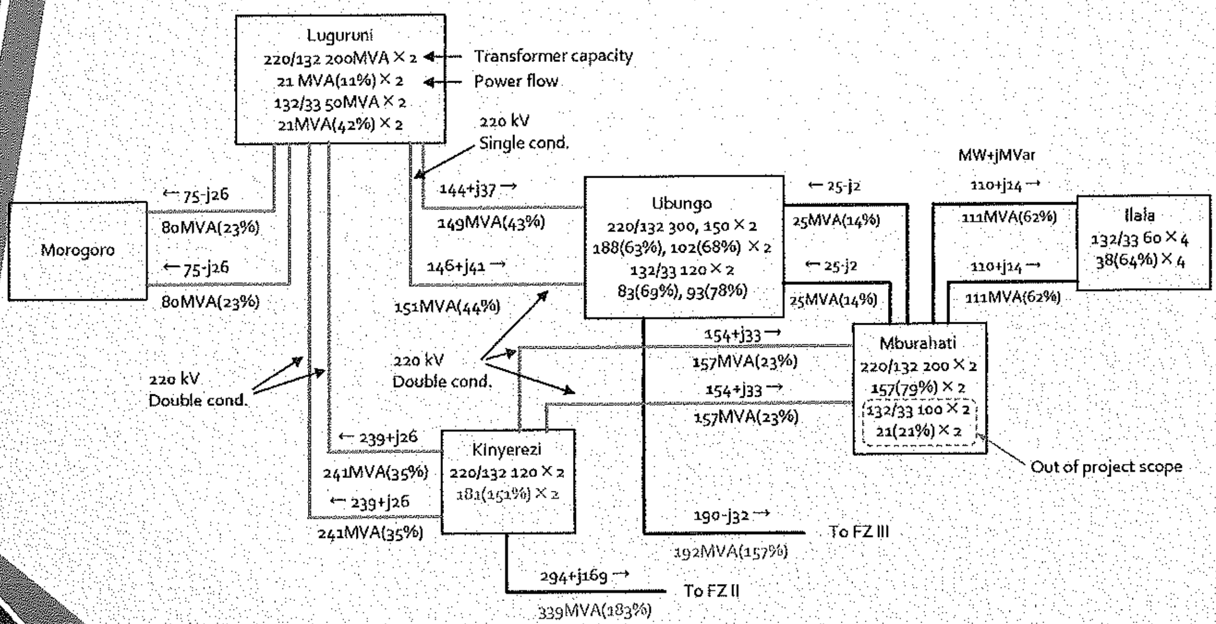
Load Flow of Alternative-4 in 2025



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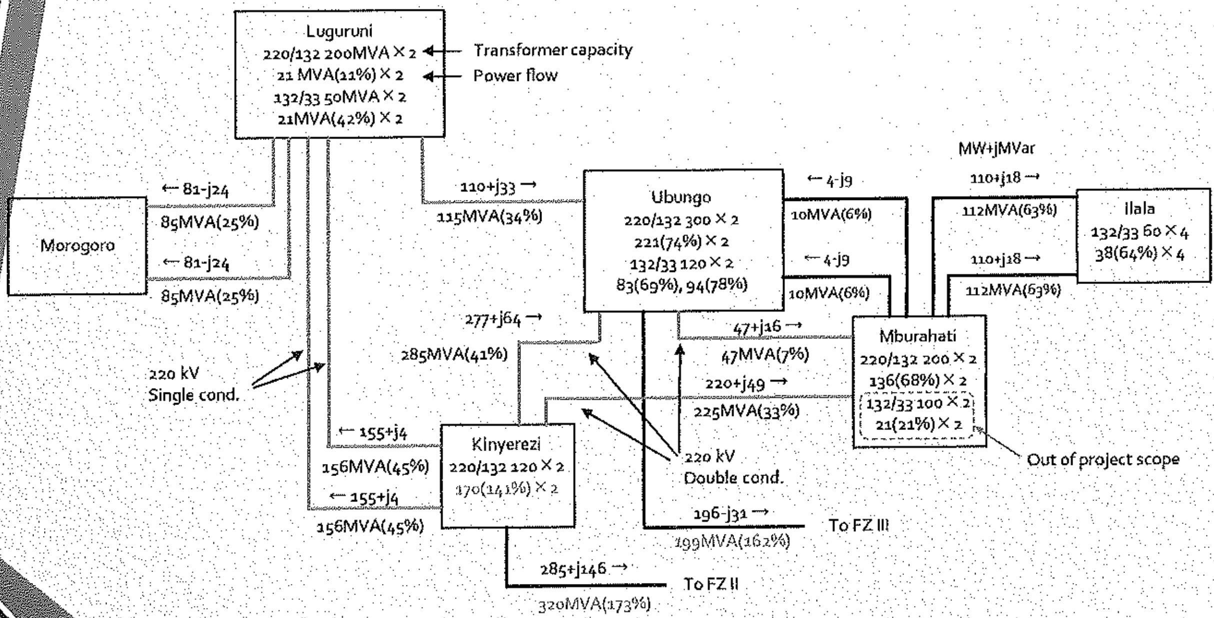
Load Flow of Alternative-5 in 2025



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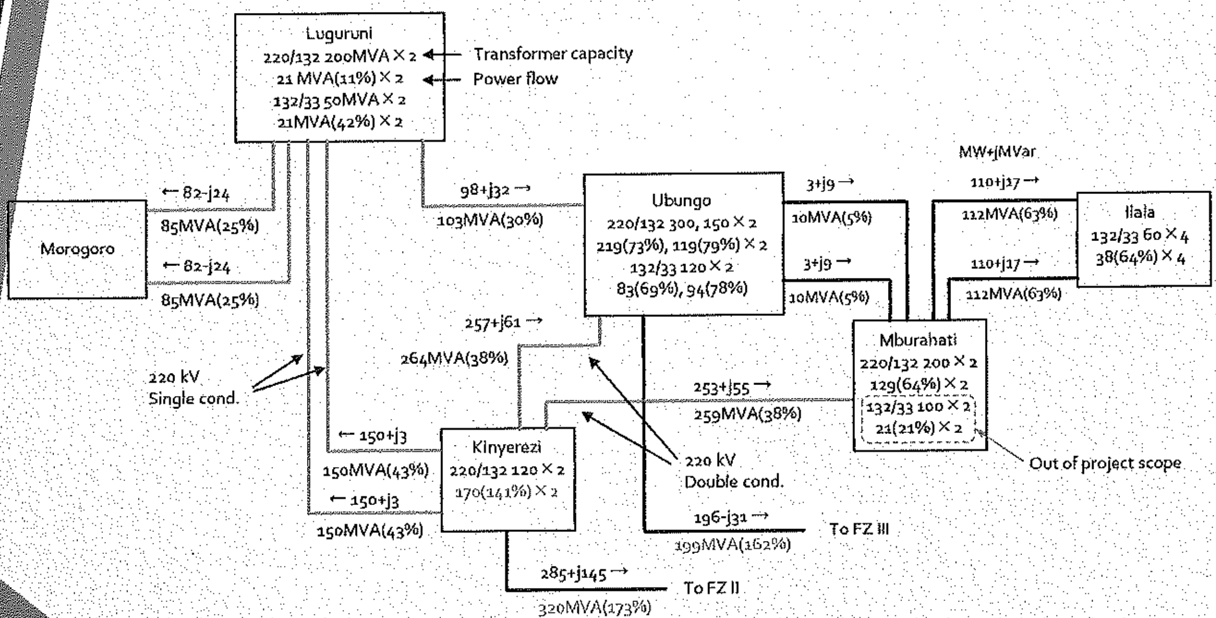
Load Flow of Alternative-5' in 2025



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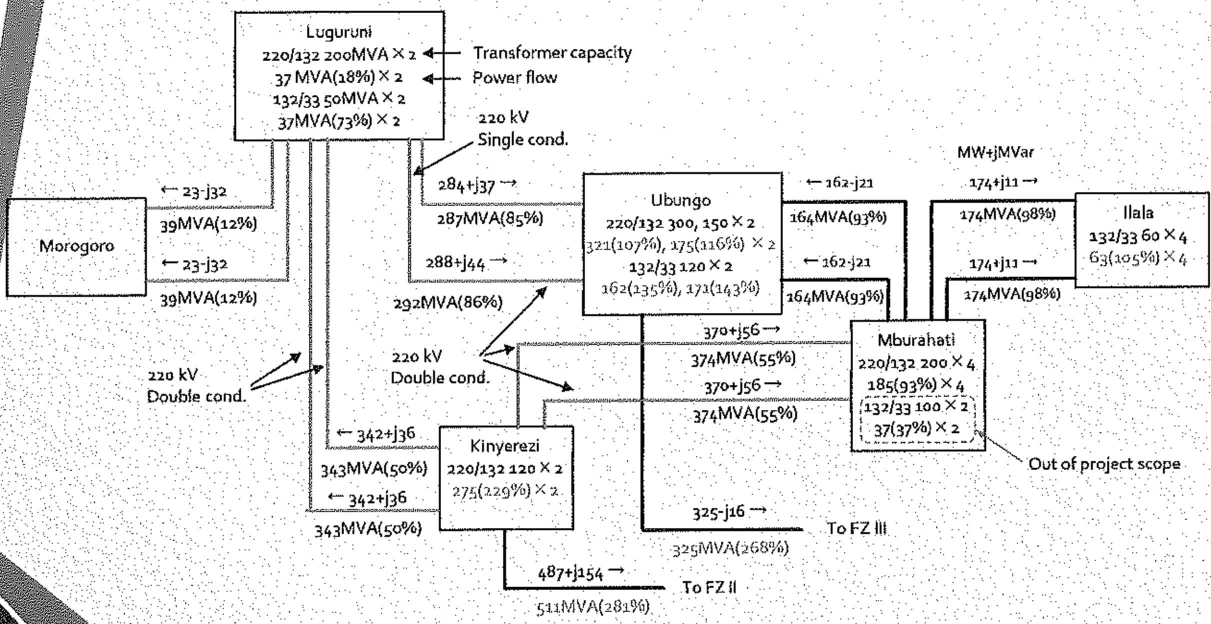
Load Flow of Alternative-4 in 2030



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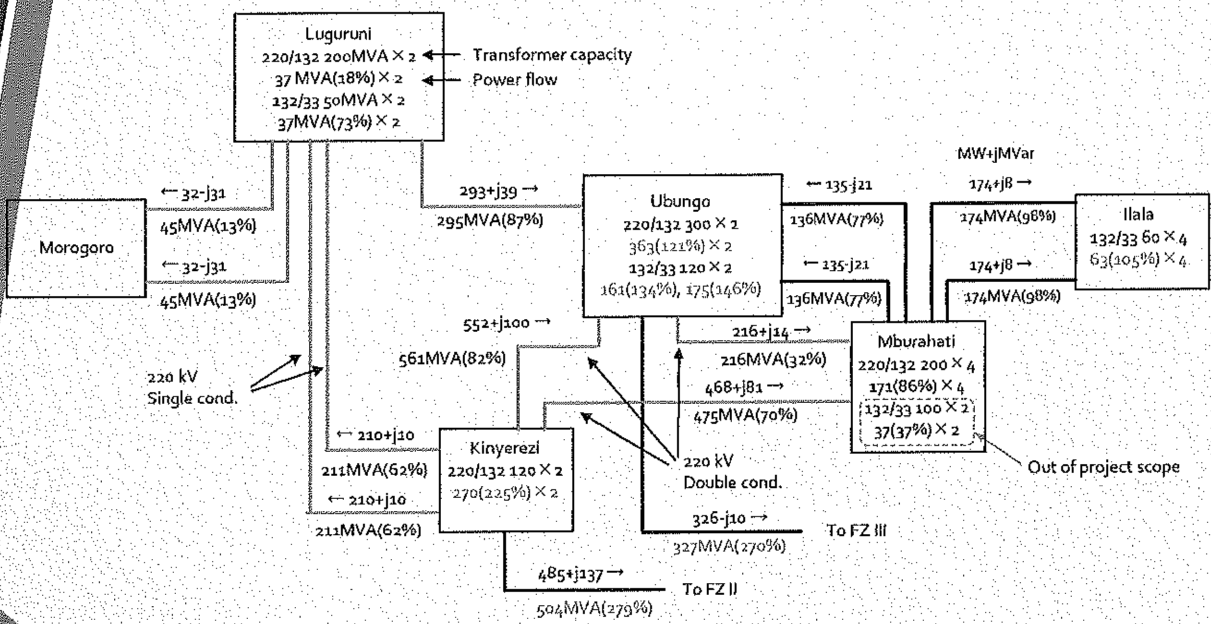
Load Flow of Alternative-5 in 2030



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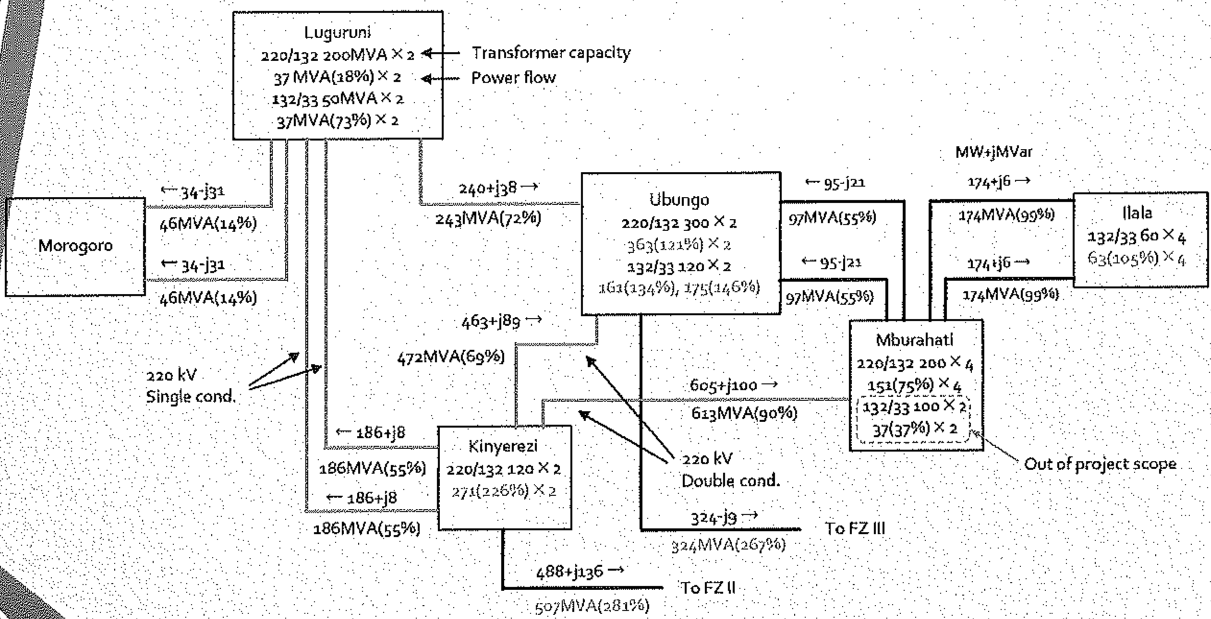
Load Flow of Alternative-5' in 2030



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Preliminary rough cost estimation of alternative transmission configurations from Kinyerezi to Mburahati

	Alt-4	Alt-5	Alt-5'
Project Cost	Japanese side: 1. Construction of Mburahati substation (220/132kV,200 MVA Transformer × 2) 2. 220kV Kinyerezi (T-off point)-Ubungo TL-1cct and Kinyerezi (T-off point)-Mburahati TL-2cct which are hung on 3 cct towers. (Total: US$ 41 million) Tanzanian side: 220kV Kinyerezi-Luguruni Transmission line (2 cct and double conductor) shall be done by TANESCO by 2025. (US$ 18 million) Undertakings that shall be done by TANESCO are more than Alt-5 and 5'.	Japanese side: 1. Construction of Mburahati substation (220/132kV, 200 MVA Transformer × 2) 2. 220kV Kinyerezi(T-off point)-Ubungo TL-1cct, Ubungo – Mburahati TL-1cct and Kinyerezi(T-off point)-Mburahati TL line-1cct which are hung on 2 cct towers. 3. Reinforcement of one 220/132kV transformer (150→300MVA) at Ubungo substation (Total: US$ 49 million) Tanzanian side: 220kV Kinyerezi-Luguruni Transmission line (2 cct and single conductor) shall be done by TANESCO by 2025. (US$ 14 million)	Japanese side: 1. Construction of Mburahati substation (220/132kV, 200 MVA Transformer × 2) 2. 220kV Kinyerezi(T-off point)-Ubungo TL-1cct and Kinyerezi(T-off point)-Mburahati TL-1cct which are hung on 2 cct towers. (Total: US$ 38 million) Tanzanian side: 220kV Kinyerezi-Luguruni Transmission line (2 cct and single conductor) shall be done by TANESCO by 2025. (US$ 14 million)
Rating	A-	B	A

14

Evaluation of alternative transmission configurations from Kinyerezi to Mburahati

	Alt-4	Alt-5'
Project cost (Japanese side)	A- Higher than Alt-5'	A Lower than Alt-4
Undertaking by Tanzanian side	A- Slightly higher than Alt-5'	A Lower than Alt-4
Reliability	A Mburahati substation is connected to 2cct transmission lines	B Mburahati substation is connected to 1cct transmission line only, therefore N-1 redundancy cannot be secured.
Ease of O&M	A- Operation and maintenance of 3 cct transmission line requires higher skill and knowledge.	A Same as existing transmission lines
Overall	A-	A

15

Recommended configuration

- If reliability issue of Alternative-5' is acceptable to TANESCO or additional 220kV transmission line to Mburahati substation is secured by other resources, Alternative-5' is the most recommended option.
- If reliability issue of Alternative-5' is not acceptable to TANESCO, Alternative-4 is recommended. Still, further cost reduction measures need to be considered in order to avoid cost overrun. TANESCO might be requested to undertake land preparation for Mburahati substation site.
- In both alternatives, the following preconditions shall be satisfied by the Tanzanian side to make them feasible.
  - Luguruni substation is completed and connected to both Ubungo - Morogoro and Kinyerezi – Morogoro TLs before the Project commences.
  - 220 kV transmission line (2cct) from Kinyerezi to Luguruni is completed by 2025.
  - Additional 2 × 200 MVA transformers are procured and installed at Mburahati substation by 2030

16

Annex-2 Study cases of load flow analyses

Case No.	Assumptions of transmission system development
Case 1	- Mkuranga 400/220/132kV S/S - New Kigamboni 132/33kV S/S - Mkuranga - New Kigamboni 132kV line (1cct or 2cct)
Case 2	- Mkuranga 400/220/132kV S/S - New Kigamboni 220/132/33 S/S - Mkuranga - New Kigamboni 220 kV line (1cct or 2cct)
Case 3	- Mkuranga 400/220/132kV S/S - Kinyerezi 400/220/132kV S/S - New Chalinze 400/220(/132)kV S/S - Bagamoyo 220/132kV S/S - Mkuranga – Kinyerezi – New Chalinze 400kV line - New Chalinze – Bagamoyo 220kV line (2cct) - Bagamoyo – Tegeta 132kV line (1cct or 2cct)
Case 4	- Mkuranga 400/220/132kV S/S - Kinyerezi 400/220/132kV S/S - New Chalinze 400/220(/132)kV S/S - Bagamoyo 220/132kV S/S - New Bahari Beach 132/33kV S/S(1) - Mkuranga – Kinyerezi – New Chalinze 400kV line - New Chalinze – Bagamoyo 220kV line (2cct) - Bagamoyo – New Bahari Beach 132kV line (1cct or 2cct)
Case 5	- Same as Case 4 - Submarine Cable from New Bahari Beach to Zanzibar
Case 6	- Enhancement of Kinyerezi – FZ II 132kV line to 2 lines

(1) New Bahari Beach 132/33 S/S is recommended as an expanded substation of the existing Bahari Beach Substation. Since there is an open space of TANESCO owned adjacent to the Bahari Beach substation, it is planned to install 132/33 kV switchgear and transformers to that location along with the addition of a transformer bank at the existing Bahari Beach substation.

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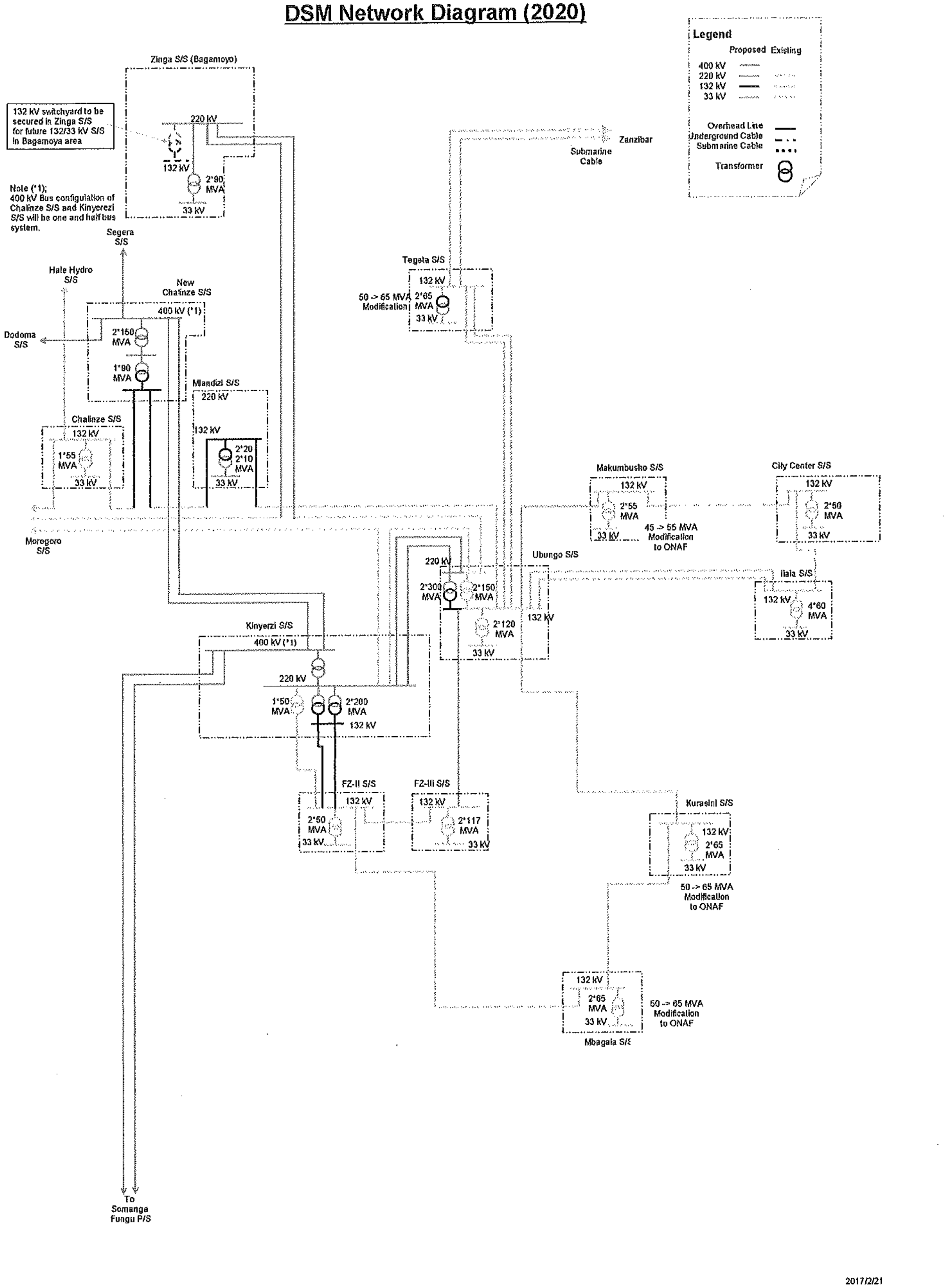
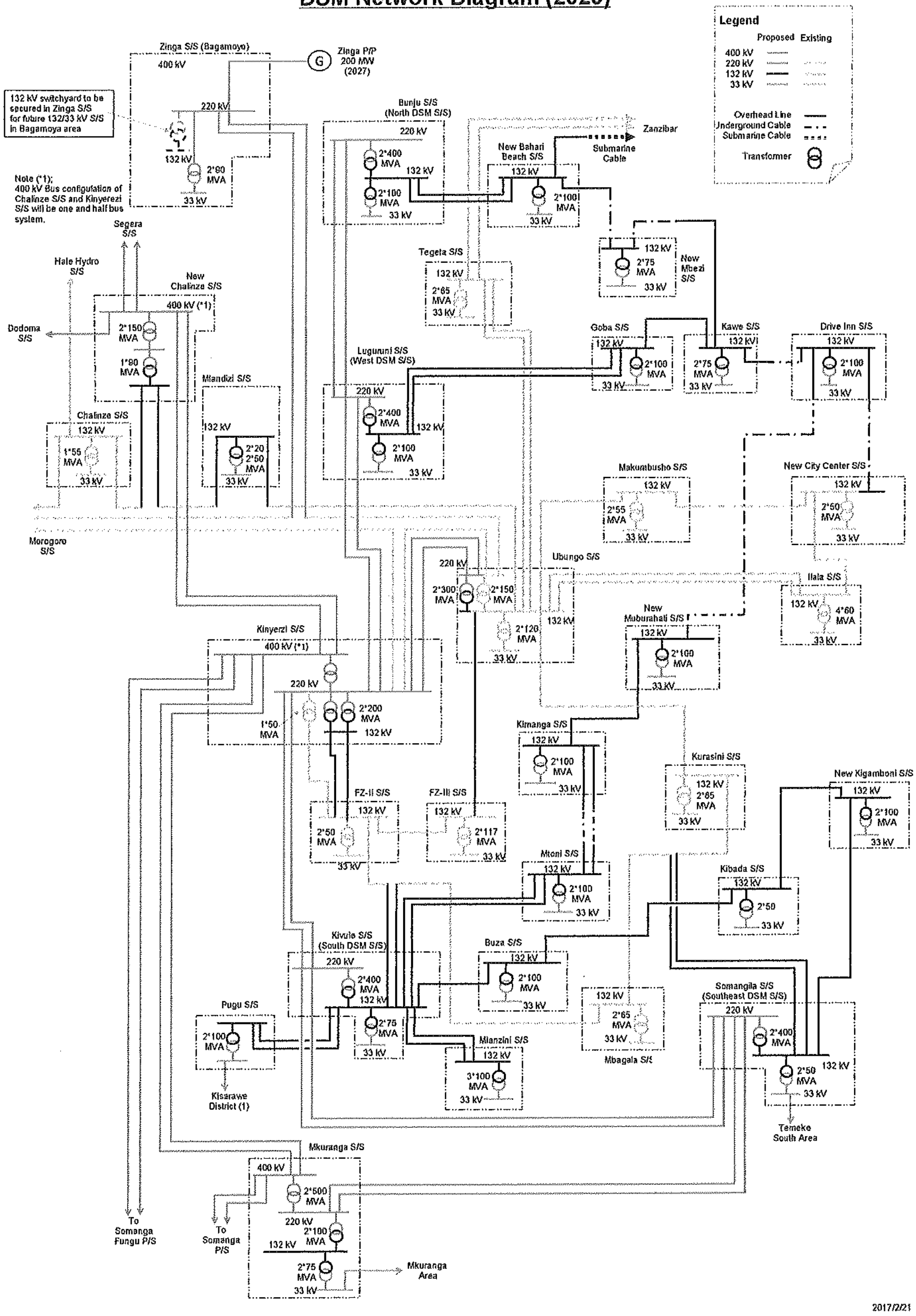
DSM Network Diagram (2020)



2017/2/21

DSM Network Diagram (2025)



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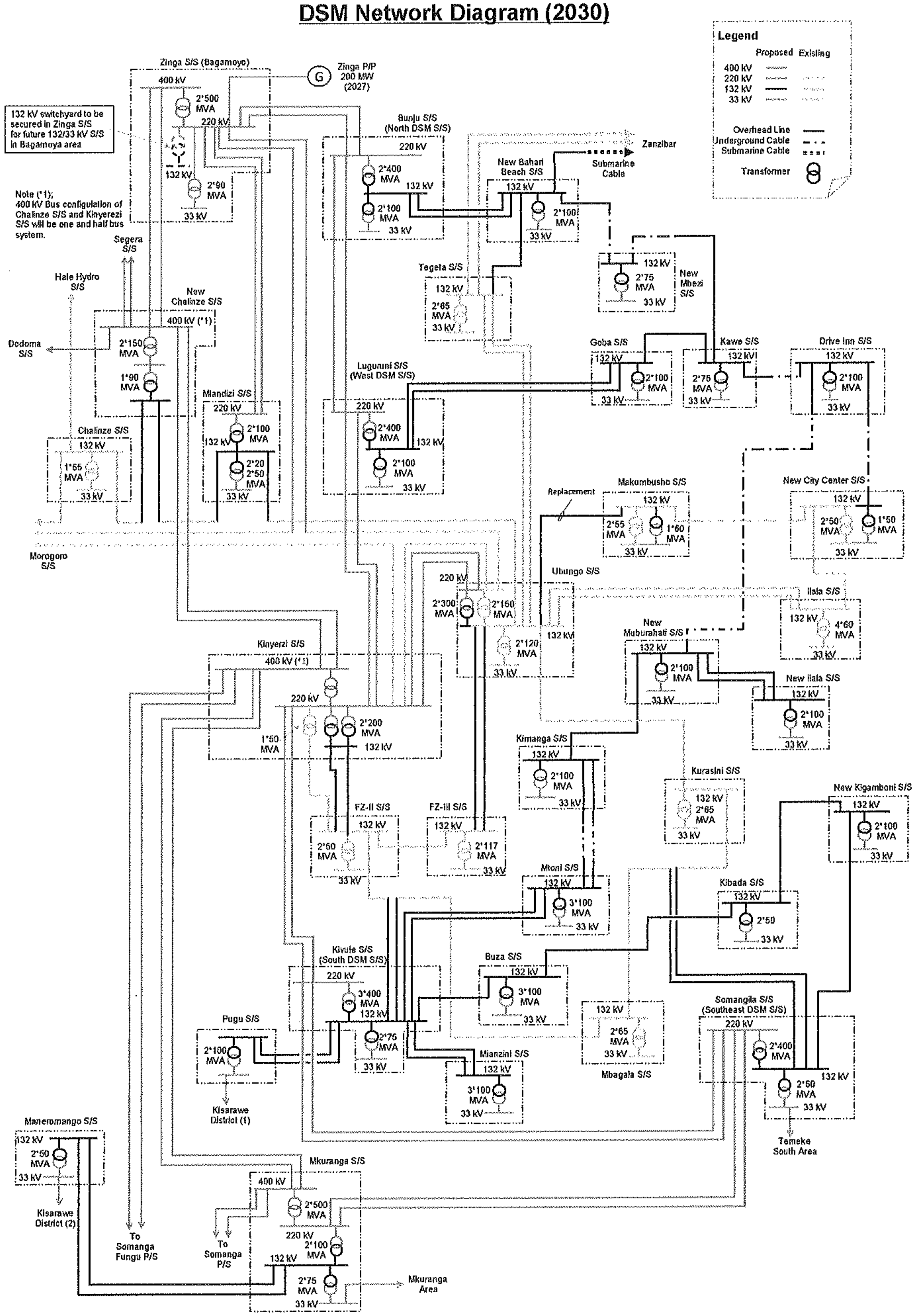
DSM Network Diagram (2030)



2017/2/21

DSMP: Annual Expenditure of Substation Construction & Expansion Cost

From 2020 to 2030

No	Substation	New or Expansion	Year to be Com-missioned	Construction Cost (T. USD)	Up to year of		
					2020	2025	2030
1	FZ-II	E	2020	6,450	6,450	0	0
2	FZ-III	E	2020	1,940	1,940	0	0
3	Ilala	E	2020	1,020	1,020	0	0
4	Jangwani Beach	E	2020	1,600	1,600	0	0
5	Kurasini	E	2020	5,760	5,760	0	0
6	Makumbusho	E	2020	3,010	3,010	0	0
7	Mbagala	E	2020	5,560	5,560	0	0
8	Mlandizi	E	2020	2,690	2,690	0	0
9	Muhimbili	E	2020	1,600	1,600	0	0
10	New Bahari Beach	N	2020	900	900	0	0
11	New Chalinze	E	2020	1,400	1,400	0	0
12	New Kigamboni	N	2020	2,690	2,690	0	0
13	New Tumbi	N	2020	2,240	2,240	0	0
14	Tandale	E	2020	1,700	1,700	0	0
15	Tandika	E	2020	1,980	1,980	0	0
16	Tegeta	E	2020	5,560	5,560	0	0
17	Ubungo	E	2020	15,450	15,450	0	0
18	Bunju (North DSM)	N	2025	23,200	0	23,200	0
19	Buza	N	2025	15,570	0	15,570	0
20	Chamazi	N	2025	2,890	0	2,890	0
21	Charambe	N	2025	2,890	0	2,890	0
22	Drive Inn	N	2025	13,810	0	13,810	0
23	FZ-III	E	2025	150	0	150	0
24	Goba	N	2025	13,190	0	13,190	0
25	Hananasifu	N	2025	2,890	0	2,890	0
26	Ilala	E	2025	450	0	450	0
27	Jangwani	N	2025	2,890	0	2,890	0
28	Kawe	N	2025	13,490	0	13,490	0
29	Kibada	N	2025	10,000	0	10,000	0
30	Kiburugwa	N	2025	2,500	0	2,500	0
31	Kijichi	N	2025	2,890	0	2,890	0
32	Kijitonyama	N	2025	2,890	0	2,890	0
33	Kimanga	N	2025	13,190	0	13,190	0
34	Kivule (South DSM)	N	2025	26,090	0	26,090	0
35	Kiwalani	N	2025	2,890	0	2,890	0
36	Kurasini	E	2025	2,190	0	2,190	0
37	Luguruni (West DSM)	N	2025	41,840	0	41,840	0
38	Mabibo	N	2025	2,890	0	2,890	0
39	Majohe	N	2025	4,750	0	4,750	0
40	Makumbusho	E	2025	300	0	300	0
41	Mbagala	E	2025	600	0	600	0
42	Mbagala II	N	2025	2,890	0	2,890	0
43	Mbeweni	N	2025	2,500	0	2,500	0
44	Mchikichini	N	2025	4,750	0	4,750	0
45	Mianzini	N	2025	19,100	0	19,100	0
46	Mkuranga	E	2025	17,340	0	17,340	0
47	Mlandizi	E	2025	5,330	0	5,330	0
48	Mtoni	N	2025	17,330	0	17,330	0
49	Mwananyamala	E	2025	1,600	0	1,600	0
50	New Bahari Beach	E	2025	18,130	0	18,130	0
51	New City Center	E	2025	4,080	0	4,080	0
52	New Kigamboni	E	2025	13,640	0	13,640	0
53	New Magomeni	N	2025	2,890	0	2,890	0

K7

Annex-4 Budget required for the transmission system development in Dar es Salaam

No	Substation	New or Expansion	Year to be Com-missioned	Construction Cost (T. USD)	Up to year of		
					2020	2025	2030
54	New Mbezi	N	2025	11,380	0	11,380	0
55	New Mburahati	N	2025	13,710	0	13,710	0
56	New Msasani	N	2025	2,890	0	2,890	0
57	Pugu	N	2025	13,910	0	13,910	0
58	Somangila (Southeast DSM)	N	2025	22,100	0	22,100	0
59	Temeke	N	2025	2,890	0	2,890	0
60	TOL	E	2025	1,270	0	1,270	0
61	Ubungo	E	2025	1,660	0	1,660	0
62	Vingunguti	N	2025	4,750	0	4,750	0
63	Yombo Kituka	N	2025	4,750	0	4,750	0
64	Buza	E	2030	6,900	0	0	6,900
65	Charambe	E	2030	1,990	0	0	1,990
66	Drive Inn	E	2030	1,150	0	0	1,150
67	FZ-I	E	2030	770	0	0	770
68	FZ-III	E	2030	700	0	0	700
69	Goba	E	2030	300	0	0	300
70	Ilala	E	2030	150	0	0	150
71	Kawe	E	2030	1,540	0	0	1,540
72	Kiburugwa	E	2030	1,600	0	0	1,600
73	Kijitonyama	E	2030	1,990	0	0	1,990
74	Kivule (South DSM)	E	2030	11,970	0	0	11,970
75	Kunduchi	N	2030	2,890	0	0	2,890
76	Kurasini	E	2030	2,140	0	0	2,140
77	Makongo	N	2030	2,890	0	0	2,890
78	Makumbusho	E	2030	3,640	0	0	3,640
79	Maneromango	N	2030	9,330	0	0	9,330
80	Mbagala II	E	2030	1,990	0	0	1,990
81	Mbeweni	E	2030	1,600	0	0	1,600
82	Mburahati	E	2030	1,570	0	0	1,570
83	Mchafukoge	N	2030	2,890	0	0	2,890
84	Mtoni	E	2030	5,270	0	0	5,270
85	New Bahari Beach	E	2030	8,580	0	0	8,580
86	New City Center	E	2030	7,260	0	0	7,260
87	New Ilala	N	2030	16,790	0	0	16,790
88	New kariakoo	N	2030	2,890	0	0	2,890
89	New Kigamboni	E	2030	1,560	0	0	1,560
90	New Mbezi	E	2030	1,990	0	0	1,990
91	New Mburahati	E	2030	1,400	0	0	1,400
92	New Tumbi	E	2030	1,340	0	0	1,340
93	Tegeta	E	2030	8,080	0	0	8,080
94	Ubungo	E	2030	150	0	0	150
95	Ukonga	N	2030	2,890	0	0	2,890
	Total Expenditure (Annual)			571,080	61,550	393,330	116,200

(Thousand USD)

K7

Transmission Line Construction Cost

DSMP Transmission Lines 132kV & above (2020-2030)

No	Rated Voltage (kV)	from	to	Route Length (km)	No. of Circuit	Conductor/Cable: Code Name	Conductor/Cable: No. of Cond. per Phase	Conductor/Cable: Aluminum Sectional Area (mm2)	Year to be Commissioned	Unit Cost (Thousand USD/km)	Construction Cost (Thousand USD)	Every 5 Year Expenditure (Thousand USD): 2017-2020	2021-2025	2026-2030
1	400	Somanga Fungu PS	Kinyerezi PS	212	2	Bluejay	8	564	2018	850	180,200	180,200	0	0
2	400	Kinyerezi PS	N. Chalinze SS	138	2	Bluejay	4	564	2020	560	77,280	77,280	0	0
3	400	N. Chalinze SS	Segera SS	175	1	Bluejay	4	564	2020	400	70,000	70,000	0	0
4	400	N. Chalinze SS	Segera SS	175	1	Bluejay	4	564	2020	400	70,000	70,000	0	0
5	400	N. Chalinze SS	Dodoma SS	336	1	Bluejay	2	564	2020	300	100,800	100,800	0	0
6	400	Mkuranga SS	Somanga PS	185	2	Bluejay	8	564	2022	850	157,250	0	157,250	0
7	400	Mkuranga SS	Kinyerezi PS	85	2	Bluejay	8	564	2022	850	72,250	0	72,250	0
8	400	N. Chalinze SS	Zinga SS (Bagamoyo)	100	2	Bluejay	8	564	2030	850	85,000	0	0	85,000
9	220	Kinyerezi PS	Ubungo SS	12	2	Bluejay	1	564	2020	270	3,240	3,240	0	0
10	220	Bunju SS (North DSM)	Lugurni SS (West DSM)	35	2	Bluejay	2	564	2025	320	11,200	0	11,200	0
11	220	Kinyerezi PS	Lugurni SS (West DSM)	21	2	Bluejay	4	564	2025	450	9,450	0	9,450	0
12	220	Kinyerezi PS	Kivule SS (South DSM)	15	2	Bluejay	4	564	2025	450	6,750	0	6,750	0
13	220	Kivule SS (South DSM)	Somangila SS (South-east DSM)	60	2	Bluejay	2	564	2025	320	19,200	0	19,200	0
14	220	Mkuranga SS	Somangila SS (South-east DSM)	95	2	Bluejay	4	564	2025	450	42,750	0	42,750	0
15	220	Zinga SS (Bagamoyo)	Bunju SS (North DSM)	29	2	Bluejay	4	564	2030	450	13,050	0	0	13,050
16	220	Zinga SS (Bagamoyo)	Mlandizi SS	51	2	Bluejay	1	564	2030	270	13,770	0	0	13,770
17	132	Kinyerezi PS	FZ-II SS	5	2	Hawk	2	242	2020	240	1,200	1,200	0	0
18	132	N. Chalinze SS	Branch to Chalinze SS	0.5	1	Wolf	1	150	2020	190	95	95	0	0
19	132	N. Chalinze SS	Branch to Mlandizi SS	0.5	1	Wolf	1	150	2020	190	95	95	0	0
20	132	Bunju SS (North DSM)	N. Bahari Beach SS	15	2	Rail	2	483	2025	260	3,900	0	3,900	0
21	132	Buza SS	Kibada SS	20	1	Rail	2	483	2025	230	4,600	0	4,600	0
22	132	Drive Inn SS	N. Mburahati SS	15	1	XLPE Cu	2	1,600	2025	1,550	23,250	0	23,250	0
23	132	Drive Inn SS	NCC SS	10	1	XLPE Cu	2	1,600	2025	1,550	15,500	0	15,500	0
24	132	Goba SS	Kawe SS	15	1	Rail	2	483	2025	1,550	23,250	0	23,250	0
25	132	Kawe SS	Drive Inn SS	5	1	Rail	2	483	2025	230	1,150	0	1,150	0
26	132	Kawe SS	Drive Inn SS	5	1	XLPE Cu	2	1,600	2025	230	1,150	0	1,150	0
27	132	Kivule SS (South DSM)	Mtoni SS	20	2	Rail	2	483	2025	1,550	31,000	0	31,000	0
28	132	Kivule SS (South DSM)	Mianzini SS	15	2	Rail	1	483	2025	260	3,900	0	3,900	0
29	132	Kivule SS (South DSM)	Pugu SS	12	2	Rail	1	483	2025	230	2,760	0	2,760	0
30	132	Kivule SS (South DSM)	Buza SS	12	1	Rail	2	483	2025	230	2,760	0	2,760	0
31	132	Kivule SS (South DSM)	Branch to FZ-II SS	0.5	1	Rail	1	483	2025	230	115	0	115	0
32	132	Kivule SS (South DSM)	Branch to Mbagala SS	0.5	1	Rail	1	483	2025	220	110	0	110	0
33	132	Lugurni SS (West DSM)	Goba SS	20	2	Rail	2	483	2025	220	4,400	0	4,400	0
34	132	Mtoni	Kimanga SS	15	2	Rail	2	483	2025	260	3,900	0	3,900	0
35	132	Mtoni	Kimanga SS	4	2	XLPE Cu	2	1,600	2025	260	1,040	0	1,040	0
36	132	N. Bahari Beach SS	N. Mbezi SS	10	1	Rail	2	483	2025	3,000	30,000	0	30,000	0
37	132	N. Bahari Beach SS	N. Mbezi SS	4	1	XLPE Cu	2	1,600	2025	230	920	0	920	0
38	132	N. Kigamboni SS	Kibada SS	12	1	Rail	2	483	2025	1,550	18,600	0	18,600	0
39	132	N. Mbezi SS	Kawe SS	4	1	Rail	1	483	2025	230	920	0	920	0
40	132	N. Mbezi SS	Kawe SS	2	1	XLPE Cu	1	1,600	2025	220	440	0	440	0
41	132	N. Mburahati SS	Kimanga SS	10	1	Rail	2	483	2025	850	8,500	0	8,500	0
42	132	Somangila SS (South-east DSM)	N. Kigamboni SS	25	1	Rail	2	483	2025	230	5,750	0	5,750	0
43	132	Ubungo SS	Makumbusho SS	7	1	ACCC Hawk	1	310	2026	185	1,295	0	0	1,295
44	132	Mkuranga SS	Maneromango SS	55	2	Hawk	1	242	2030	220	12,100	0	0	12,100
45	132	N. Bahari Beach SS	Tegeta SS	4	1	Hawk	1	242	2030	190	760	0	0	760
46	132	N. Mburahati SS	N. Ilala SS	5	2	Hawk	2	242	2030	240	1,200	0	0	1,200
47	132	Ubungo SS	FZ-III SS	9	2	Hawk	1	242	2030	160	1,440	0	0	1,440
							Total				1,138,290	502,910	506,765	128,615
							Total except planned in PSMP				434,400	190	417,415	16,795

Included in PSMP 2016 update

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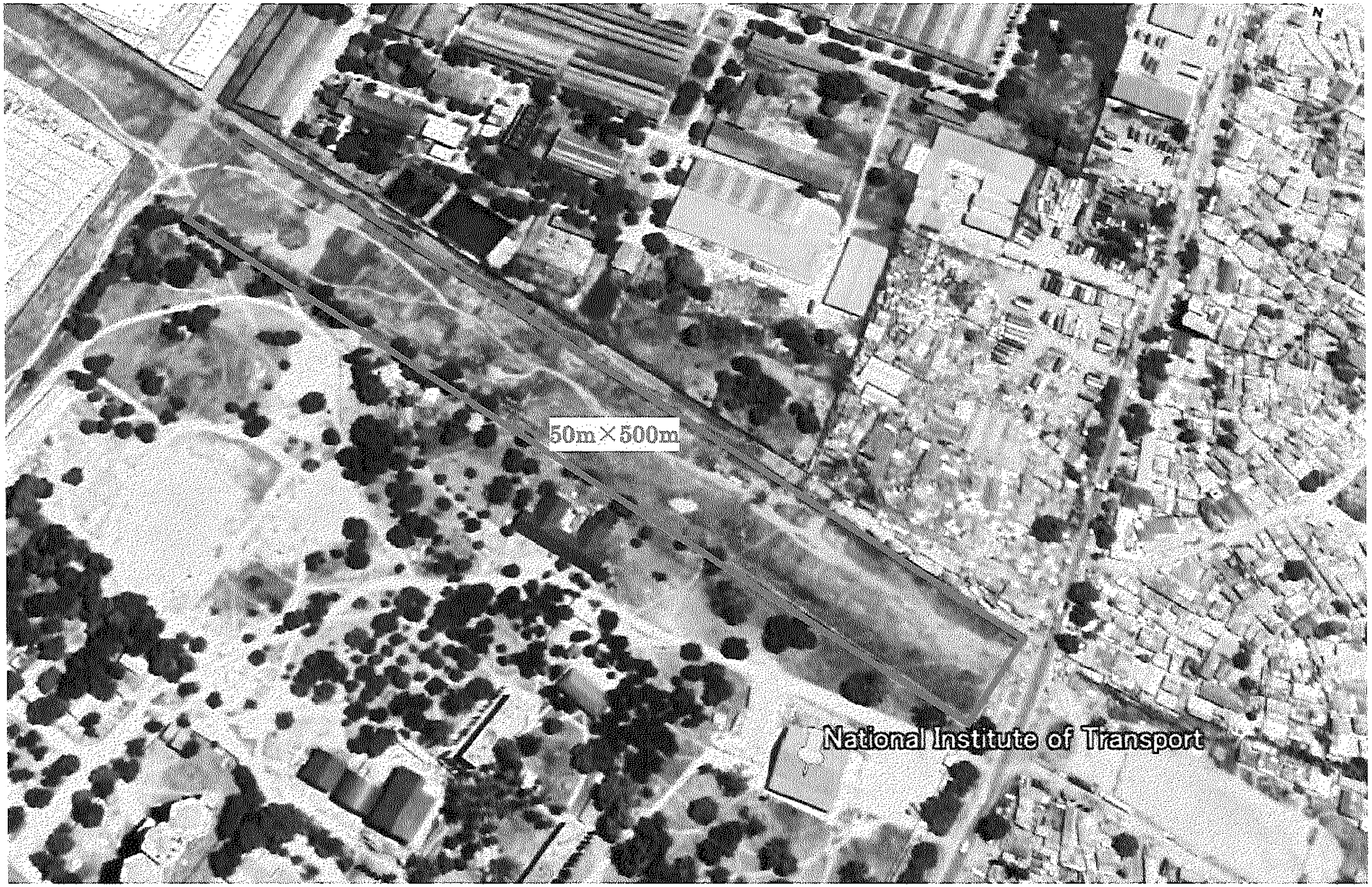
Annex-5 Project site for New 220/132kV substation



Note: The above red area for New 220/132kV substation is within the Boundary of Way leaves, which is tentative and subject to be changed.

Minutes of Discussions
on the Preparatory Survey for the Project for
Reinforcement of Supply from Kinyerezi Power Station

In response to the request from the Government of the United Republic of Tanzania (hereinafter referred to as “Tanzania”), Japan International Cooperation Agency (hereinafter referred to as “JICA”) dispatched the Preparatory Survey Team for the Outline Design (hereinafter referred to as “the Team”) of the Project for Reinforcement of Supply from Kinyerezi Power Station (hereinafter referred to as “the Project”) to Tanzania. The Team held a series of discussions with the officials of the Government of Tanzania and conducted a field survey. In the course of the discussions, both sides have confirmed the main items described in the attached sheets.

Dodoma, , 2019

小早川 徹

Dr. Toru Kobayakawa
Leader, Preparatory Survey Team
Japan International Cooperation Agency
Japan

Dr. Eng. Tito E. Mwinuka
Managing Director
Tanzania Electric Supply Company Limited
The United Republic of Tanzania

Witness

Dr. Hamisi H. Mwinyimvua
Permanent Secretary
Ministry of Energy
The United Republic of Tanzania

ATTACHMENT

1. Objective of the Project
   The objective of the Project is to reinforce the power supply to Dar es Salaam by reinforcing transmission networks and substation between Kinyerezi Power Station and the central area of the city, thereby contributing to the improvement of economic activities and the civic life.

2. Title of the Preparatory Survey
   Both sides agreed to tentatively change the title of the Preparatory Survey from "the Preparatory Survey for the Project for Reinforcement of Supply from Kinyerezi Power Station to Ubungo Substation" to "the Preparatory Survey for the Project for Reinforcement of Supply from Kinyerezi Power Station".

3. Project site
   Both sides confirmed that the sites of the Project are in Dar es Salaam, which is shown in Annex 1.

4. Responsible authority for the Project
   Both sides confirmed the authorities responsible for the Project are as follows:

4-1. The Tanzania Electric Supply Company Limited (TANESCO) will be the executing agency for the Project (hereinafter referred to as "the Executing Agency"). The Executing Agency shall coordinate with all the relevant authorities to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be managed by relevant authorities properly and on time. The organization chart is shown in Annex 2.

4-2. The line ministry of the Executing Agency is the Ministry of Energy (MOE). The Ministry of Energy shall be responsible for supervising the Executing Agency on behalf of the Government of Tanzania.

5. Items requested by the Government of Tanzania

5-1. As a result of discussions, both sides confirmed that the items requested by the Government of Tanzania are as follows:
   (1) Construction of 220/132 kV Mburahati (Mabibo) substation
   (2) Construction of 220 kV transmission lines from Kinyerezi Power Plant (i.e., T-off point) to Mburahati (Mabibo) substation
   (3) Reinforcement of Switchgears at Kinyerezi Power Plant
   (4) Expansion of Ubungo substation

5-2. JICA will assess the feasibility of the above requested items through the survey and will report the findings to the Government of Japan. The final scope of the Project will be decided by the Government of Japan.

6. Procedures and Basic Principles of Japanese Grant

6-1. The Tanzanian side agreed that the procedures and basic principles and basic principles of Japanese Grant (hereinafter referred to as "the Grant") as described in Annex 3 shall be applied to the Project.
   As for the monitoring of implementation of the Project, JICA requires Tanzanian side to submit the Project Monitoring Report, the form of which is attached as Annex 4.

6-2. The Tanzanian side agreed to take the necessary measures, as described in Annex 5, for smooth implementation of the Project. The contents of Annex 5 will be elaborated and

refined during the Preparatory Survey and be agreed in the mission dispatched for explanation of the Draft Preparatory Survey Report.
The contents of Annex 5 will be updated as the Preparatory Survey progresses, and eventually, will be used as an attachment to the Grant Agreement.

7. Schedule of the Survey
 7-1. The Team will proceed with further survey in Tanzania until 22 November 2019.
 7-2. JICA will prepare a draft Preparatory Survey Report in English and dispatch a mission to Tanzania in order to explain its contents around May 2020.
 7-3. If the contents of the draft Preparatory Survey Report is accepted and the undertakings for the Project are fully agreed by the Tanzanian side, JICA will finalize the Preparatory Survey Report and send it to Tanzania around August 2020.
 7-4. The above schedule is tentative and subject to change.

8. Environmental and Social Considerations
 8-1. The Tanzanian side confirmed to give due environmental and social considerations before and during implementation, and after completion of the Project, in accordance with the JICA Guidelines for Environmental and Social Considerations (April, 2010).
 8-2. The Project is categorized as "B" from the following considerations:
 The project is not considered to be a large-scale transmission line and substation construction project, is not located in a sensitive area, and has none of the sensitive characteristics under the JICA guidelines for environmental and social considerations (April 2010), it is not likely to have a significant adverse impact on the environment.
 The Tanzanian side confirmed to conduct the necessary procedures concerning the environmental assessment (including stakeholder meetings, Environmental Impact Assessment (EIA) /Initial Environmental Examination (IEE) and information disclosure, etc.) and make EIA/IEE report of the Project. The EIA/IEE approval shall be received from the responsible authorities and submitted to JICA by August 2020.
 8-3. For the Project that will result in involuntary resettlement, the Tanzanian side confirmed to prepare a Resettlement Action Plan (RAP)/Abbreviated Resettlement Action Plan (ARAP) and make it available to the public. This Project may involve involuntary resettlement of a few households. In such a case, ARAP needs to be prepared by the end of this Preparatory Survey and approved by the Tanzanian authority before the Japanese Cabinet approves the implementation of the Project. In addition, the Tanzanian side confirmed to provide the affected people with sufficient compensation and/or support in accordance with ARAP, which is consistent with JICA Guidelines for Environmental and Social Considerations (April, 2010), in a timely manner (at least before the construction under the Project starts).

9. Other Relevant Issues
 9-1. Discussion of different options of the project
 Tanzanian side and JICA mission members had discussed and conducted preliminary evaluation for five options how to develop Kinyerezi – Mburahati axis during the first field survey in March 2019. As a result, they agreed to proceed further study on Alternative-4, 5 and 5' that are shown in Annex 6-1.
 The Team explained the results of load flow analyses on Alternative-4, 5 and 5' to TANESCO, along with rough cost estimation, an evaluation of the options and a recommended option for the Project as shown in Annex 6-1. While Alternative-5 was excluded from further consideration due to budgetary limitation, Alternative-4 and 5' were compared to seek the best option. At the stage of second field survey in August

2019, TANESCO preferred Alternative-4 from the view point of system reliability stating that Alternative-5' had only one circuit of transmission line between Ubungo and Morogoro and it was not acceptable.

However, it has been identified that there are two challenges regarding Alternative-4. Firstly, Alternavie-4 has more dependence on Kinyerezi – Luguruni lines compared to Alternative-5'. Secondly, Kinyerezi - Luguruni lines cannot be covered by Japan's grant aid due to budgetary limitation. If the Project depends on the progress of Kinyerezi-Luguruni lines, the delay of the lines may cause the delay of the Project.

Due to the situation above, TANESCO reconsidered the alternatives and came up with new option, i.e. Alternative-6 in which the second Ubungo – Morogoro 220kV line will be maintained as shown in Annex 6-2. TANESCO considers that Alternetive-6 is better than Alternative-4 considering the possible delay of Kinyerezi – Luguruni 220kV transmission lines because Alternative-6 has less dependence on the Kinyerezi – Luguruni lines. The only challenge for Alternative-6 is the availability of land to install additional 220kV bay for new incoming line at Ubungo substation.

Therefore, TANESCO and the Team jointly conducted a site reconnaissance at Ubungo substation and it turned out that the space for a new 220kV bay could be created inside Ubungo substation and within the wayleave of existing transmission lines. As a conclusion, both sides agreed to proceed further study on Alternative-6. Since the new 220kV bay needs to be integrated into the existing 220kV system at Ubungo, the Team requested TANESCO to provide necessary information of existing equipment.

9-2. The capacity of the transformers of Mburahati (Mabibo) substation

While the Team initially proposed installation of two transformers with 200MVA at Mburahati (Mabibo) substation, TANESCO requested to increase the capacity of transformers to 200MVAx3.

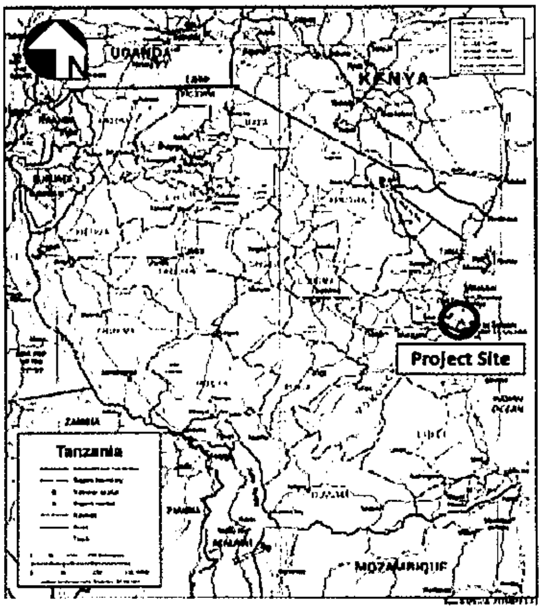
9-3. Exemption of taxes and duties

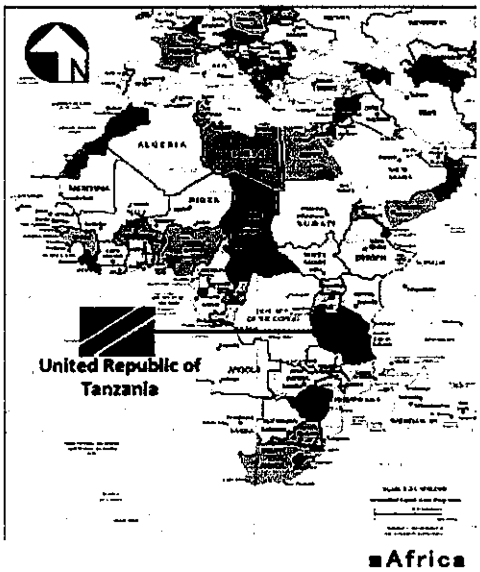
Both sides agreed that the timely approval by the Tanzanian Cabinet on exemption of taxes and duties under this Project is important for smooth implementation of the Project.

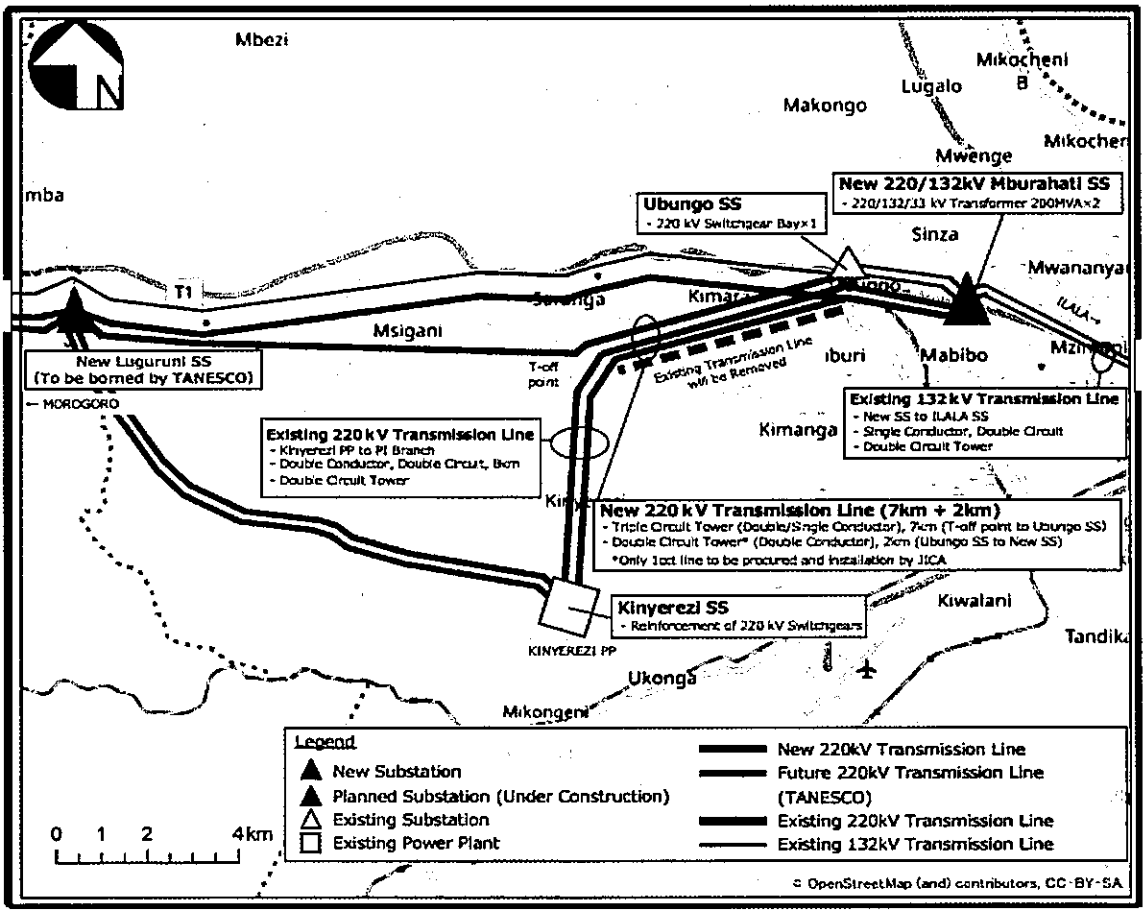
9-4. Survey schedule

The Tanzanian side requested to expedite the schedule of the survey so that the Project can be implemented in a timely manner. The Team explained that the above-mentioned schedule is tentative and may be adjusted according to the progress of the survey.

Annex 1 Project Site
Annex 2 Organization Chart
Annex 3 Japanese Grant
Annex 4 Project Monitoring Report (template)
Annex 5 Major Undertakings to be taken by the Government of Tanzania
Annex 6-1 Results of load flow analyses (Summary of Analysis in Japan and Recommended Development Plan)
Annex 6-2 Configuration of Alternative-6

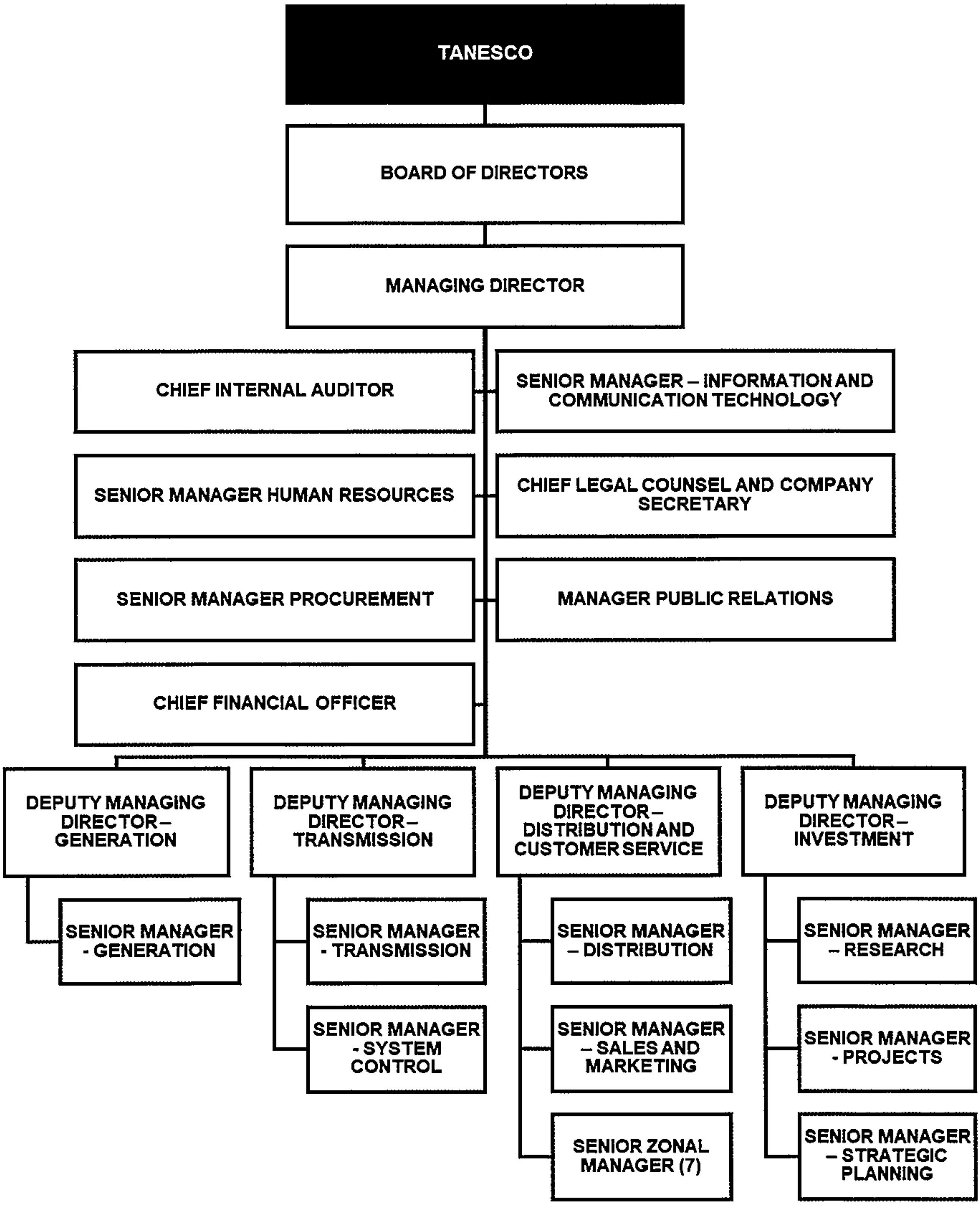






Project Site

Organization Structure of the Tanzania Electric Supply Company Limited (TANESCO)



Annex 3

JAPANESE GRANT

The Japanese Grant is non-reimbursable fund provided to a recipient country (hereinafter referred to as "the Recipient") to purchase the products and/or services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. Followings are the basic features of the project grants operated by JICA (hereinafter referred to as "Project Grants").

1. Procedures of Project Grants

Project Grants are conducted through following procedures (See "PROCEDURES OF JAPANESE GRANT" for details):

(1) Preparation
- The Preparatory Survey (hereinafter referred to as "the Survey") conducted by JICA

(2) Appraisal
-Appraisal by the government of Japan (hereinafter referred to as "GOJ") and JICA, and Approval by the Japanese Cabinet

(3) Implementation

Exchange of Notes
-The Notes exchanged between the GOJ and the government of the Recipient

Grant Agreement (hereinafter referred to as "the G/A")
-Agreement concluded between JICA and the Recipient

Banking Arrangement (hereinafter referred to as "the B/A")
-Opening of bank account by the Recipient in a bank in Japan (hereinafter referred to as "the Bank") to receive the grant

Construction works/procurement
-Implementation of the project (hereinafter referred to as "the Project") on the basis of the G/A

(4) Ex-post Monitoring and Evaluation
-Monitoring and evaluation at post-implementation stage

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide basic documents necessary for the appraisal of the the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the Recipient necessary for the implementation of the Project.
- Evaluation of the feasibility of the Project to be implemented under the Japanese Grant from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.

- Preparation of an outline design of the Project.
- Estimation of costs of the Project.
- Confirmation of Environmental and Social Considerations

The contents of the original request by the Recipient are not necessarily approved in their initial form. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant.

JICA requests the Recipient to take measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the executing agency of the Project. Therefore, the contents of the Project are confirmed by all relevant organizations of the Recipient based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA contracts with (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the feasibility of the Project.

3. Basic Principles of Project Grants

(1) Implementation Stage

1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the Recipient to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Recipient to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Recipient, and procurement conditions. The terms and conditions generally applicable to the Japanese Grant are stipulated in the "General Terms and Conditions for Japanese Grant (January 2016)."

2) Banking Arrangements (B/A) (See "Financial Flow of Japanese Grant (A/P Type)" for details)

a) The Recipient shall open an account or shall cause its designated authority to open an account under the name of the Recipient in the Bank, in principle. JICA will disburse the Japanese Grant in Japanese yen for the Recipient to cover the obligations incurred by the Recipient under the verified contracts.

b) The Japanese Grant will be disbursed when payment requests are submitted by the Bank to JICA under an Authorization to Pay (A/P) issued by the Recipient.

3) Procurement Procedure

The products and/or services necessary for the implementation of the Project shall be procured in accordance with JICA's procurement guidelines as stipulated in the G/A.

4) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the Recipient to continue to work on the Project's implementation after the E/N and G/A.

5) Eligible source country

In using the Japanese Grant disbursed by JICA for the purchase of products and/or services, the eligible source countries of such products and/or services shall be Japan and/or the Recipient. The Japanese Grant may be used for the purchase of the products and/or services of a third country as eligible, if necessary, taking into account the quality, competitiveness and economic rationality of products and/or services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm, which enter into contracts with the Recipient, are limited to "Japanese nationals", in principle.

6) Contracts and Concurrence by JICA

The Recipient will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be concurred by JICA in order to be verified as eligible for using the Japanese Grant.

7) Monitoring

The Recipient is required to take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and to regularly report to JICA about its status by using the Project Monitoring Report (PMR).

8) Safety Measures

The Recipient must ensure that the safety is highly observed during the implementation of the Project.

9) Construction Quality Control Meeting

Construction Quality Control Meeting (hereinafter referred to as the "Meeting") will be held for quality assurance and smooth implementation of the Works at each stage of the Works. The member of the Meeting will be composed by the Recipient (or executing agency), the Consultant, the Contractor and JICA. The functions of the Meeting are as followings:

a) Sharing information on the objective, concept and conditions of design from the Contractor, before start of construction.

b) Discussing the issues affecting the Works such as modification of the design, test, inspection, safety control and the Client's obligation, during of construction.

(2) Ex-post Monitoring and Evaluation Stage

1) After the project completion, JICA will continue to keep in close contact with the Recipient in order to monitor that the outputs of the Project is used and maintained properly to attain its expected outcomes.

2) In principle, JICA will conduct ex-post evaluation of the Project after three years from the completion. It is required for the Recipient to furnish any necessary information as JICA may reasonably request.

(3) Others

1) Environmental and Social Considerations

The Recipient shall carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the Recipient and JICA Guidelines for Environmental and Social Considerations (April, 2010).

2) Major undertakings to be taken by the Government of the Recipient

For the smooth and proper implementation of the Project, the Recipient is required to undertake necessary measures including land acquisition, and bear an advising commission of the A/P and payment commissions paid to the Bank as agreed with the GOJ and/or JICA. The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the Products and/or the Services be exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

3) Proper Use

The Recipient is required to maintain and use properly and effectively the products and/or services under the Project (including the facilities constructed and the equipment purchased), to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japanese Grant.

4) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient.

Project Monitoring Report
on
Project Name
Grant Agreement No. XXXXXXX

20XX, Month

Organizational Information

Signer of the G/A (Recipient)	Person in Charge Contacts	(Designation) Address: Phone/FAX: Email:
Executing Agency	Person in Charge Contacts	(Designation) Address: Phone/FAX: Email:
Line Ministry	Person in Charge Contacts	(Designation) Address: Phone/FAX: Email:

General Information:

Project Title	
E/N	Signed date: Duration:
G/A	Signed date: Duration:
Source of Finance	Government of Japan: Not exceeding JPY ________ mil. Government of (__________): ________________

1: Project Description

1-1 Project Objective

1-2 Project Rationale

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

1-3 Indicators for measurement of "Effectiveness"

Quantitative indicators to measure the attainment of project objectives		
Indicators	Original (Yr)	Target (Yr)
Qualitative indicators to measure the attainment of project objectives		

2: Details of the Project

2-1 Location

Components	Original *(proposed in the outline design)*	Actual
1.		

2-2 Scope of the work

Components	Original* *(proposed in the outline design)*	Actual*
1.		

Reasons for modification of scope (if any).

(PMR)

2-3 Implementation Schedule

Items	Original (proposed in the outline design)	Original (at the time of signing the Grant Agreement)	Actual

Reasons for any changes of the schedule, and their effects on the project (if any)

2-4 Obligations by the Recipient

2-4-1 Progress of Specific Obligations

See Attachment 2.

2-4-2 Activities

See Attachment 3.

2-4-3 Report on RD

See Attachment 11.

2-5 Project Cost

2-5-1 Cost borne by the Grant(<u>Confidential until the Bidding</u>)

Components			Cost (Million Yen)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
	1.			
Total				

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = Yen

2-5-2 Cost borne by the Recipient

Components			Cost (1,000 Taka)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
	1.			

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar =

Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)

2-6 Executing Agency

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original *(at the time of outline design)* name: role: financial situation: institutional and organizational arrangement (organogram): human resources (number and ability of staff):
Actual *(PMR)*

2-7 Environmental and Social Impacts

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

3: Operation and Maintenance (O&M)

3-1 Physical Arrangement

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spareparts, etc.)

Original *(at the time of outline design)*
Actual *(PMR)*

3-2 Budgetary Arrangement

- Required O&M cost and actual budget allocation for O&M

Original *(at the time of outline design)*
Actual *(PMR)*

4: Potential Risks and Mitigation Measures

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

Assessment of Potential Risks *(at the time of outline design)*

Potential Risks	Assessment
1. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
2. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
3. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:

	Contingency Plan (if applicable):
Actual Situation and Countermeasures	
(PMR)	

5: Evaluation and Monitoring Plan (after the work completion)

5-1 Overall evaluation

Please describe your overall evaluation on the project.

5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

5-3 Monitoring Plan of the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

Attachment

1. Project Location Map
2. Specific obligations of the Recipient which will not be funded with the Grant
3. Monthly Report submitted by the Consultant

Appendix - Photocopy of Contractor's Progress Report (if any)
- Consultant Member List
- Contractor's Main Staff List

4. Check list for the Contract (including Record of Amendment of the Contract/Agreement and Schedule of Payment)
5. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final)only)
8. Pictures (by JPEG style by CD-R) (PMR (final)only)
9. Equipment List (PMR (final)only)
10. Drawing (PMR (final)only)
11. Report on RD (After project)

Monitoring sheet on price of specified materials

1. Initial Conditions (Confirmed)

	Items of Specified Materials	Initial Volume A	Initial Unit Price (¥) B	Initial total Price C=A×B	1% of Contract Price D	Condition of payment	
						Price (Decreased) E=C−D	Price (Increased) F=C+D
1	Item 1	●●t	●	●	●	●	●
2	Item 2	●●t	●	●	●		
3	Item 3						
4	Item 4						
5	Item 5						

2. Monitoring of the Unit Price of Specified Materials
(1) Method of Monitoring : ●●

(2) Result of the Monitoring Survey on Unit Price for each specified materials

	Items of Specified Materials	1st ●month, 2015	2nd ●month, 2015	3rd ●month, 2015	4th	5th	6th
1	Item 1						
2	Item 2						
3	Item 3						
4	Item 4						
5	Item 5						

(3) Summary of Discussion with Contractor (if necessary)

-
-
-

Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)
(Actual Expenditure by Construction and Equipment each)

	Domestic Procurement (Recipient Country) A	Foreign Procurement (Japan) B	Foreign Procurement (Third Countries) C	Total D
Construction Cost	(A/D%)	(B/D%)	(C/D%)	
Direct Construction Cost	(A/D%)	(B/D%)	(C/D%)	
others	(A/D%)	(B/D%)	(C/D%)	
Equipment Cost	(A/D%)	(B/D%)	(C/D%)	
Design and Supervision Cost	(A/D%)	(B/D%)	(C/D%)	
Total	(A/D%)	(B/D%)	(C/D%)	

Annex 5

Major Undertakings to be taken by the Government of Tanzania

Specific obligations of the Government of Tanzania which will not be funded with the Grant

(1) Before the Tender

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To open a bank account (B/A)	within xx month after the signing of the G/A			
2	To issue an authorization to pay (A/P) to a bank in Japan (the Agent Bank) for the payment to the consultant	within xx month after the signing of the contract			
3	To approve EIA (conditions of approval should be fulfilled, if any) and secure the necessary budget for implementation.	within xx month after the signing of the G/A		xx TZS	
4	To approve ARAP (conditions of approval should be fulfilled, if any).	before the Japanese Cabinet approves the Project			
5	To pay compensation according to ARAP.	before securing the Project site			
6	To secure Project site and temporary yard.	before start of the construction		xxTZS	
7	To remove and relocate the following facilities. 1) Removal of existing fence and gate 2) Cutting trees at the project site 3) Relocation of boundary wall at Ubungo substation 4) Demolish an existing 132kV transmission tower (UB-FZIII TW1) at Ubungo and switch the connection from overhead to underground up to the second tower 5) Convert 132kV transmission towers type from suspension to tension near the Mabibo substation 6) Connection of 220kV temporary towers near T-off point of Kinyerezi-Ubungo lines	before start of the construction		xx TZS	
8	To submit Project Monitoring Report (with the result of Detail Design)	before preparation of bidding documents			

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

(2) During the Project Implementation

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the Supplier(s)	within xx month after the signing of the contract(s)			
2	To bear the following commissions to a bank in Japan for the banking services based upon the B/A				
	1) Advising commission of A/P	within xx month after the signing of the contract(s)		xx TZS	
	2) Payment commission for A/P	every payment		xx TZS	
3	To ensure prompt unloading and customs clearance at ports of disembarkation in recipient country and to assist the Supplier(s) with internal transportation therein	during the Project			
4	To accord Japanese nationals and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry	during the Project			

	into the country of the Recipient and stay therein for the performance of their work				
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be exempted	during the Project			
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project		xx TZS	
7	1) To submit Project Monitoring Report after each work under the contract(s) such as shipping, hand over, installation and operational training	within one month after completion of each work			
	2) To submit Project Monitoring Report (final)	within one month after signing of Certificate of Completion for the works under the contract(s)			
8	To submit a report concerning completion of the Project	within six months after completion of the Project			
9	To construct access roads 1) Outside the site (if necessary)	3 months before completion of the construction			
10	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the site(s)				
	1) Electricity The distributing line to the site	before start of the construction			
	2) Furniture and Equipment General furniture	1 month before completion of the construction			
11	To take necessary measure for safe construction - traffic control - rope off	during the construction			
12	To implement Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP)	during the construction			
13	To submit results of environmental monitoring to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	during the construction			
14	To implement RAP (livelihood restoration program, if needed)	for a period based on livelihood restoration program		xx TZS	
15	To implement social monitoring, and to submit the monitoring results to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report - Period of the monitoring may be extended if affected persons' livelihoods are not sufficiently restored. Extension of the monitoring will be decided based on agreement between TANESCO and JICA.	- until the end of livelihood restoration program (In case that livelihood restoration program is provided) - *for two years after land acquisition and resettlement complete (In case that livelihood restoration program is not provided)*		xxTZS	

5. Field Report

PREPARATORY SURVEY ON REINFORCEMENT OF SUPPLY FROM KINYEREZI POWER STATION IN THE UNITED REPUBLIC OF TANZANIA

FIELD REPORT

August 2021
(Revised on 8th November, 2021)

JICA PREPARATORY SURVEY TEAM

Yachiyo Engineering Co., Ltd.
West Japan Engineering Consultants, Inc.

Prepared and Submitted by:	Confirmed and Agreed by:
Kyoji Fujii Chief Consultant JICA Preparatory Survey Team The Consortium of Yachiyo Engineering Co., Ltd. and West Japan Engineering Consultant, inc.	Isaac A. Chanji Acting Deputy Managing Director (Transmission) Tanzania Electric Supply Company Ltd. (TANESCO)

Contents

[Annex]

Annex – 1	Results of load flow analyses (Summary of Analysis in Japan and Recommended Development Plan)
Annex – 2	Configuration of Alternative-6

[Attachment]

Attachment – 1	Member List of the Study Team
Attachment – 2	Work Demarcation
Attachment – 3	Tentative Implementation Schedule
Attachment – 4	Drawings

1 Outline of the Project

1.1 Background of the Project

In response to the request from the Government of the Republic of Tanzania (Tanzania), Japan International Cooperation Agency (JICA), in consultation with the Government of Japan, decided to conduct a Preparatory Survey (the Survey) on the Project for Reinforcement of Supply from Kinyerezi Power Station to Ubungo Substation in Dar es Salaam (the Project).

JICA sent to Tanzania the Preparatory Survey Team (the Team) headed by Mr. Toru Kobayakawa, Team Leader, JICA, to conduct the field survey and the Team is scheduled to stay in the country from 26th October to 25th November, 2019 (the third field survey) and from 6th February to 18th February, 2020 (the forth field survey).

The Team continued discussions with the concerned officials of Tanzania and the field survey in Tanzania.

TANESCO and the Team had series of technical discussions to form mutual understandings about the contents, scope, preconditions for the outline design, basic specifications, general layouts, and so on of the Project throughout the field survey. TANESCO and the Team agreed to record the following issues described on this Field Report as a conclusion of the discussions.

Components of the Project will be further examined and may be modified through the consultation with the Japanese Ministry of Foreign Affairs and JICA headquarters. <u>It is important for the Tanzanian side to understand that the Preparatory Survey is not a commitment for the future implementation of the Project.</u>

Particularly, in consideration of the schedule and procedures of Japan’s Grant Aid projects, the Team explained, and <u>TANESCO agreed with the Team to proceed with the further study, the outline design, planning of the implementation schedule, the cost estimation and so on of the Project in accordance with the mutual understandings made on this field report immediately after the forth field survey.</u>

1.2 Discussion of different options of the Project

Tanzanian side and the Team had discussed and conducted preliminary evaluation for five options how to develop Kinyerezi – Mburahati axis during the first field survey in March 2019. As a result, they agreed to proceed further study on Alternative-4, 5 and 5’ that are shown in Annex-1.

The Team explained the results of load flow analyses on Alternative-4, 5 and 5’ to TANESCO, along with rough cost estimation, an evaluation of the options and a recommended option for the Project as shown in Annex-1. While Alternative-5 was excluded from further consideration due to budgetary limitation, Alternative-4 and 5’ were compared to seek the best option. At the stage of second field survey in August 2019, TANESCO preferred Alternative-4 from the view point of system reliability stating that Alternative-5’ had only one circuit of transmission line between Ubungo and Morogoro and it was not acceptable.

However, it has been identified that there are two challenges regarding Alternative-4. Firstly, Alternavie-4 has more dependence on Kinyerezi – Luguruni lines compared to Alternative-5'. Secondly, Kinyrezi - Luguruni lines cannot be covered by Japan's grant aid due to budgetary limitation. If the Project depends on the progress of Kinyerezi-Luguruni lines, the delay of the lines may cause the delay of the Project.

Due to the situation above, TANESCO reconsidered the alternatives and came up with new option, i.e. Alternative-6 in which the second Ubungo – Morogoro 220kV line will be maintained as shown in Annex-2. TANESCO considers that Alternetive-5'' is better than Alternative-4 considering the possible delay of Kinyerezi – Luguruni 220kV transmission lines because Alternative-6 has less dependence on the Kinyerezi – Luguruni lines. The only challenge for Alternative-6 is the availability of land to install additional 220kV bay for new incoming line at Ubungo substation.

Therefore, TANESCO and the Team jointly conducted a site reconnaissance at Ubungo substation and it turned out that the space for a new 220kV bay could be created inside Ubungo substation and within the wayleave of existing transmission lines. As a conclusion, both sides agreed to proceed further study on Alternative-6.

Hence, this Field Report is consisting of results of the site survey based on Alternative-6.

1.3 Framework for the Project

The framework for the Project is shown as follows;

- The responsible ministry is Ministry of Energy (MOE).
- The implementing agency is Tanzania Electric Supply Company Limited (TANESCO).

1.4 The Scope of the Japanese side

The Scope of the Japanese side is shown in Table 1.3-1 and G-01 Project Site in the Drawings.

Table 1.4-1 Outline of the Proposed Components

Components	Capacity
Procurement and Installation Work	
1. 220/132 kV Mabibo Substation	
(a) 200 MVA, 220/132/33 kV transformer	2 units
(b) 220 kV switchgear	1 lot
(c) 132 kV switchgear	1 lot
(d) Control/supervisory and Protection panels	1 lot
(e) Substation power supply system	1 lot
2. Expansion of Ubungo Substation	
(a) 220 kV switchgear (Transmission line bay)	1 bay
(b) Control and Protection panels	1 lot
3. Reinforcement of Switchgear at Kinyerezi Power Plant	
(a) Replacement of existing 220 kV equipment for 2 x transmission line feeders	1 lot
4. 220 kV Transmission Line	
(a) 220 kV Transmission Line (Triple circuit) from Kinyerezi Power Plant (T-off point) to Ubungo Substation	Approx. 7.0 km
(b) 220 kV Transmission Line (Double circuit) from Ubungo Substation to Mabibo Substation	Approx. 2.0 km
5. 132 kV Transmission Line	
- 132 kV Transmission Line (Double circuit) between the existing transmission line (Ubungo – Ilala) and Mabibo Substation	1 lot
Procurement Work	
6. Maintenance Tools for the Equipment to be procured under the Project	1 lot
7. Spare parts for the Equipment to be procured under the Project	1 lot
Civil Work	
8. Control Building of Mabibo Substation	1 building

[Remark] Quantities shall be examined in the outline design.

1.5 Obligations/Undertakings of the Tanzanian side for the Project

1.5.1 Environmental and Social Considerations

The Tanzanian side has agreed to conduct the environmental and social considerations required by JICA Guidelines for Environmental and Social Considerations (2010) as well as laws and regulations in Tanzania. An Abbreviated Resettlement Action Plan (ARAP) must be implemented and the land acquisition should be completed before notice of tender (January 2023). An approval on environmental clearance, such as EIA Certificate of Authorization as well as other relevant permits/licenses required for the implementation of the Project must be obtained in a timely manner to meet the Project schedule.

1.5.2 Major Necessary Inputs by the Tanzanian side

A Before the Tender announcement

[General]

A-1 Completion of Environmental Assessment and Issue of EIA Certificate of Authorization

A-2 Preparation and Implementation of ARAP

A-3 Land acquisition, cutting trees and clearance of obstacles

A-4 Access road to the project sites

A-5 Temporary storage yard for equipment and materials

A-6 Power outage

[220 kV Transmission line (From Kinyerezi Power Plant (T-off point) to Mabibo Substation)]

A-7 To complete the construction of Luguruni substation with additional 220 kV bays for Kinyerezi - Luguruni 220 kV transmission lines

A-8 To shift the 220 kV Kinyerezi – Morogoro line to a temporary tower nearby T-off point (including installation work of the temporary tower) including OPGW and/or ADSS

A-9 To demolish the existing towers of 220 kV Kinyerezi – Ubungo line (No. 792 - No. 805) including OPGW and/or ADSS

[132 kV Transmission Line (From Ubungo substation to Ilala substation)]

A-10 To build modular, temporary bypass single circuit 132 kV towers near T19 and T20 and string single circuit from T20 to T18 for Ubungo – Ilala 132 kV lines to allow the construction of dead end towers and stringing conductors by the Japanese side

[Ubungo Substation]

A-11 Expansion of 220 kV substation site

A-12 To switch the existing 132 kV Factory zone III and Symbion feeders from overhead to underground cables which fall under the expansion area

A-13 To divert the existing high pressure gas piping of Songas from the expansion area in order to secure the safety of construction work for 220 kV switchgear expansion **(Pending)**

B During the Project Implementation

[Mabibo Substation]

B-1 To schedule both power and communication network shutdown required for construction works of the Project, and carry out in timely manner. The Tanzania side shall also manage any issue concerning the shutdown including related procedures, and compensation to and grievances from customers.

B-2 To provide the setting list of protection relays related to the Project for coordination of setting values with new relays to be supplied under the Project. The setting value change at the existing substations where the transmission lines connected from Mabibo substation shall be conducted by the Tanzania side including necessary tests and their records shall be presented to Japan side.

B-3 Modification of SCADA System of Grid Control Center (GCC) and Network Management system for accommodation of Mabibo Substation.

B-4 Modification of communication system for protection system in Kinyerezi power plant for Mabibo substation

B-5 To provide TANESCO's standard Watt hour meters for 220/132 kV transmission lines. The meters will be fitted on Metering panels at site by Japanese side. (The panel will also be supplied by Japanese side)

- 220 kV feeders : 1 piece
- 132 kV feeders : 4 pieces
- Transformer bay : 2 pieces (132 kV side)

(Total 7 pieces)

B-6 33 kV power supply to Mabibo Substation site (for inside substation use)

[220 kV Transmission line (From Kinyerezi Power Plant (T-off point) to Mabibo Substation)]

B-7 To shift the 220 kV Kinyerezi – Morogoro line from a temporary tower to newly installed towers

[132 kV Transmission Line (From Ubungo substation to Ilala substation)]

B-8 Connection of lines from new dead-end tower (No. NT19/ NT20) to the towers (No. T18/No. T20) on 132 kV Ubungo – Ilala line

B-9 Re-routing of existing ADSS cables between No. T18 and No. T20

B-10 To demolish modular, temporary bypass single circuit 132 kV towers near NT19 and NT20

B-11 Removal work of the existing conductor, grounding wire, accessories, steel tower and foundation etc.

[Ubungo Substation]

B-12 AC/DC power supply for 220 kV switchgear and new associated panels

B-13 To provide one (1) set of TANESCO's standard Watt hour meter for 220 kV transmission line (Kinyerezi). The meter will be fitted on its new control panel at site by Japanese side. (New control panel will be provided by Japanese side)

C After the Project

C-1 To monitor environmental and social impacts during the operation with an adaptive management approach.

1.6 Eligible Source Countries

The equipment to be supplied under the Project (See the list of the equipment in the Specification attached) shall be the product of Japan, DAC countries, AESAN countries, and other countries (India, Turkey, etc.) (GIS shall be the product of Japan)

2 Technical requirements confirmed in the third field survey

2.1 Technical requirements for the Substation of the Project

2.1.1 General requirement

(a) General Design Condition

Table 2.1.1-1 Basic Conditions for the Facility Design of the Project

Items		Values
Altitude		50～200 m
Ambient Temperature	Maximum	38 Degrees Centigrade
	Minimum	15 Degrees Centigrade
	Mean	20 Degrees Centigrade
Maximum Wind Velocity		25 m/s
Average relative humidity		82 %
Annual Rain Fall		1,100 mm/year
Seismic Force		Horizontal 0.10 G

(b) System voltage

Table 3.1.1-2 Standard Voltage Levels

	Voltage limits in Percent of nominal			
Voltage Class (kV)	Normal Operation Condition		Emergency Operation Condition	
220	95%	105%	90%	110%
132	95%	105%	90%	110%

(c) Frequency

50 Hz ± 1.0 Hz (49.0 - 50 – 51.0 Hz)

(d) Short circuit current

- 220 kV : Less 40 kA
- 132 kV : Less 31.5 kA

(e) Grounding system

- 220 kV : Solid grounding
- 132 kV : Solid grounding

(f) Pollution level for Insulator

- Mabibo Substation, Ubungo Substation : Heavy (IEC-60815-2008)
- Kinyerezi Switchgear : Heavy (IEC-60815-2008)

(g) Noise level

Mabibo site is categorized as “Industrial area”.

Day (6:00-22:00) : 70 dBA

Night (22:00-6:00) : 60 dBA

(h) Applicable Codes and Standards

Transmission and substation equipment shall be designed based on latest version of IEC standards or equivalent of IEC standards such as JEC etc.

2.1.2 Technical requirements for the equipment of Mabibo Substation

The following equipment should be installed for Mabibo Substation.

- 220/132/33 kV, 200 MVA transformers
- 220 kV switchgear with double busbar configuration;-
- 132 kV switchgear with double busbar configuration;-
- Indoor type, 33 kV switchgear with single busbar system should be installed for the substation use in the control building.
- Control and protection equipment including Micro SCADA system
- Communication equipment
- Substation power supply system
- Entire grounding system in the substation

Reference drawings;-

SS-01: Single Line Diagram for Mabibo Substation (Preliminary)
SS-02: Overall Layout Plan of Mabibo Substation (Preliminary)
SS-03: Layout Plan of Control Building (Preliminary)
SS-04: System Configuration Diagram for Mabibo Substation (Preliminary)

(1) Main transformer

- ➢ Applied Standard : IEC, JIS, JEC, JEM or equivalent
- ➢ Type : Outdoor, Auto-transformer, with On-load tap changer
- ➢ Capacity : 200 MVA
  The capacity of tertiary winding to be advised later.
- ➢ Cooling : ONAN/ONAF
- ➢ Frequency : 50 Hz
- ➢ Phase : 3
- ➢ Vector group : YNa0(d)
- ➢ Voltage
  - Primary : 221.250 kV + 6*1.41%, -12*1.41%
  - Secondary : 132 kV
  - Tertiary : 33 kV

➢ Insulation

Insulation Voltage	220 kV	132 kV	Neutral	33 kV
Lightning Impulse withstand voltage (kV-p)	1,050	650	250	170
Power frequency withstand voltage (kV)	460	230	95	70
Switching Impulse withstand voltage (kV-p)	750	-	-	-

➢ Others

- 220/132 kV lightning arresters

  220 kV and 132 kV lightning arresters should be mounted on the transformers.

- 132/33 kV transformer

  132/33 kV transformers are out of Japanese scope. The space for two (2) sets of transformers is secured in the substation, as per Drawing SS-02.

- Noise level

  The noise level of each transformer should be less than 70 dBA.

- Oil pit

  Oil pit should be provided for transformers with oil-water separator pit. The volume of the oil pit should be approximately 50% of the total oil volume of each transformer. A mobile drainage pump should be provided for the oil pit.

- Fire wall

  Fire walls should be installed between transformers, and between transformer and 220/132 kV GIS.

- Local control panel

  Local control panel should be installed on each transformer for the control of cooling fans and others. The power supply facilities for the mobile drainage pump above should be provided in the panel. The panel should be of IP-54.

(2) 220/132 kV Switchgear

Gas Insulated Switchgear (GIS) should be applied for both 220 kV and 132 kV switchgear due to very narrow space of substation site.

a. Current ratings of 220/132 kV GIS

The following table shows the current ratings of the GIS.

Bay	220 kV	132 kV
Main Busbar and Bus coupler bay	3,150 A	3,150 A
Transmission line bay	2,500 A	1,250 A
Transformer bay	1,250 A or more	1,250 A

b. 220 kV GIS with double busbar configuration

- One (1) set of 220 kV Transmission line bay for Kinyerezi power plant, comprising of;-
  - One (1) set of Double busbar

- One (1) set of Bus side Disconnecting Switch (DS) with Earthing Switch (ES)
- One (1) set of Bus side DS
- One (1) set of Circuit Breaker (CB)
- One (1) set of Line side DS with ES
- Five (5) sets of Current Transformer (CT)
- One (1) set of Voltage Transformer (VT) with Isolating device
- One (1) set of Lightning Arrester (LA)
- One (1) set of Cable Head (CH)
- One (1) set of Local control panel (LCP)

Note: According to the Tanzanian Grid Code (Clause 4.4.2 Use of bypasses of the Network Code), bypasses should be provided in 220 kV transmission line bay for CB maintenance and testing. However, there is another power supply circuit from Kinyerezi to Ilala through 220/132 kV Ubungo even though 220 kV circuit in Mabibo substation or line has some problem. Thus, the GIS without bypass circuit can be applied for Mabibo substation.

- Two (2) sets of 220 kV Transformer bay, one (1) set comprising of;-
  - One (1) set of Double busbar
  - One (1) set of Bus side DS with ES
  - One (1) set of Bus side DS
  - One (1) set of CB
  - Four (4) sets of CT
  - One (1) set of Cable Head (CH)
  - One (1) set of LCP

- One (1) set of 220 kV Bus Coupler bay with Busbar VTs, comprising of;-
  - One (1) set of Double busbar
  - Two (2) sets of DS with ES
  - One (1) set of CB
  - Four (4) sets of CT
  - Two (2) sets of 220 kV Busbar VT with Isolating device
  - One (1) set of LCP

Note) The space for one (1) bay for 220 kV transmission line and two (2) bays for 220/132/33 kV transformers should be secured for future use.

c. 132 kV GIS with double busbar configuration

- Four (4) sets of 132 kV Transmission line bay for each 2 sets of Ubungo and Ilala feeders, one (1) set comprising of;-
  - One (1) set of Double busbar
  - One (1) set of Bus side DS with ES
  - One (1) set of Bus side DS

- One (1) set of CB
- One (1) set of Line side DS with ES
- Four (4) sets of CT
- One (1) sets of VT with Isolating device
- One (1) set of LA
- One (1) set of CH
- One (1) set of LCP

- Two (2) sets of 132 kV Transformer bay, one (1) set comprising of;-
  - One (1) set of Double busbar
  - One (1) set of Bus side DS with ES
  - One (1) set of Bus side DS
  - One (1) set of CB
  - Four (4) sets of CT
  - One (1) set of CH
  - One (1) set of LCP

- One (1) sets of 132 kV Bus Coupler bay with Busbar VTs, comprising of;-
  - One (1) set of Double busbar
  - Two (2) sets of Bus side DS with ES
  - One (1) set of CB
  - Four (4) sets of CT
  - Two (2) sets of 132 kV Busbar VT with Isolating device
  - One (1) set of LCP

Note) The space for the following bays should be secured for future use.
- Two (2) bays for 220/132/33 kV transformers
- Two (2) bays for 132/33 kV distribution transformers
- Four (4) bays for transmission lines (future installation)

d. Major specification of the equipment is shown below.

Description	Unit	220 kV	132 kV
- Rated voltage	kV	245	145
- Rated short-time withstand current	kA	40	31.5
- Rated short time	s	3	3
- Rated lightning impulse withstand voltage	kV-p	1,050	650
- Rated power frequency withstand voltage	kV rms	460	275

e. Dielectric test of the main circuits of the GIS

Dielectric test on site should be energized by the respective service voltage (220 and 132 kV) with duration of at least 30 minutes in accordance with IEC standard (IEC62271-203 Annex C.3.2.3). For 220 kV GIS, the partial discharge measurement should be done also by the service voltage (line to earth voltage) in accordance with IEC standard (IEC62271-203 10.2.101.2.3).

(3) Other necessary 220/132 kV equipment and materials

a. 220/132 kV lightning arresters (LA) and cable heads (CH)
- 220 kV LA and CH for Kinyerezi feeder (three phases)
- 132 kV LA and CH for Ubungo and Ilala feeders (total 4 x three phases)

Note) LA and CH are installed at each 220/132 kV dead end tower.

b. Supporting structures for LA and CH above

c. 220/132 kV conductors and fittings

d. Drainage pumps for cable pits inside the substation and their associated materials, such as electrical connection materials, pipes and others.

e. Other necessary materials

(4) 33 kV Switchgear with single busbar
- Rated voltage : 36 kV
- Rated current (busbar): 1,250 A

The following 33 kV switchgear should be supplied for substation use.
- Double incoming bays for the tertiary windings of main transformers and one (1) auxiliary transformer bay
- Single incoming bay for 33 kV distribution line

The switchgear can be extendable for future 33 kV reactor(s).

Note) The space for the following bays should be secured for future use.
- Two (2) incoming feeder from 132/33 kV distribution transformers
- Eight (8) distribution feeders
- One (1) section bay for busbar

(5) Control and Protection

a) 220 and 132 kV transmission line
- Bay control unit
- Protection relays

According to our survey at substations, the existing 220 kV and 132 kV transmission line protection system in current situation is shown below.

Station	Line	Main Protection	Main 2 protection
Kinyerezi P/P	220 kV Ubungo line	REL 670 Distance protection	REL 670 Distance protection

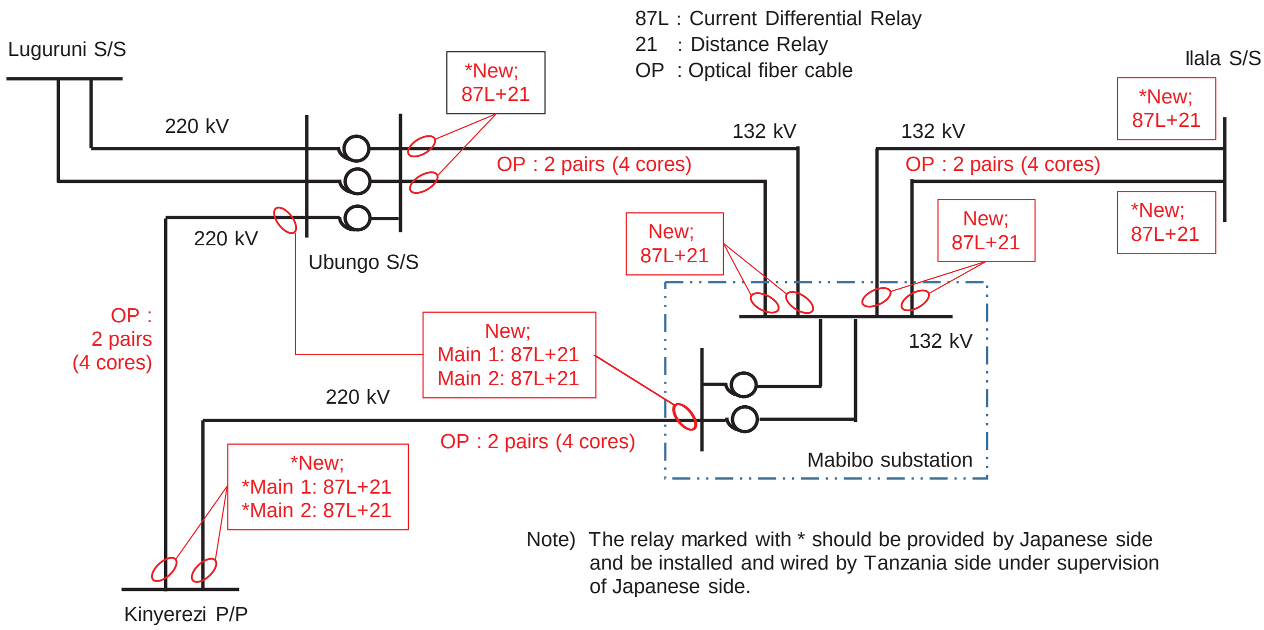
Sustation	Line	Main Protection
Ubungo S/S	132 kV Ilala line	Quadromho (Distance protection)
Ilala S/S	132 kV Ubungo line	Micom P443 (Distance protection)

According to the request of TANESCO, the following line differential protection system through optical fiber cable should be supplied as a main protection system at Mabibo substation because of the short distance transmission lines. The same differential protection relays for remote end substations of Kinyerezi power station, Ubungo substation and Ilala substation should be supplied as well. For the communication of the line current signals for differential relays, one (1) pair of fiber optic cores should be utilized exclusively for each transmission line protection relay set. See the drawing below.

Line	Main 1 Protection	Main 2 protection
220 kV Kinyerezi	Current Differential protection RED 670 or equivalent	Current Differential protection RED 670 or equivalent

Line	Main Protection
132 kV Ilala line	Current Differential protection Micom P543 or equivalent
132 kV Ubungo line	Current Differential protection Micom P543 or equivalent

<u>Transmission line protection system around Mabibo substation</u>



Note) The relay marked with * should be provided by Japanese side and be installed and wired by Tanzania side under supervision of Japanese side.

b) 200 MVA transformer
- Bay control unit
- On-load tap changer control
- Transformer differential protection including restricted earth fault protection
- Other necessary devices

c) 220 kV bus coupler

- Bay control unit
- 220 kV busbar protection relay

d) 132 kV bus coupler

- Bay control unit
- 132 kV busbar protection relay

(6) Metering panel

The metering panel(s) includes Eight (8) of TANESCO's standard Watt hour meters for 220/132 kV transmission feeders. The class of CT for Wh-meter should be 0.2.

- 220 kV feeders : 1 meters
- 132 kV feeders : 4 meters
- Transformer bays : 2 meters

(7) Micro SCADA system

a) System

- Server and Client (Workstation HMI) with bay control unit (BCU) system for control and supervising of Mabibo substation. (Standard : IEC-61850)
- Remote Terminal Unit (RTU) and/or gateway system for communication with the existing Grid Control Center (GCC) SCADA system. (Standard : IEC-60870-104)

b) Data collection

All data of the equipment inside the substation shall be collected through BCU, switching-hub unis, etc., utilizing various I/O data in a substation, such as status of transformers, 220/132 kV switchgears, control and protection devices, power supply units and other local control facilities.

c) Micro SCADA system

Control and monitoring of the substation should be done using the data in the Substation collected data above through control and monitoring server installed in the control room.

d) Control and Monitoring

- Measurement and display: Voltage, current, active power, reactive power, etc. of all 220 kV, 132 kV and 33 kV circuits
- Monitoring: Position indications of 220 kV, 132 kV and 33 kV equipment, alarms on the transmission lines, transformers and other information of the substation
- Operation: Open/close operation of 220 kV, 132 kV and 33 kV switchgear at Workstation (The operations above shall also be able to done at BCU ends)

e) Workstation

- Two (2) sets of Operator's Workstation
- Two (2) sets of Printers for log, various measurements, alarms, etc.
- Optical fiber cable, LAN cable and other necessary materials for Mabibo Substation control,

monitoring and communication system

- Control voltage : 230 V AC (Uninterruptible power supply)

(8) Communication system

The communication system includes;-

- SDH/multiplexer
- Router
- PABX equipment with telephone sets
- Splicing boxes for optical fiber cables (24c)
- Cables including optical fiber cables for the substation inside
- Control voltage : 48 V DC or 230V AC

(9) Substation power supply system

a) AC power supply system

- Two (2) sets of Auxiliary transformer
- 400/230 V AC distribution panel(s)

Note: In consideration of future reactor(s) installation, the space for voltage regulator facilities for auxiliary power supply is secured.

b) 110 V DC system

- 110 V DC charger (Dual charger system)
- 110 V DC batteries (Valve regulated lead acid (VRLA) type or equivalent)
  The battery capacity should include the one for UPS system. The capacity should be advised later.
- 110 V DC distribution panel(s)

c) 48 V DC system (for Communication system)

- 48 V DC charger (Single charger)
- 48 V DC batteries (Valve regulated lead acid (VRLA) type or equivalent)
  The battery capacity should be advised later.
- 48 V DC distribution panel(s)

d) Uninterruptible power supply (UPS) system

Note; Batteries of 110 V DC system above should be used for UPS system.

(10) 220/132/33 kV power cables (XLPE cable)

a) 220 kV cables

- 220 kV dead end tower to 220 kV switchgear
- 220 kV switchgear to 200 MVA transformer

b) 132 kV cables

- 200 MVA transformer to 132 kV switchgear
- 132 kV switchgear to 132 kV dead end tower

c) 33 kV cables and their cable sealing ends

- 200 MVA transformer to 33 kV switchgear
- 33 kV switchgear to Auxiliary transformer
- 33 kV switchgear to 33 kV Pole of Distribution line
  (33 kV pole should be supplied and installed by TANESCO)

(11) Low voltage power and control cables

Necessary low voltage power and control cables and necessary accessories for connection

(12) Substation grounding system

The grounding system should be in accordance with IEEE standard or equivalent international standards.

- Grounding conductor, grounding rod and other necessary materials
- Lightning mast, Lightning rod and/or overhead grounding wires should be applied for whole substation area.

2.1.3 Technical requirements for the equipment of Ubungo Substation

The equipment of 1 x 220 kV transmission line bay should be installed with the following ratings.

Rated voltage	:	245 kV
Rated current		
Circuit Breaker	:	3,150 A
Other equipment	:	2,500 A
Rated short-time withstand current		
	:	40 kA – 3s.

One (1) set of equipment is comprising of;-

- One (1) set of Main bus side DS
- One (1) set of Bypass DS (Transfer bus side)
- One (1) set of CB
- One (1) set of Line side DS with ES
- One (1) set of CT (3 phases)
- One (1) set of CVT (3 phases)
- One set of LA (3 phases)
- One (1) set of Local control panel
- One (1) set of the following materials
  Dead-end tower for transmission lines
  Steel structures for bus conductors
  Bus conductors and the branch conductors
  Supporting insulators
  Supporting structures for the equipment
  Grounding materials (to be connected to existing grounding grid)
  Other necessary materials

Control and Protection panels-

- Control panel (BCU, Watt-hour meter (supplied by TANESCO) and other devices, to be installed in Control building)
- Protection panel (Relays and other devices, to be installed in Control building)
  Please see the Figure "Transmission line protection system around Mabibo substation" in 2.1.2 (5) (page 11 - 12).

Line	Main 1 Protection	Main 2 protection
220 kV Kinyerezi	Current Differential protection RED 670 or equivalent	Current Differential protection RED 670 or equivalent

- Communication equipment for the substation micro SCADA system

2.1.4 Technical requirements for the equipment of Kinyerezi Switchgear

The equipment in two (2) x 220 kV transmission line bays should be replaced with new ones with the following ratings.

Rated voltage	:	245 kV
Rated current	:	2,500 A
Rated short-time withstand current	:	40 kA – 3s.

One (1) set of equipment for one (1) bay is comprising of;

- One (1) set of Bus-1 side DS
- One (1) set of Bus-2 side DS
- One (1) set of Bypass DS
- One (1) set of CB
- One (1) set of CB Line side DS
- One (1) set of CT
- One (1) set of Line side DS with ES
- One (1) set of Line trap (0.5 mH)
- One (1) set of branch conductor
  (Existing CVT and LA can be used as they are)

The existing secondary wirings to the existing equipment should be used for the new equipment above.

The following works should be done by TANESCO.

- Adjustment of SCADA system in the power plant
- Replacement and settings of transmission line relays under supervision of Japanese side
- Adjustment of Watt-hour meters
- Interlock test of whole substation (The tests of equipment itself should be done by Japanese side)

2.1.5 Technical requirements for the civil and building of Mabibo Substation

Basic design policy for substation building

The facility planning and design of the Mabibo Substation, in accordance with the building standards of United republic of Tanzania, and the facility design and construction plan that conforms to Tanzania local natural conditions, construction conditions, etc., the following are basic policies of facility design.

- The plan is based on future power demand and expansion plans such as power distribution plans.
- Ensure the safety, durability and maintenance of facilities.
- The facility is designed to suitable local materials that can be procured in Tanzania, as well as general methods and technologies in Tanzania locality.
- The site layout will be designed in consideration of the natural slope and existing waterway in the northern part.
- The road inside the substation will be designed in consideration of the future plan and maintenance.
- The floor level should be higher than ordinary buildings to protect equipment inside from water in case of heavy rain.

2.2 Technical requirement for Transmission Line

2.2.1 Technical requirement for Transmission Line

(1) Scope of Work

Scope of the work for transmission line is shown in G-01 Project Site in the Drawings.

1) 220 kV Transmission Line and 132 kV Transmission Line

Mabibo Substation will be energized from new 220 kV transmission line between Kinyerezi Power Plant (T-off point) and Mabibo Substation. The existing steel towers including foundation between T-off point and Ubungo Substation on the existing 220 kV transmission line and existing 132 kV (1 cct) steel towers including foundation between Ubungo Substation and Mabibo Substation (including new 132 kV dead end tower) shall be dismantle by Tanzania side and new steel towers between Kinyerezi Power Plant (T-off point) and Mabibo Substation shall be erected, refer to attached drawing TL-01.

2) Design Conditions for 220 kV Transmission Line and 132 kV Transmission Line

Natural Conditions and Electrical Conditions are shown in Table 2.2.1-1 and Table 2.2.1-2, respectively.

Table 2.2.1-1 Design Conditions

Items	Design Values
Altitude	From 50 m to 200 m
Conductor temperature	-
Maximum temperature	90 degree Centigrade

Sag calculation to determine steel tower height	90 degree Centigrade
Wind speed	30 m/s
Conductor tension at 2nd condition (EDS:Every Day Stress)	Safety factor more than 5.0 (Less than 20% of UTS)
Conductor tension at 1st condition	Safety factor more than 2.5 (Less than 40% of UTS)
Soil bearing capacity	Depends on the soil investigation result

Table 2.2.1-2 Electrical Conditions

Items	Design Value
Right of Way (ROW)	- 220 kV T/L for triple circuits: 40m width (20m +20m) - 220 kV T/L for double circuits: 40m width (20m +20m) - 132 kV T/L for double circuits: 30m width (15m +15m)
Height of conductor	
General area (m)	220 kV:8 m, 132 kV:6.7 m
Waterway (m)	220 kV:10 m, 132 kV:7 m
Railway	220 kV:13.0 m, 132 kV:9.0 m
to Road crossing (m)	220 kV:8.5 m, 132 kV:8.0 m
Shield angle for Lightning	Less than 30 degree
Minimum nominal specific creepage distance	31 mm/kV

3) Requirements for 220 kV Transmission Line

Specification for 220 kV Transmission Line is shown as follows.

Table 2.2.1-3 Specification for 220 kV Transmission Line

No.	Items	Specifications	
1)	Tower	Type: Material: Foundation: Type of tower:	Steel lattice type tower Hot rolled steel, Zinc coat galvanized Pad and Chimney or Mat, Reinforced concrete 3 ccts dead end tower for T-off point (Type3D-1) 3 ccts angle tension tower (Type3B) 3 ccts suspension tower (Type3A) 3 ccts tension tower (Type3C) 3 ccts dead end tower to Ubungo substation (Type3D-2) 2 ccts suspension tower (Type2A) 2 ccts tension tower (Type2C) 2 ccts tension tower (Type2D)
2)	Conductor Overhead Line	Type:	Bluejay Aluminum conductor steel reinforced (ACSR) with corrosion resistance (Salt resistance) AC type a. Three (3) phase, Double conductor (Double bundle) from T-off point to Ubungo substation (Kinyerezi - Ubungo) b. Three (3) phase, Double conductor (Double bundle) from T-off point to Mabibo substation (Kinyerezi - Mabibo)

		c. Three (3) phase, Single conductor from T-off point to Ubungo substation (Luguruni - Ubungo) d. Three(3) phase, Double conductor (Double bundle) from Tower No.16 to Mabibo substation Size: Approx. 603 mm^2 Others: Including all necessary equipment and materials for installation
3)	Insulator (Suspension and Tension)	Material: Glass Number of insulators: 20 or 18×2 pcs/phase (Double strings) Minimum creepage distance: 31 mm/kV Others: Including all necessary equipment and materials for installation
4)	Insulator (Insulator for Jumper)	Material: Glass Number of insulators: 20 or 18×1 pcs/phase (Single string) Minimum creepage distance: 31 mm/kV Others: Including all necessary equipment and materials for installation
5)	Shield Wire and Optical Fiber Cable	Type: OPGW-90mm^2 Double phase (2 units) Between T-off point and dead end tower to Ubungo substation Between dead end tower to Ubungo substation and Mabibo Substation Number of Optic Fiber Core: 24 cores Shielding angle: less than 30 degree Others: With splice boxes Including all necessary equipment and materials for installation.
6)	Shield Wire	Type: AC Aluminum Clad Steel Conductor Shielding angle: less than 30 degree. Size: Approx. 70 mm^2

4) Requirements for 132 kV Transmission Line

Specification for 132 kV Transmission Line is shown as follows.

Table 2.2.1-3 Specification for 132 kV Transmission Line

No.	Items	Specifications
1)	Tower	Type: Steel lattice type tower Material: Hot rolled steel, Zinc coat galvanized Foundation: Pad and Chimney or Mat, Reinforced concrete Type of tower: 2 ccts dead end tower for Mabibo Substation (Type132-2D)
2)	Conductor Overhead Line	Type: Hawk Concentric Lay Stranded Thermal Resistant Aluminum Alloy Conductors (TACSR) with corrosion resistance (Salt resistance) Three (3) phase, single conductor Between existing 132 kV tower No. 20 and existing 132 kV tower No. 18 (Pass through 132 kV dead end tower and Mabibo Substation) Size: Approx. 240 mm^2 Others: Including all necessary equipment and materials for installation

No.	Items	Specifications
3)	Insulator (Tension)	Material: Glass Number of insulators: 11×1 pcs/phase Minimum creepage distance: 31 mm/kV Others: Including all necessary equipment and materials for installation
4)	Shield Wire	Type: AC Aluminum Clad Steel Conductor Shielding angle: less than 30 degree. Size: 55 mm^2

2.2.2 Technical requirements for the Foundation of Transmission Line

(1) Requirements for the Facilities

Necessary land development including Access Road, Earth wall, Land Levelling, Boundary Fence would be constructed by the Tanzania side.

The Outline of the foundation for Tower of 220 kV and 132 kV Transmission Lines is shown in Table 2.2.2-1.

Table 2.2.2.1 Outline of the Foundation of 220 kV Transmission Line Tower

Items	Contents	Details
Structure	Reinforced Concrete Foundation (Pad & Chimney or Mat Type)	Stability by the result of soil investigation report Reinforcing Bar :Deformed Bar : Mild steel

Table 2.2.2.1 Outline of the Foundation of 132 kV Transmission Line Tower

Items	Contents	Details
Structure	Reinforced Concrete Foundation (Pad & Chimney or Mat Type)	Stability by the result of soil investigation report Reinforcing Bar :Deformed Bar : Mild steel

(2) Detail procedure of the work

Work shall be performed with maximum care to avoid collapse of existing towers during construction.

To apply adequate work procedure is essential.

Some of the preparatory work has to be done with energized condition. Maximum care is deemed to be necessary in order not to make electrical accident.

To minimize the shutdown duration, it is essential to plan and apply parallel works as much as possible.

Followings are the tentative work procedure.

For tentative T-off point work procedure: See drawing TL-02

For tentative dead end tower to Ubungo Substation work procedure: See drawing TL-03

For tentative Mabibo Substation work procedure (132 kV transmission line): See drawing TL-04

(3) Transmission line over Ubungo flyover

The Team proposed TANESCO that overhead transmission lines are desirable to over pass the Ubungo flyover due to budgetary limitation of the Project. The Team and the Consultant of the Ubungo flyover project had meetings and reached a conclusion that overhead line crossing will be possible if necessary clearance is secured against the flyover. The Team will provide information of overhead transmission lines such as position of towers, height of towers, clearance under conductors, etc. and the Consultant will assess the clearance between the flyover and the transmission lines. After confirming that adequate clearance is secured, the mode of over passing flyover will be agreed between TANROADS and TANESCO.

(4) Clearance of existing ROW

TANESCO has been implementing wayleave (ROW) patrol along its transmission lines to identify and warn any intruders into its ROW as its daily operation. If TANESCO finds any facilities which is built within the wayleave, TANESCO informs the owner of the facility to remove it and indicate the limit of boundary with red paint.

The Consultant strongly requested TANESCO to expedite the clearance of the existing ROW for securing the area of newly-constructed transmission towers. TANESCO agreed that the clearance shall be completed by the end of March, 2022.

2.3 Environmental and Social Consideration

The following table shows a schedule for EIA and ARAP, which was agreed upon between TANESCO and JICA Preparatory Survey Team. The detail explanation is described in Table 2.3-1 and 2.3-2 below. During all the work of EIA and ARAP, TANESCO should work in collaboration with a local consultant hired by JICA Preparatory Survey Team and facilitate them in accessing necessary data and information to carry out their tasks.

Table 2.3-1 Schedule of Environmental Assessment and Preparation of ARAP (tentative for discussion Nov. 2019)

Items	Activities	Organizations in charge	2019						2020						2020		
			Nov.			Dec.			Jan.			Feb.			Oct.		
Environmental Assessment	Confirmation of required process/ Submission of project brief to NEMC for screening	TANESCO/JICA		■													
	Issue of screening results	NEMC			■												
	Further environmental study (if required)	TANESCO/ Local consultant hired by TANESCO			■	■	■	■									
	Submission of EIA report to NEMC	TANESCO/ Local consultant hired by TANESCO							■								
	Issue of EIA Certificate of Authorization	NEMC									■						
Preparation of ARAP	ARAP study	TANESCO/ Local consultant hired by JICA team							■	■	■						
	Submission of ARAP to JICA Study Team	TANESCO/ Local consultant hired by JICA team											■				
	Approval of ARAP by TANESCO	TANESCO											■				
	Approval of ARAP by Ministry of Land	TANESCO/Ministry of Land											■				
Implementation of ARAP	Completion of land acquisition/ compensation	TANESCO													■	■	■
Others	Mobilization of a local consultant	JICA/ Local consultant		■	■	■	■	■	■	■	■	■	■				

Note: Implementation of ARAP should be fully completed within three months after the approval of the Project by the Japanese Government.

2.3.1 Environmental Impact Assessment

Legal Frameworks on the Environmental Impact Assessment in the country provided by Environmental Management Act, 2004, Cap 191. Under the Act, The Environmental Management (Environmental Impact Assessment and Audit)(Amendment) Regulations,2018 instruct detail procedure for the process.

In line with the regulation, TANESCO should process to obtain an environmental clearance certificate from National Environmental Management Council (NEMC) prior to the project implementation. Receiving a Project brief as the registration of the project, NEMC will determine whether the Project requires a full EIA and issue screening results to TANESCO (within 2 weeks after the submission according to the regulation). TANESCO should keep close communication with NEMC, including conducting site inspection, so that NEMC can have sufficient information for screening.

TANESCO should commence the environmental process with the NEMC within November 2019. In order to implement the currently proposed project timely based on the discussion between TANESCO and JICA, TANESCO is expected to submit the whole result of the environmental study approved by NEMC to JICA by May 2010. In accordance with screening results from NEMC, a further environmental study such as full EIA will be carried out by TANESCO. The reply from the NEMC shall be shared with the JICA study team in timely manner.

2.3.2 Abbreviated Resettlement Action Plan

JICA Preparatory Survey Team conducted the site visit with TANESCO, and confirmed that the Project would require land acquisition and resettlement to some extent. Based on the JICA Guideline (2010), TANESCO is required to prepare an abbreviated resettlement action plan (ARAP). ARAP should be finalized and authorized by TANESCO by March 2020.

The newly-constructed 220 kV transmission line (Kinyerezi Power Plant (T-off point) - Mabibo) will be installed within the currently operated Right-of Way by TANESCO having enough safety distance from any obstacles in the area. However, the new line is planned to pass through outside of the existing Ubungo S/S to connect the existing 132kV line without entering the S/S and some extra land is required for the Right-of Way, approximately in a length of 300m. (Refer to G-02)

For acquiring the land, the following principles are applied for newly-constructed 220 kV transmission line according to the Guideline of Right-of-Way by TANESCO:

- Right-of-Way of 220 kV electrical lines is **40m width (20m + 20m)**.
- Any permanent building such as houses and shops is not permitted on the Right-of-Way.

TANESCO agreed and stated that the following criteria of resettlement and land acquisition are applied for 220 kV transmission line between Kinyerezi Power Plant (T-off point) and Mabibo Substation:

Table 2.3-2 Rights-of-Ways, Criteria for Land Acquisition and Resettlement

No.	Items	Right-of-Ways, Criteria for land acquisition and resettlement
1.	Right-of Ways for new Acquisition	220 kV transmission line: **40m width (20m +20m)**
2.	Land acquisition	Lands are required **only the area where the** Right-of Ways is not operated.
3.	Resettlement of structures lived or used by people such as houses , shops etc.	The transmission line installation is planned to have a minimum clearance from the lowest conductor to the structures is **5.85m**.
4.	Resettlement of trees	All tress within the above Right-of-Way must be removed.
5.	Resettlement of other objects	Other objects within the above Right-of Way not meeting the minimum clearance (5.85m) will be evaluated based on social impacts and safety.

Once the exact coordinates of towers are finalized, TANESCO should conduct site visit with the local sub-contractor. In case involuntary resettlement is predicted due to the Project, TANESCO should avoid or minimize the impacts, exploring all viable alternative routes.

The schedule of land acquisition agreed upon between TANESCO and JICA Preparatory Survey Team is shown in the table below. For the smooth implementation of the project, TANESCO agreed to complete all the land acquisition as well as compensation process within three months after the approval of the Project by the Japanese Government.

Table 2.3-3 Schedule of Land Acquisition after ARAP Preparation

Stage	Responsible bodies	Actions	Timeframe
1. Draft ARAP preparation	TANESCO/ Local consultant	ARAP survey will be implemented to meet the requirement of JICA Environmental and Social Guidelines. Adequate Stakeholder meeting implemented. Draft ARAP shall be shared with JICA	By January, 2019
2. Approval of the ARAP in TANESCO	TANESCO	Finalizing the ARAP document and necessary budget to be secured Approved ARAP shall be shared with JICA	January, 2019
3. Approval of the ARAP in Ministry of Land	TANESCO	The ARAP to be authorized by Tanzanian government Approved ARAP shall be shared with JICA	February, 2019
4. ARAP Implementation	TANESCO	Whole compensation shall be implemented. Desplacement of the PAPs	Within three(3) months after the approval of the Project by the Japanese Government.
5. Land title request	TANESCO/ Ubungo municipality	TANESCO will implement necessary process for transfer of land title	Within three(3) months after the approval of the Project by the Japanese Government.

2.4 Procurement Plan of Spare Parts and Maintenance Tools

Capability of sustainable operation and maintenance for the equipment of the Project by the Recipient is one of conditions for the Japan’s Grant Aid. The Tanzania side shall keep operation and maintenance for the equipment of the Project properly by himself, including procurement of spare parts. On the other hand, the warranty period for the Project is 1 year after issue of the completion certificate in case of the Japan’s Grant Aid. To secure operation and maintenance for the equipment of the Project for the warranty period, the Spare parts required for the period shall be provided as the scope of the Japanese.

Possession of maintenance tools for proper operation and maintenance for the equipment of the Project by the Recipient is one of conditions for the Japan’s Grant Aid. However, the special tools required for operation and maintenance of the equipment of the Project shall be provided as the scope of the Japanese.

Spare parts and maintenance tools listed in Table 2.4-1 and Table 2.4-2 are recommended to be procured. More detailed parts, tools, test equipment and the quantity will be explained in the Draft Final Report.

Table 2.4-1 Recommended Spare Part List

Legend; pc: piece

Name of Spare Parts	Quantity
1. Transformer	
1.1 220/132 kV Transformer	
(1) Gasket (complete set)	1 set
(2) Buchholz relay set	1 set
(3) Oil temperature indicator (main tank and conservator)	1 pc each
(4) Oil level indicators (main tank and conservator)	1 pc each
(5) Silica gel for Breathers	200%
2. 220 kV Switchgear equipment	
2.1 Gas density meter	1 pc./bay
2.2 Circuit breaker (CB)	
(1) Closing coil	1 pc
(2) Tripping coil	1 pc
(3) Drive mechanism for CB	1 set
(4) Spring charging motor, if applied	1 set
2.3 Disconnecting Switch (DS) and Earthing Switch (ES)	
(1) Drive mechanism	1 set each
(2) Motor	1 pc each
2.4 Overpressure relief	3 sets
2.5 Set of LV equipment (1 set of each type of Relays, MCCB, lamps, push buttons, 10% of terminal blocks)	1 set
3. 132 kV Switchgear equipment	
3.1 Gas density meter	1 pc./bay
3.2 Circuit breaker (CB)	
(1) Closing coil	1 pc
(2) Tripping coil	1 pc
(3) Drive mechanism for CB	1 set
(4) Spring charging motor, if applied	1 set
3.3 Disconnecting Switch (DS) and Earthing Switch (ES)	
(1) Drive mechanism	1 set
(2) Motor	1 pc each
3.4 Overpressure relief	3 sets
3.5 Set of LV equipment (1 set of each type of Relays, MCCB, lamps, push buttons, 10% of terminal blocks)	1 set
4. Control and Protection	
(1) Protection relay (each type)	1 pc each.
(2) Bay control unit (each type)	1 pc each.
(3) Ethernet switch (each type)	1 pc each
(4) MCCB (each type)	1 pc each
(5) Server	1 set
(6) Fuse (each type)	100%
(7) Meter (each type), if applied	1 pc each.
(8) Auxiliary relay (each type)	1 pc each.
(9) Control and selector switch, if any (each type)	1 pc each.
(10) Test block (each type)	1 pc each
5. Substation Power Supply System Equipment	
5.1 AC Distribution Board	
(1) MCCB (each type)	1 pc each.
(2) Indicating lamp, if any (each type)	100%
(3) Fuse (each type)	100%
(4) Meter (each type)	1 pc each.
(5) Terminal block (3 phases of each size)	1 pc each
5.2 DC Distribution Board	
(1) MCCB (each type)	1 pc each.
(2) Indicating lamp, if any (each type)	100%

Name of Spare Parts	Quantity
(3) Fuse (each type)	100%
(4) Meter (each type)	1 pc each.
(5) Terminal block (2 (P-N) of each type)	1 pc each
5.3 Battery and Charger	
(1) Battery	2 cells each.
(2) Electrolyte for spare batteries	1 lot
(3) Control Card and diode module	1 pc each.
(4) MCCB (each type)	1 pc each
(4) Indicating lamp, if any (each type)	100%
(5) Fuse (each type)	100%
(6) Meter (each type)	1 pc each.
5.4 Uninterruptible power supply system	
(1) Pulse generator	1 pc each.
(2) Thyristor stack	1 pc each.
(3) MCCB (each type)	1 pc each.
(4) Indication lamp (each type)	100%
(5) Fuse (each type)	100%
(6) Meter (each type)	1 pc.each.
6. Communication	
(1) Multiplexer	1 set

Table 2.4-2 Maintenance Tool

Maintenance Tool	Quantity
1. Gas filling device	1 set
2. Gas leak detector	1 set
3. Voltage detector for 220/132 kV use	2 set

2.5 On-the-Job Training (OJT)

On-the-job training (OJT) shall be carried out during the construction period. Through the OJT, maintenance and operation staff of the Tanzanian side will be able to experience practical and advanced skill from Manufacturer’s engineers. Contents of OJT are suggested as follows;

- Operation and maintenance on 220 kV and 132 kV substation equipment
- Protection relay setting
- Fault analysis and operation record management
- Operation and maintenance on 220 kV and 132 kV transmission lines

3 Tentative Implementation Schedule of the Project

The tentative implementation schedule is shown in Attachment-3. In case that the Project is approved by the Japanese Government, the Project will proceed as below in the earliest scenario. The installation work of the Project will start in August, 2023. <u>It is important for both sides to understand that the Preparatory Survey is not a commitment for the future implementation of the Project.</u>

- ➢ The Exchange of Notes between the Tanzania and Japanese Government will be signed in August, 2022. (To be considered)
- ➢ The Tender Opening will be held in March, 2023. (To be considered)
- ➢ Installation work of the Project will start in August, 2023. (To be considered)
- ➢ Commissioning of the Project will be the end of February, 2026. (To be considered)

THE PROJECT
FOR
REINFORCEMENT OF SUPPLY
FROM KINYEREZI POWER STATION TO UBUNGO
SUBSTATION
(Development of Kinyerezi-Mburahati axis)

Summary of Analysis in Japan and Recommended Development Plan

August 2019

JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

YACHIYO ENGINEERING CO., LTD.

WEST JAPAN ENGINEERING CONSULTANTS, INC.

Summary

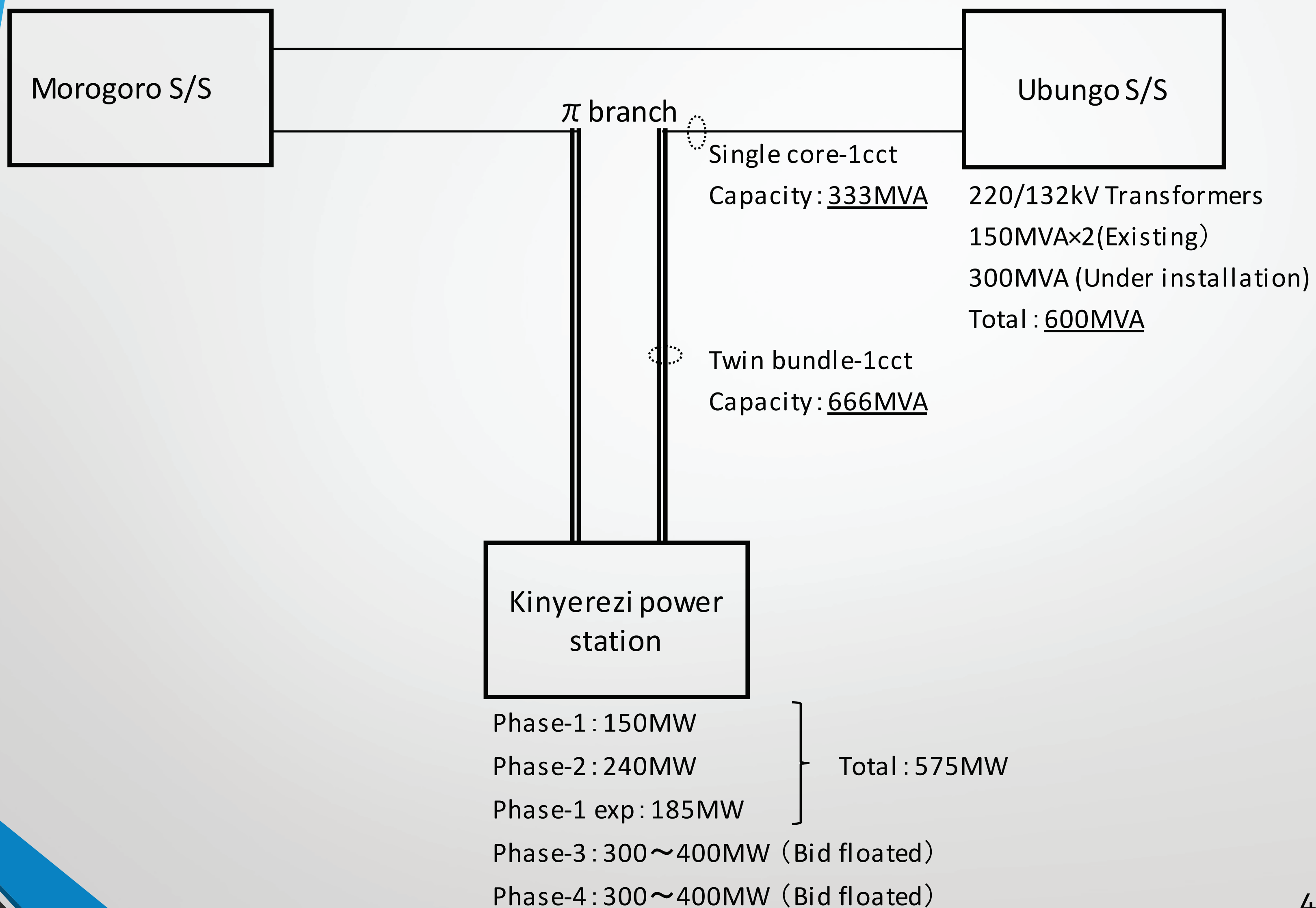
- JICA Study Team has conducted load flow analyses on Alternative-4 and 5 which Tanzanian side and JICA mission members jointly narrowed down from various options during the first field survey in March 2019.
- JICA Study Team has come up to a better option derived from Alternative-5, which is named Alternative-5'.
- The results of load flow analyses prove that Alternative-4, 5 and 5' are technically feasible.
- Due to the limitation of Japan's grant budget, one of the components of the Project, i.e., construction of Kinyerezi-Luguruni 220kV transmission lines needs to be undertaken by the Tanzanian side. This line is important to ensure the reliability of power evacuation from Kinyerezi to Ubungo and Morogoro after diverting Kinyerezi's power evacuation lines to Mburahati.
- In addition to the scope of the grant aid project, transmission system development proposed by DSMP is necessary to ensure the capacity and reliability of transmission network in Dar es Salaam.

Preliminary evaluation of alternatives at the stage of 1st field survey

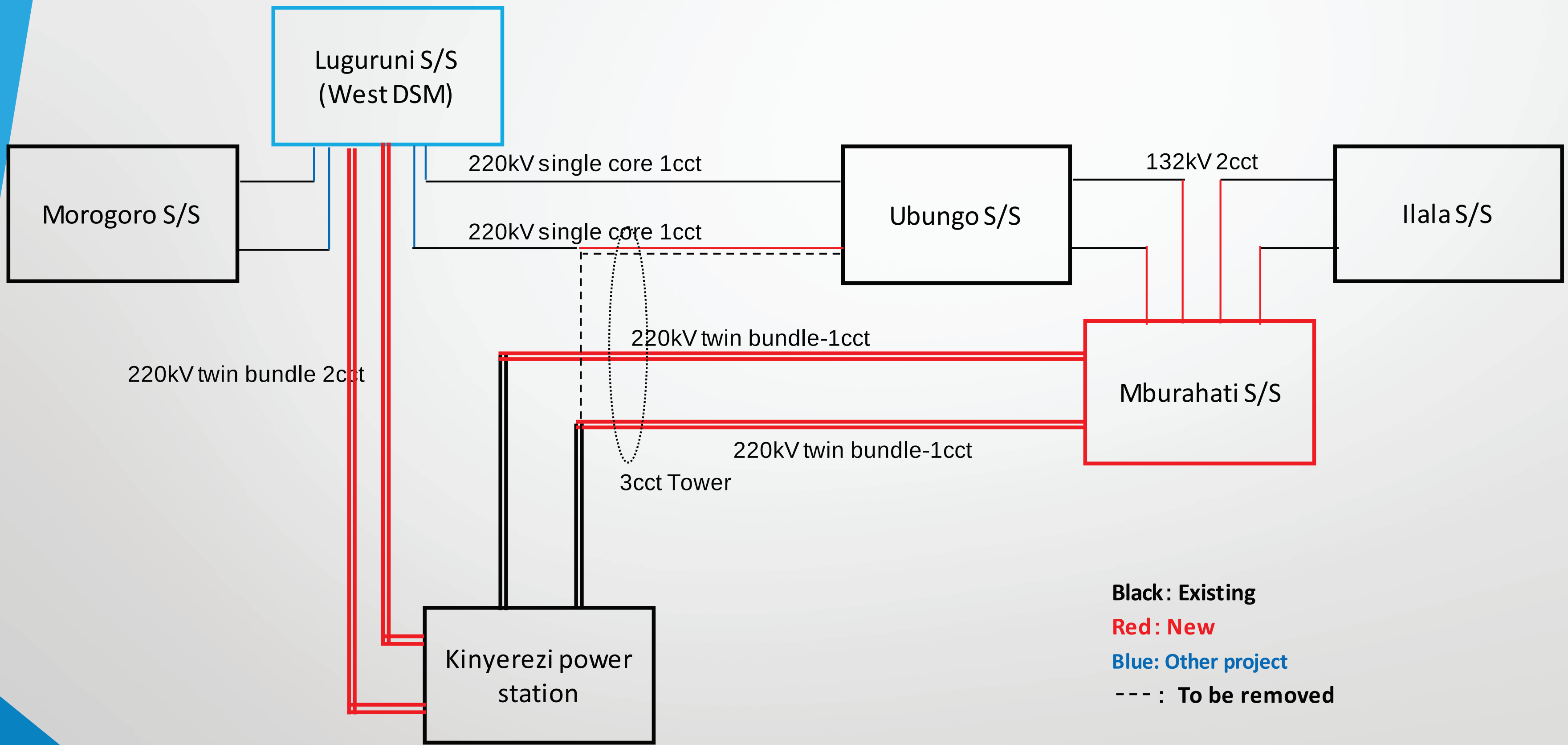
- Pros and cons of the different configurations as well as the evaluations are shown below at first field survey.

	Requested	Alt-1	Alt-2	Alt-3	Alt-4	Alt-5
Transformer Cost	C	A	B	A	A	C
Transmission line Cost	B	B-	A	B-	C	C
Land constraint at Existing Substation	A	A	A	C	A	A
Ease of ROW acquisition	B	C-	A	C	B	B
Power evacuation during construction	B	A	B	B	A	A
Ease of O&M	A	A	A	A	B	A
Reliability	B	A	C-	A	A	A
Overall (Points)	23	-	-	20	27 **Best**	25 **2nd Best**

Current configuration

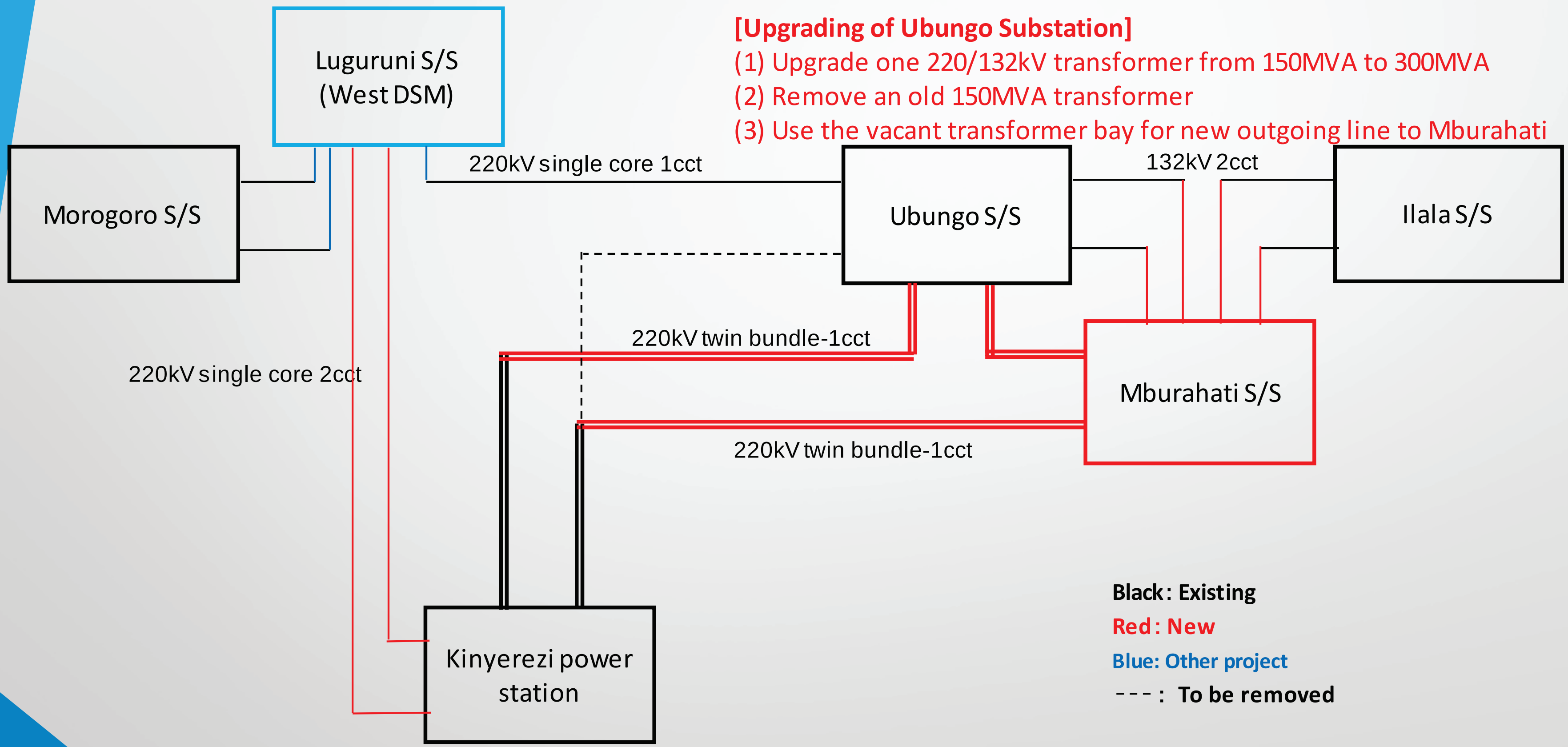


Alternative-4

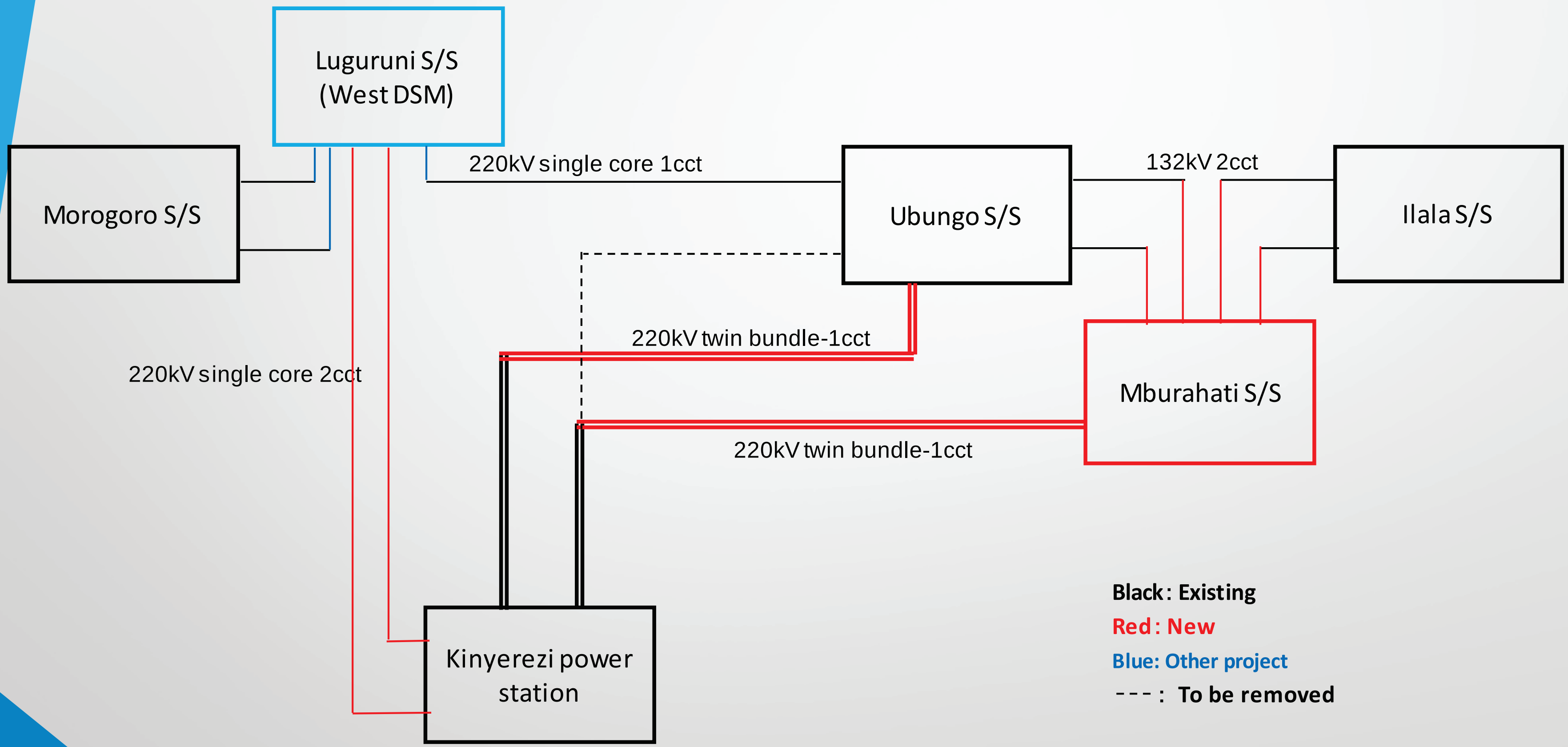


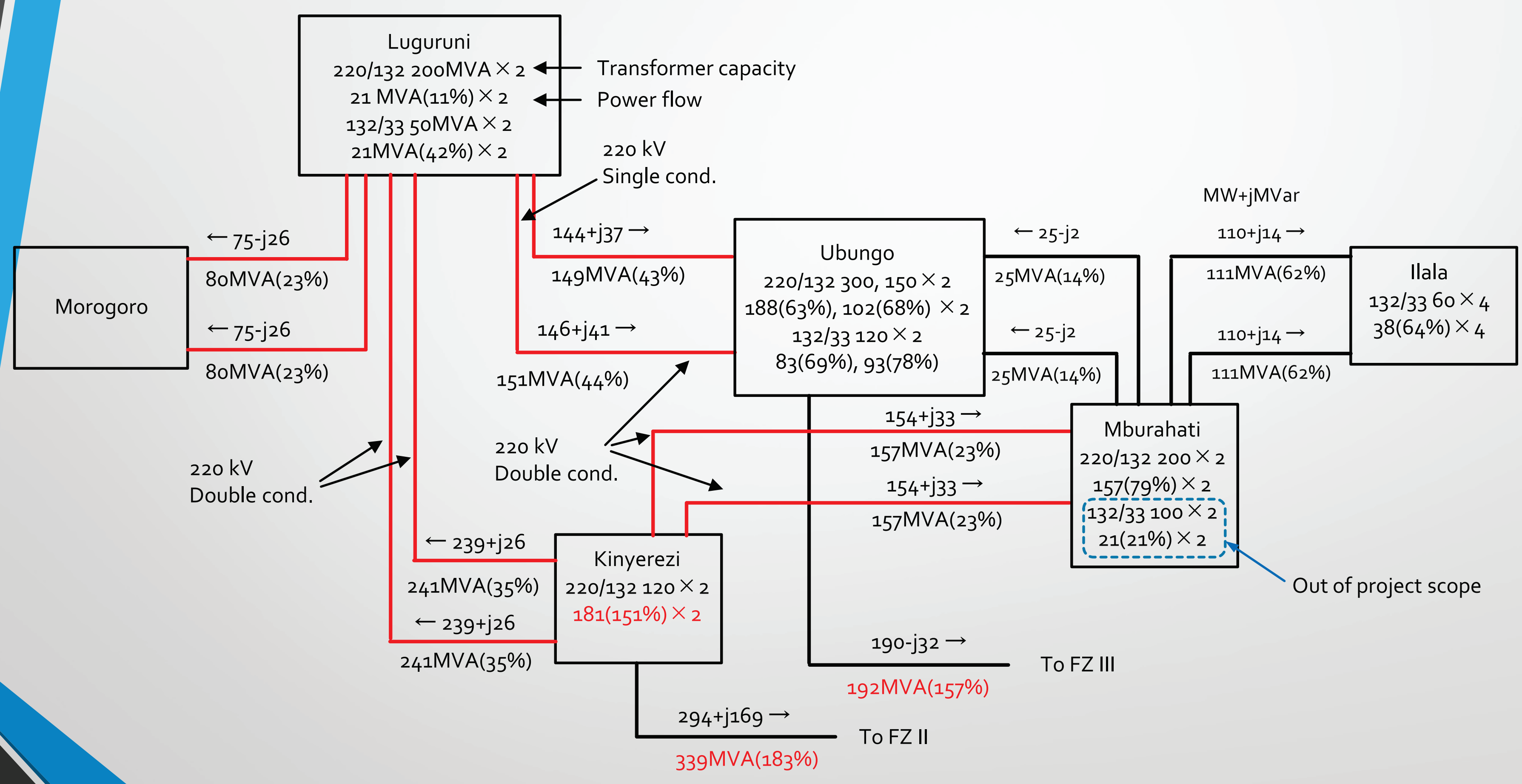
Alternative-5

[Upgrading of Ubungo Substation]
(1) Upgrade one 220/132kV transformer from 150MVA to 300MVA
(2) Remove an old 150MVA transformer
(3) Use the vacant transformer bay for new outgoing line to Mburahati



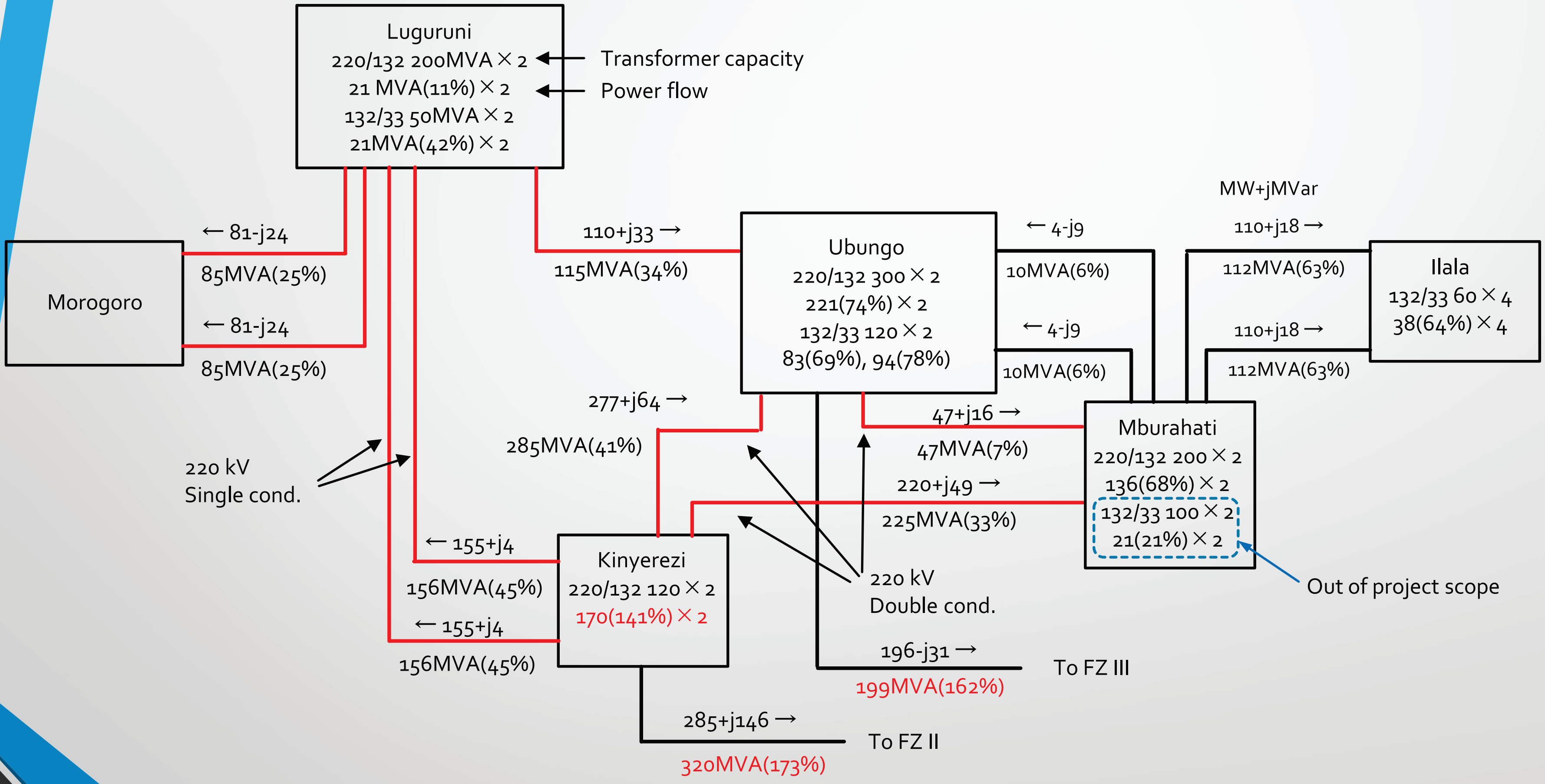
Alternative-5′

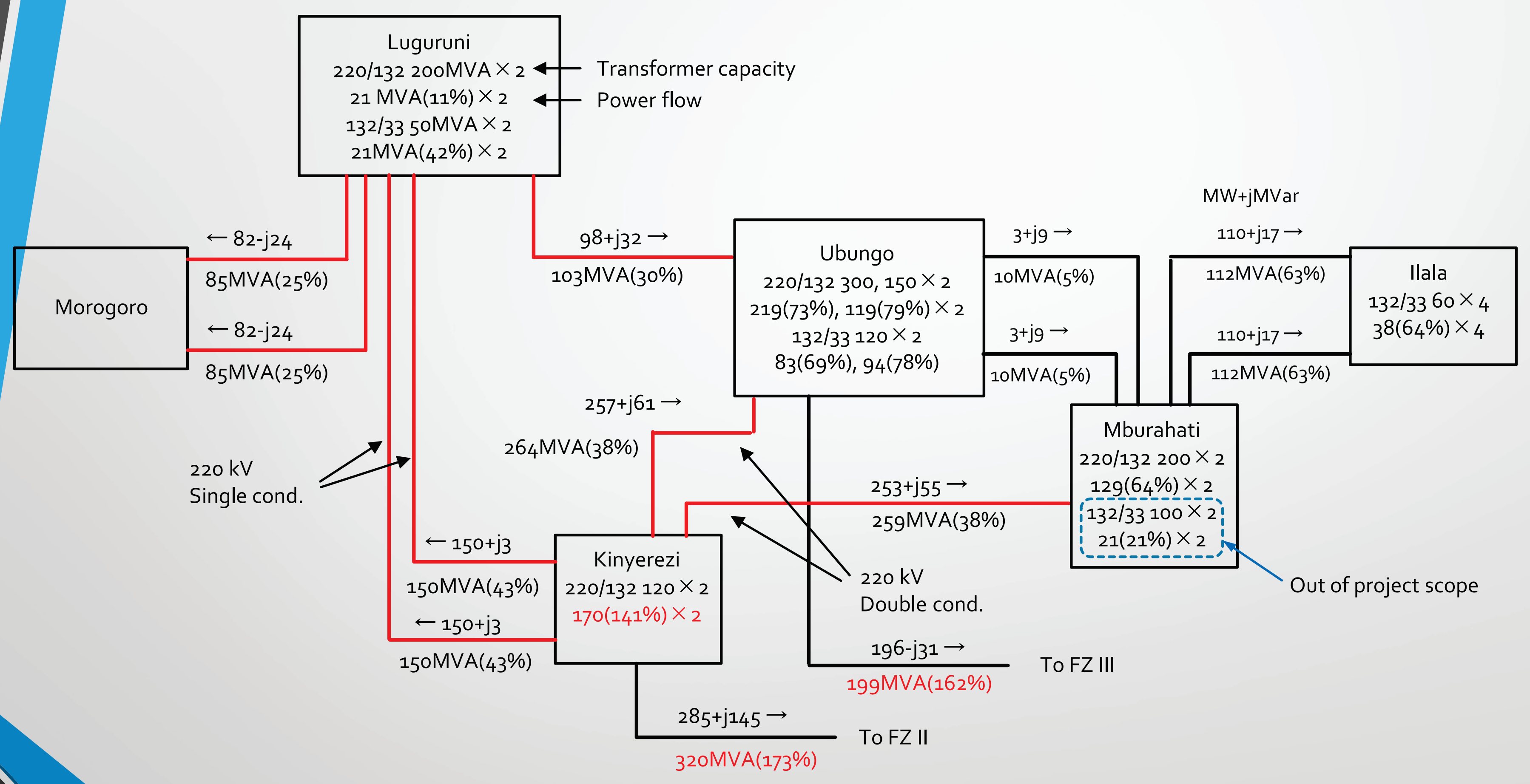


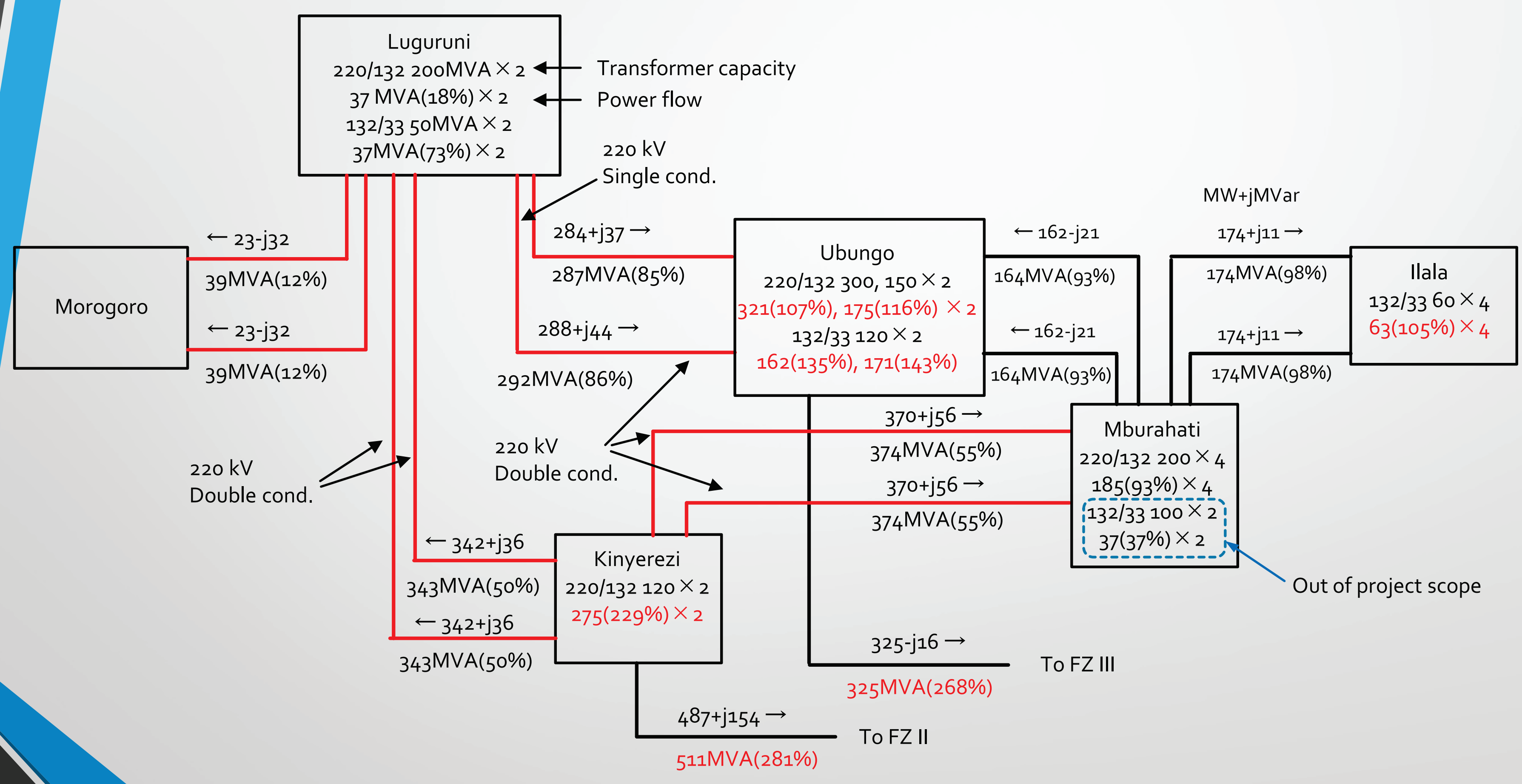


Luguruni
220/132 200MVA × 2
21 MVA(11%) × 2
132/33 50MVA × 2
21MVA(42%) × 2
Transformer capacity
Power flow
220 kV
Single cond.
Morogoro
← 75-j26
80MVA(23%)
← 75-j26
80MVA(23%)
144+j37 →
149MVA(43%)
146+j41 →
151MVA(44%)
Ubungo
220/132 300, 150 × 2
188(63%), 102(68%) × 2
132/33 120 × 2
83(69%), 93(78%)
← 25-j2
25MVA(14%)
← 25-j2
25MVA(14%)
MW+jMVar
110+j14 →
111MVA(62%)
110+j14 →
111MVA(62%)
Ilala
132/33 60 × 4
38(64%) × 4
220 kV
Double cond.
220 kV
Double cond.
154+j33 →
157MVA(23%)
154+j33 →
157MVA(23%)
Mburahati
220/132 200 × 2
157(79%) × 2
132/33 100 × 2
21(21%) × 2
Out of project scope
← 239+j26
241MVA(35%)
← 239+j26
241MVA(35%)
Kinyerezi
220/132 120 × 2
181(151%) × 2
190-j32 →
192MVA(157%)
To FZ III
294+j169 →
339MVA(183%)
To FZ II

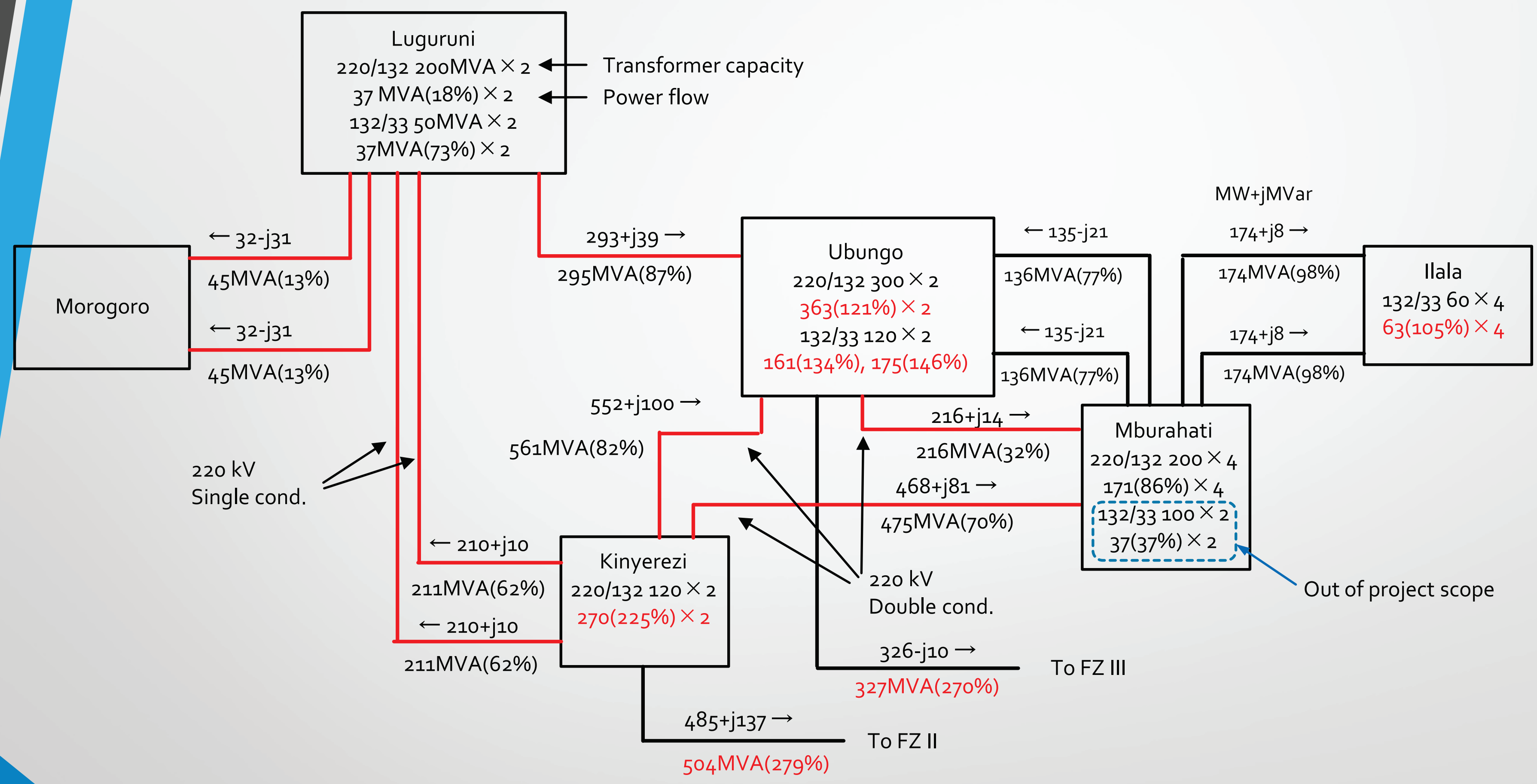
A5–36


Luguruni
220/132 200MVA × 2
21 MVA(11%) × 2
132/33 50MVA × 2
21MVA(42%) × 2
Transformer capacity
Power flow
Morogoro
← 81-j24
85MVA(25%)
← 81-j24
85MVA(25%)
220 kV
Single cond.
110+j33 →
115MVA(34%)
Ubungo
220/132 300 × 2
221(74%) × 2
132/33 120 × 2
83(69%), 94(78%)
← 4-j9
10MVA(6%)
← 4-j9
10MVA(6%)
MW+jMVar
110+j18 →
112MVA(63%)
110+j18 →
112MVA(63%)
Ilala
132/33 60 × 4
38(64%) × 4
277+j64 →
285MVA(41%)
47+j16 →
47MVA(7%)
220+j49 →
225MVA(33%)
Mburahati
220/132 200 × 2
136(68%) × 2
132/33 100 × 2
21(21%) × 2
Out of project scope
← 155+j4
156MVA(45%)
← 155+j4
156MVA(45%)
Kinyerezi
220/132 120 × 2
170(141%) × 2
220 kV
Double cond.
196-j31 →
199MVA(162%)
To FZ III
285+j146 →
320MVA(173%)
To FZ II

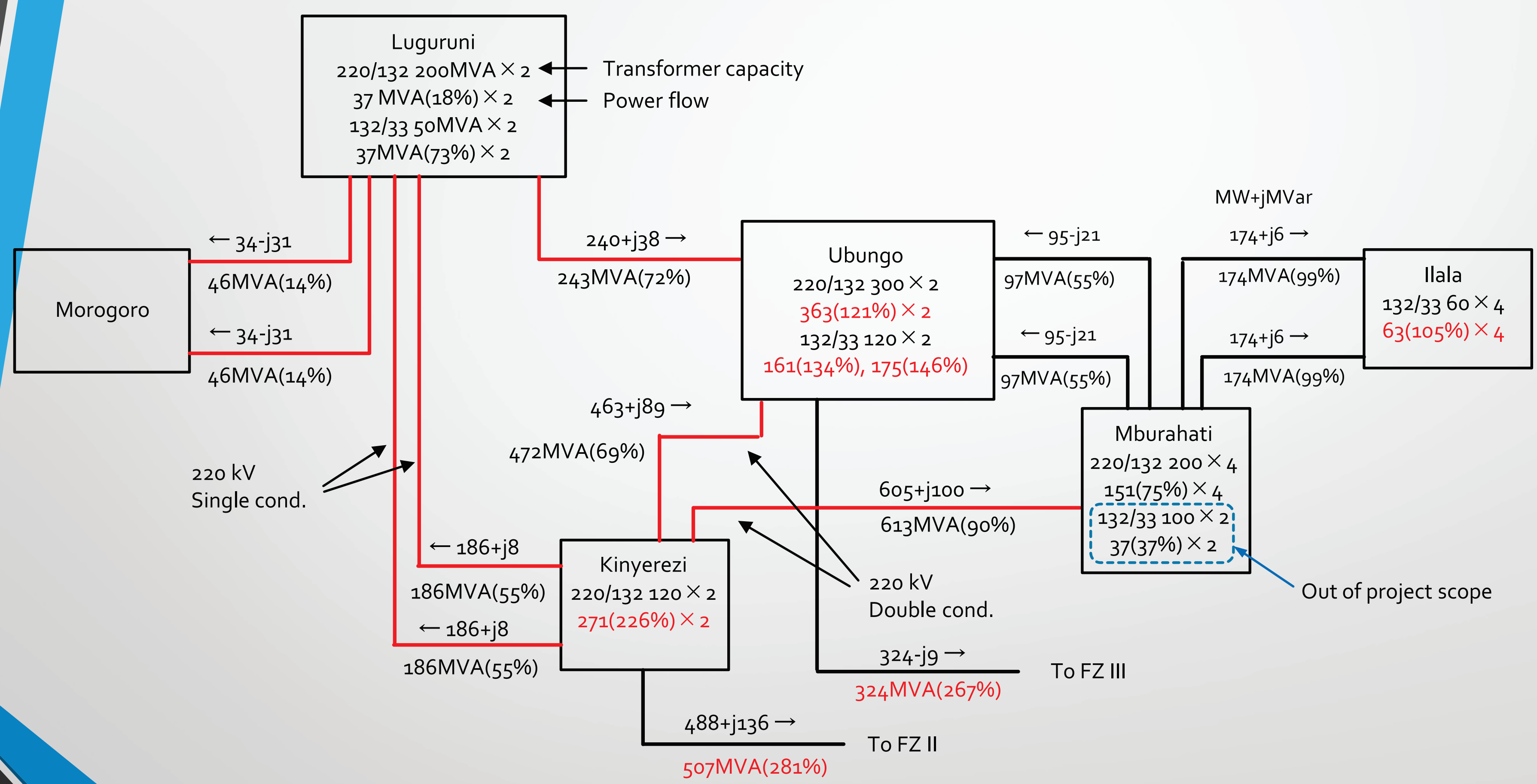

Luguruni
220/132 200MVA × 2
21 MVA(11%) × 2
132/33 50MVA × 2
21MVA(42%) × 2
Transformer capacity
Power flow
Morogoro
← 82-j24
85MVA(25%)
← 82-j24
85MVA(25%)
98+j32 →
103MVA(30%)
Ubungo
220/132 300, 150 × 2
219(73%), 119(79%) × 2
132/33 120 × 2
83(69%), 94(78%)
3+j9 →
10MVA(5%)
3+j9 →
10MVA(5%)
MW+jMVar
110+j17 →
112MVA(63%)
110+j17 →
112MVA(63%)
Ilala
132/33 60 × 4
38(64%) × 4
Mburahati
220/132 200 × 2
129(64%) × 2
132/33 100 × 2
21(21%) × 2
Out of project scope
257+j61 →
264MVA(38%)
220 kV
Single cond.
253+j55 →
259MVA(38%)
220 kV
Double cond.
← 150+j3
150MVA(43%)
← 150+j3
150MVA(43%)
Kinyerezi
220/132 120 × 2
170(141%) × 2
196-j31 →
199MVA(162%)
To FZ III
285+j145 →
320MVA(173%)
To FZ II



Luguruni
220/132 200MVA × 2
37 MVA(18%) × 2
132/33 50MVA × 2
37MVA(73%) × 2
Transformer capacity
Power flow
220 kV
Single cond.
Morogoro
← 23-j32
39MVA(12%)
← 23-j32
39MVA(12%)
284+j37 →
287MVA(85%)
288+j44 →
292MVA(86%)
Ubungo
220/132 300, 150 × 2
321(107%), 175(116%) × 2
132/33 120 × 2
162(135%), 171(143%)
← 162-j21
164MVA(93%)
← 162-j21
164MVA(93%)
MW+jMVar
174+j11 →
174MVA(98%)
174+j11 →
174MVA(98%)
Ilala
132/33 60 × 4
63(105%) × 4
220 kV
Double cond.
220 kV
Double cond.
370+j56 →
374MVA(55%)
370+j56 →
374MVA(55%)
Mburahati
220/132 200 × 4
185(93%) × 4
132/33 100 × 2
37(37%) × 2
Out of project scope
← 342+j36
343MVA(50%)
← 342+j36
343MVA(50%)
Kinyerezi
220/132 120 × 2
275(229%) × 2
325-j16 →
To FZ III
325MVA(268%)
487+j154 →
To FZ II
511MVA(281%)



Luguruni
220/132 200MVA×2
37 MVA(18%)×2
132/33 50MVA×2
37MVA(73%)×2
Transformer capacity
Power flow
Morogoro
← 32-j31
45MVA(13%)
← 32-j31
45MVA(13%)
293+j39 →
295MVA(87%)
Ubungo
220/132 300×2
363(121%)×2
132/33 120×2
161(134%), 175(146%)
← 135-j21
136MVA(77%)
← 135-j21
136MVA(77%)
MW+jMVar
174+j8 →
174MVA(98%)
174+j8 →
174MVA(98%)
Ilala
132/33 60×4
63(105%)×4
552+j100 →
561MVA(82%)
216+j14 →
216MVA(32%)
468+j81 →
475MVA(70%)
Mburahati
220/132 200×4
171(86%)×4
132/33 100×2
37(37%)×2
Out of project scope
220 kV
Single cond.
← 210+j10
211MVA(62%)
← 210+j10
211MVA(62%)
Kinyerezi
220/132 120×2
270(225%)×2
220 kV
Double cond.
326-j10 →
327MVA(270%)
To FZ III
485+j137 →
504MVA(279%)
To FZ II


Luguruni
220/132 200MVA × 2
37 MVA(18%) × 2
132/33 50MVA × 2
37MVA(73%) × 2
Transformer capacity
Power flow
Morogoro
← 34-j31
46MVA(14%)
← 34-j31
46MVA(14%)
220 kV
Single cond.
240+j38 →
243MVA(72%)
Ubungo
220/132 300 × 2
363(121%) × 2
132/33 120 × 2
161(134%), 175(146%)
← 95-j21
97MVA(55%)
← 95-j21
97MVA(55%)
MW+jMVar
174+j6 →
174MVA(99%)
174+j6 →
174MVA(99%)
Ilala
132/33 60 × 4
63(105%) × 4
463+j89 →
472MVA(69%)
Mburahati
220/132 200 × 4
151(75%) × 4
132/33 100 × 2
37(37%) × 2
605+j100 →
613MVA(90%)
Out of project scope
← 186+j8
186MVA(55%)
← 186+j8
186MVA(55%)
Kinyerezi
220/132 120 × 2
271(226%) × 2
220 kV
Double cond.
324-j9 →
324MVA(267%)
To FZ III
488+j136 →
507MVA(281%)
To FZ II

Preliminary rough cost estimation of alternative transmission configurations from Kinyerezi to Mburahati

	Alt-4	Alt-5	Alt-5′
Project Cost	Japanese side: 1. Construction of Mburahati substation (220/132kV,200 MVA Transformer × 2) 2. 220kV Kinyerezi (T-off point)-Ubungo TL-1cct and Kinyerezi (T-off point)-Mburahati TL-2cct which are hung on 3 cct towers. (Total: US$ 41 million) Tanzanian side: 220kV Kinyerezi-Luguruni Transmission line (2 cct and double conductor) shall be done by TANESCO by 2025. (US$ 18 million) Undertakings that shall be done by TANESCO are more than Alt-5 and 5′.	Japanese side: 1. Construction of Mburahati substation (220/132kV, 200 MVA Transformer × 2) 2. 220kV Kinyerezi(T-off point)-Ubungo TL-1cct, Ubungo – Mburahati TL-1cct and Kinyerezi(T-off point)-Mburahati TL line-1cct which are hung on 2 cct towers. 3. Reinforcement of one 220/132kV transformer (150→300MVA) at Ubungo substation (Total: US$ 49 million) Tanzanian side: 220kV Kinyerezi-Luguruni Transmission line (2 cct and single conductor) shall be done by TANESCO by 2025. (US$ 14 million)	Japanese side: 1. Construction of Mburahati substation (220/132kV, 200 MVA Transformer × 2) 2. 220kV Kinyerezi(T-off point)-Ubungo TL-1cct and Kinyerezi(T-off point)-Mburahati TL-1cct which are hung on 2 cct towers. (Total: US$ 38 million) Tanzanian side: 220kV Kinyerezi-Luguruni Transmission line (2 cct and single conductor) shall be done by TANESCO by 2025. (US$ 14 million)
Rating	A-	B	A

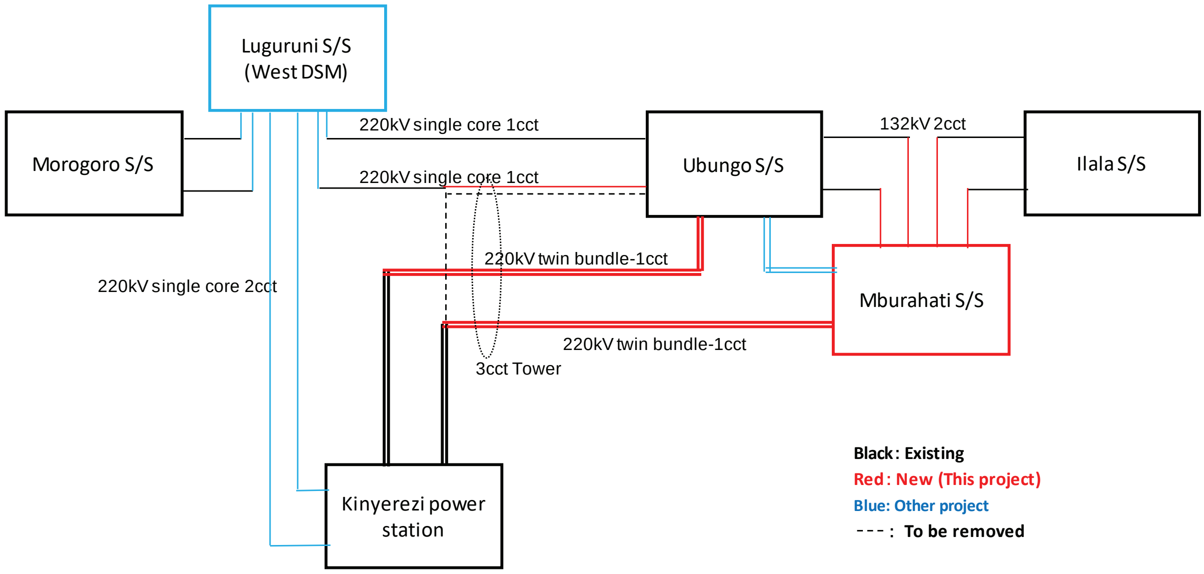
Evaluation of alternative transmission configurations from Kinyerezi to Mburahati

	Alt-4	Alt-5′
Project cost (Japanese side)	A- Higher than Alt-5′	A Lower than Alt-4
Undertaking by Tanzanian side	A- Slightly higher than Alt-5′	A Lower than Alt-4
Reliability	A Mburahati substation is connected to 2cct transmission lines	B Mburahati substation is connected to 1cct transmission line only, therefore N-1 redundancy cannot be secured.
Ease of O&M	A- Operation and maintenance of 3 cct transmission line requires higher skill and knowledge.	A Same as existing transmission lines
Overall	A-	A

Recommended configuration

- If reliability issue of Alternative-5' is acceptable to TANESCO or additional 220kV transmission line to Mburahati substation is secured by other resources, Alternative-5' is the most recommended option.
- If reliability issue of Alternative-5' is **not** acceptable to TANESCO, Alternative-4 is recommended. Still, further cost reduction measures need to be considered in order to avoid cost overrun. TANESCO might be requested to undertake land preparation for Mburahati substation site.
- In both alternatives, the following projects shall be undertaken by the Tanzanian side to enhance feasibility.
  - Luguruni substation is completed and connected to both Ubungo - Morogoro and Kinyerezi – Morogoro TLs before the Project commences.
  - 220 kV transmission line (2cct) from Kinyerezi to Luguruni is completed by 2025.
  - Additional 2 × 200 MVA transformers are procured and installed at Mburahati substation by 2030.

Configuration of Alternative-6



Attachement-1 Member List of the Study Team
1. Third Field Survey

Name	Assignment	Organization
Toru Kobayakawa	Team Leader	Japan International Corporation Agency
Kazuki Seki	Planning Management	Japan International Corporation Agency
Kyoji Fujii	Chief Consultant / Transmission and Substation Planning	Yachiyo Engineering Co., Ltd.
Mitsuharu Nakagawa	Deputy Chief Consultant / Transmission Facilities	Yachiyo Engineering Co., Ltd.
Kenji Sakemura	Substation Facilities	West Japan Engineering Consultants, Inc.
Keiichiro Ohashi	Protection, Control & Monitoring Facilities 1	West Japan Engineering Consultants, Inc.
Taro Nakamura	Protection, Control & Monitoring Facilities 2	West Japan Engineering Consultants, Inc.
Hisayuki Yamamoto	Civil Engineering / Natural Condition	Yachiyo Engineering Co., Ltd.
Kosei Ito	Civil Engineering Planning / Cost Estimation	Yachiyo Engineering Co., Ltd.
Kazuo Iiyama	Environmental and Social Considerations	Yachiyo Engineering Co., Ltd.
Kyohei Kurohane	Procurement Planning / Cost Estimation	Yachiyo Engineering Co., Ltd.
Mikiko Iwago	Coordinator	Yachiyo Engineering Co., Ltd.

2. Forth Field Survey

Name	Assignment	Organization
Kyoji Fujii	Chief Consultant / Transmission and Substation Planning	Yachiyo Engineering Co., Ltd.
Mitsuharu Nakagawa	Deputy Chief Consultant / Transmission Facilities	Yachiyo Engineering Co., Ltd.
Kenji Sakemura	Substation Facilities	West Japan Engineering Consultants, Inc.
Keiichiro Ohashi	Protection, Control & Monitoring Facilities 1	West Japan Engineering Consultants, Inc.
Taro Nakamura	Protection, Control & Monitoring Facilities 2	West Japan Engineering Consultants, Inc.
Mikiko Iwago	Coordinator	Yachiyo Engineering Co., Ltd.

Work Demarcation

Undertakings to be covered by Japan and Tanzania

No.	Work Items	Japan Side		Tanzania Side		Deadline
		Procurement	Installation	Procurement	Installation	
1.	Mabibo Substation					
1.1	Before notice of tender					
(1)	Land acquisition, cutting trees and clearance of obstacles			●	●	Including Pan-African gas piping
(2)	Access road to the project sites			●	●	
(3)	Temporary storage yard for equipment and materials			●	●	
1.2	During the Project Implementation					
(1)	Cutting trees and clearance of obstacles (if necessary)			●	●	
(2)	Access road to the project sites (if necessary)			●	●	
(3)	Site leveling (Land development)	●	●			
(4)	Gate and fence (temporary)	●	●			
(5)	Road and parking lot in the site	●	●			
(6)	Building work of the substation (including control room, support structure, steel gantry, foundations and other related work for building)	●	●			
(7)	220 kV switchgear	●	●			
(8)	220/132 kV transformers	●	●			
(9)	Auxiliary transformers	●	●			
(10)	132 kV switchgear	●	●			
(11)	33 kV power supply to Mabibo substation site			●	●	- For substation use - Including 33 kV poles, cables, arresters, etc.
(12)	Control and protection equipment	●	●			
(13)	110 V DC battery and charger	●	●			
(14)	48 V DC battery and charger	●	●			
(15)	Uninterruptible Power Supply (UPS)	●	●			
(16)	Communication equipment inside substation	●	●			
(17)	Power cables (XLPE)	●	●			
(18)	Control cables	●	●			

No.	Work Items	Japan Side		Tanzania Side		Deadline
		Procurement	Installation	Procurement	Installation	
(19)	Grounding works	●	●			
(20)	TANESCO's standard Wh-meter		●	●		
(21)	Protection Relay setting confirmation and change of the substations where the transmission lines from Mabibo substation to be interconnected (Kinyerezi, Ubungo and Ilala substations) *: If replacement of protection relays is necessary, Japanese side will procure new relays for existing substations and installation shall be undertaken by the Tanzanian side, under the supervision of Japanese side.	(●)*	(●)*	(●)*	●	
(22)	Modification of SCADA System of GCC and Network Management system for accommodation of Mabibo substation			●	●	
(23)	Spare parts	●				
(24)	Maintenance tools	●				
(25)	Technical training for equipment		●			
1.3	After the Project					
(1)	Gate and fence (Permanent)	●	●			
2	220 kV Transmission line					
2.1	Before notice of tender					
(1)	Land acquisition, cutting trees and clearance of obstacles			●	●	Including removal of gas pipe line, water pipe line, optical cable, distribution line etc.
(2)	Access road to the project sites			●	●	
(3)	Temporary storage yard for equipment and materials			●	●	
(4)	To complete Luguruni substation with additional 220 kV bays for 220 kV Kinyerezi – Luguruni line			●	●	
(5)	To shift the 220 kV Kinyerezi – Morogoro line to a temporary tower nearby T-off point (including installation work of the temporary			●	●	Including foundation etc.

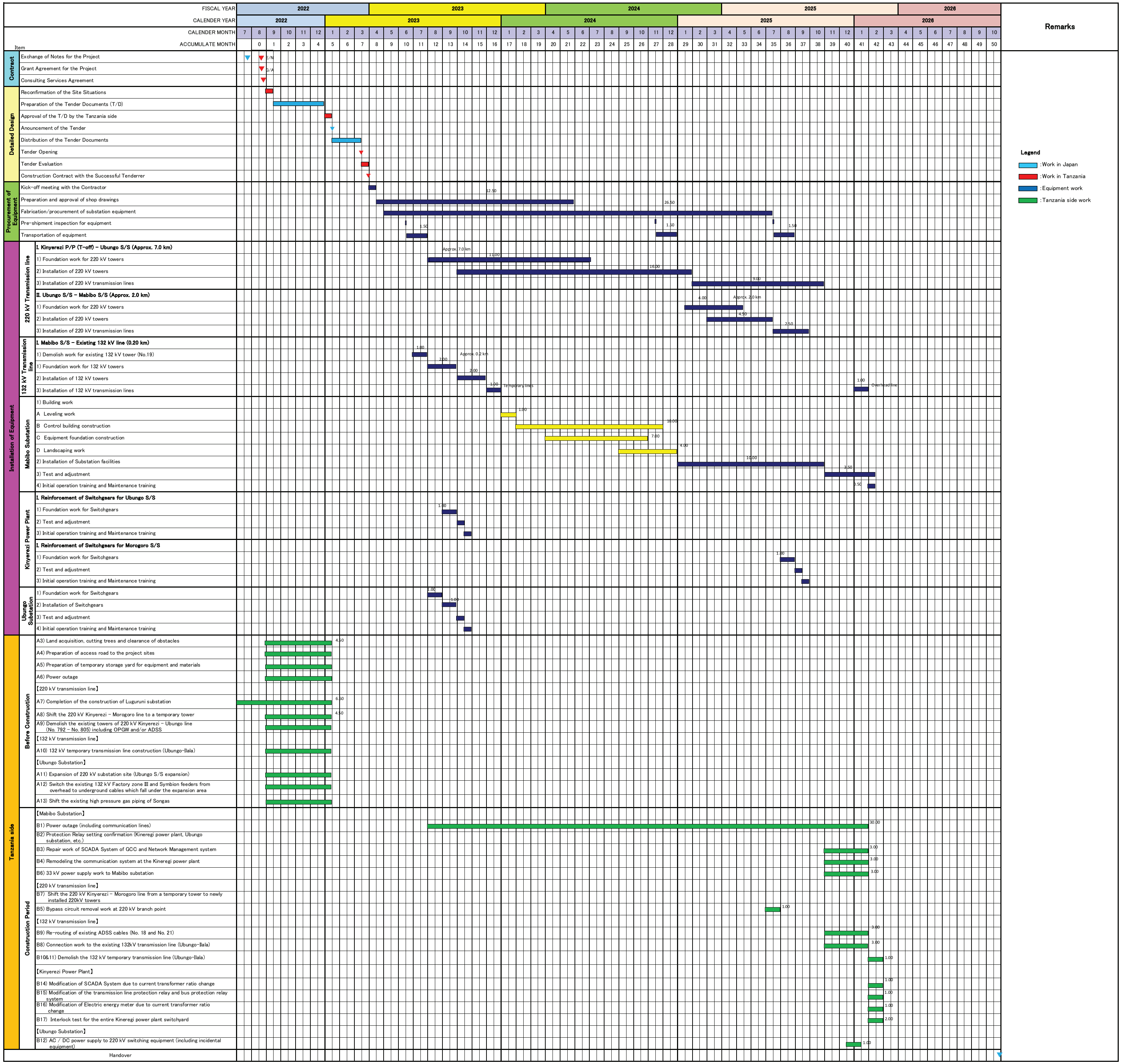
No.	Work Items	Japan Side		Tanzania Side		Deadline
		Procurement	Installation	Procurement	Installation	
	tower) including OPGW and/or ADSS					
(6)	To demolish the existing towers of 220 kV Kinyerezi – Ubungo line (No. 792 - No. 805) including OPGW and/or ADSS			●	●	Including foundation etc.
(7)	Power outage				●	
(8)	Connecting work of 220 kV transmission line (T15) to existing Ubungo substation	●	●	●	●	Including materials, etc. between Ubungo substation and T15
(9)	Connecting work of 220 kV transmission line (T22) to Mabibo substation	● (1 line)	● (1 line)	● (1 line)	● (1 line)	Including materials, etc. between Mabibo substation and T22
2.2	During the Project Implementation					
(1)	Cutting trees and clearance of obstacles (if necessary)			●	●	
(2)	Access road to the project sites (if necessary)			●	●	
(3)	Site leveling (Land development)	●	●			
(4)	Gate and fence (temporary)	●	●			
(5)	Steel towers and foundations	●	●			
(6)	Overhead conductor	●	●			
(7)	Overhead grounding wire (including OPGW)	●	●			
(8)	Connection box for OPGW	●	●			
(9)	Power outage				●	
(10)	Removal work of the existing conductor, grounding wire, accessories, steel tower and foundation etc. (if necessary)				●	
(11)	To shift the 220 kV Kinyerezi – Morogoro line from a temporary tower to newly installed towers			●	●	
2.3	After the Project					
(1)	Fence for a dead end tower (permanent)	●	●			
3.	132 kV Transmission line					
3.1	Before notice of tender					
(1)	Land acquisition, cutting trees and clearance of			●	●	Including removal

No.	Work Items	Japan Side		Tanzania Side		Deadline
		Procurement	Installation	Procurement	Installation	
	obstacles					of gas pipe line, water pipe line, optical cable, distribution line etc.
(2)	Access road to the project sites			●	●	
(3)	Temporary storage yard for equipment and materials			●	●	
(4)	To build modular, temporary bypass single circuit 132kV towers near T19 and T20 and string single circuit from T21 to T18 for Ubungo – Ilala 132kV lines to allow the construction of dead end towers and stringing conductors by the Japanese side.			●	●	
(5)	Power Outage				●	
3.2	During the Project Implementation					
(1)	Cutting trees and clearance of obstacles (if necessary)			●	●	
(2)	Access road to the project sites (if necessary)			●	●	
(3)	Site leveling (Land development)	●	●			
(4)	Gate and fence (temporary)	●	●			
(5)	Steel towers and foundations (NT19 and NT20)	●	●			
(6)	Overhead conductor	●	●			
(7)	Underground cable (temporary)	●	●			
(8)	ADSS cable (temporary)			●	●	
(9)	Overhead grounding wire	●	●			
(10)	Power outage				●	
(11)	Removal work of the existing conductor, grounding wire, accessories, steel tower and foundation etc. (if necessary)				●	
(12)	Replacement, connection or reconnection of the existing lines (towers, etc.)			●	●	
~~(13)~~	~~To demolish the existing 132 kV conductor between No. 20 and No. 19~~				~~●~~	
(13)	To demolish the existing towers (No. 19) on 132 kV Ubungo – Ilala line	●	●			Including foundation etc.

No.	Work Items	Japan Side		Tanzania Side		Deadline
		Procurement	Installation	Procurement	Installation	
(14)	Connection of lines from new dead-end tower (No. NT19/ NT20) to the towers (No. 18/No. 20) on 132 kV Ubungo – Ilala line	●			●	
(15)	To demolish modular, temporary bypass single circuit 132 kV towers near NT 19 and NT 20			●	●	
(16)	Technical training for equipment		●			
3.3	After the Project					
(1)	Fence for dead end towers (permanent) (if necessary)	●	●			
4.	Ubungo Substation (one bay expansion)					
4.1	Before notice of tender					
(1)	Expansion of 220 kV substation site			●	●	
(2)	To switch the existing 132 kV Factory zone III and Symbion feeders from overhead to underground cables which fall under the expansion area			●	●	
(3)	To divert the existing high pressure gas piping of Songas from the expansion area in order to secure the safety of construction work for 220 kV switchgear expansion			●	●	**Pending**
4.2	During the Project Implementation					
(1)	220 kV switchgear	●	●			
(2)	Equipment test of 220 kV switchgear		●			
(3)	Control and protection equipment	●	●			
(4)	Communication equipment inside substation	●	●			
(5)	Modification of micro SCADA system in Ubungo substation				●	
(6)	Low voltage power and control cables	●	●			
(7)	Grounding works	●	●			
(8)	TANESCO's standard Wh-meter		●	●		
(9)	Protection Relay setting confirmation and change of the substations where the transmission lines from Ubungo substation to be interconnected (Kinyerezi power plant)	(●)*	(●)*	(●)*	●	

No.	Work Items	Japan Side		Tanzania Side		Deadline
		Procurement	Installation	Procurement	Installation	
	*: If replacement of protection relays is necessary, Japanese side will procure new relays for existing substations and installation shall be undertaken by the Tanzanian side, under the supervision of Japanese side.					
(10)	Modification of SCADA System of GCC and Network Management system for accommodation of Ubungo additional bay			●	●	
(11)	AC/DC power supply for 220 kV switchgear and new associated panels			●	●	
5.	Substation in Kinyerezi power plant (replacement of 220 kV switchgear equipment for 2 x transmission line feeders)					
(1)	220 kV switchgear	●	●			
(2)	Equipment test of 220 kV switchgear		●			
(3)	Adjustment of SCADA system in the power plant (CT ratio needs to be changed)			●	●	
(4)	Adjustment of transmission line relay settings and busbar protection *: If replacement of protection relays is necessary, Japanese side will procure new relays for Kinyerezi power station and installation shall be undertaken by the Tanzanian side, under the supervision of Japanese side.	(●)*	(●)*	●	●	
(5)	Adjustment of Watt-hour meters (CT ratio needs to be changed)			●	●	
(6)	Interlock test of whole substation			●	●	
6.	Other					
(1)	To bear the cost of fiscal levies such as overload surcharge for transporting heavy equipment, registration fees for Engineers Registration Board (ERB), and Contractors Registration Board (CRB)			●	●	

Tentative Implementation Schedule of the Project

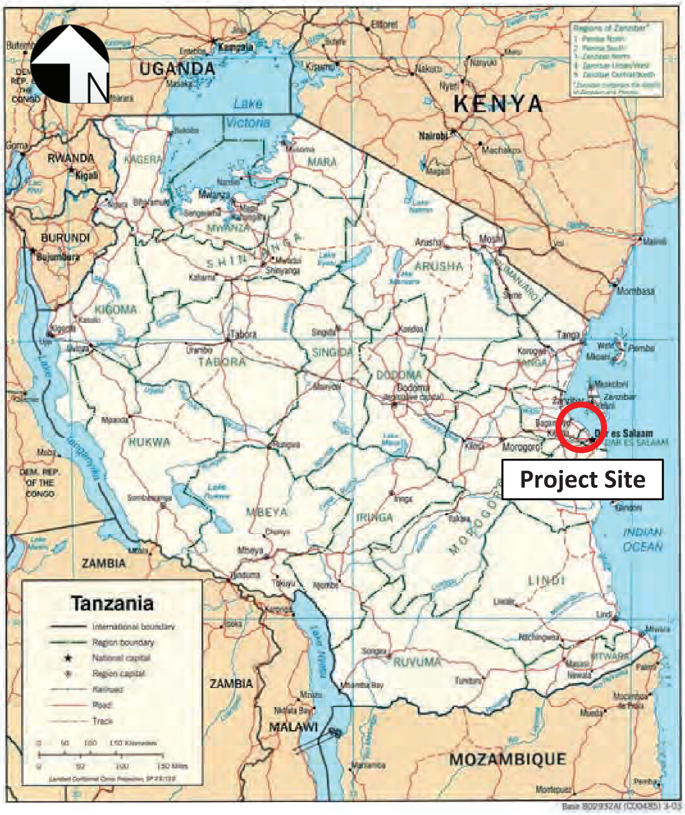


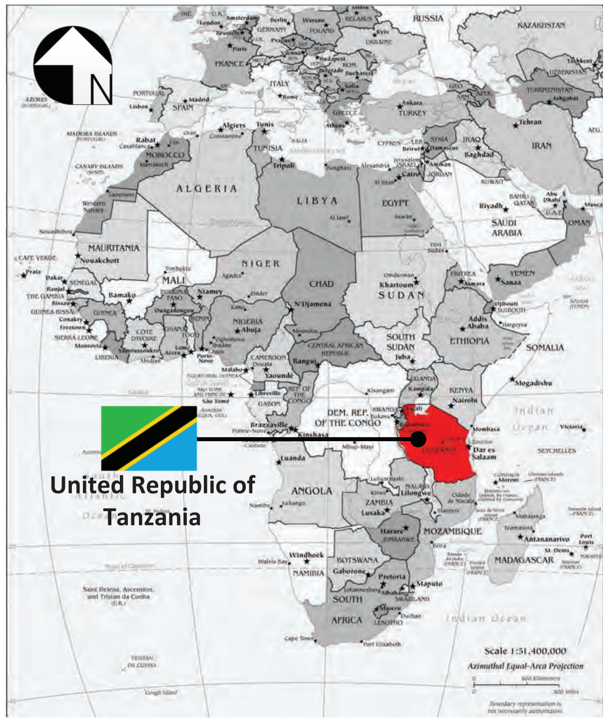
Drawing List

DWG No.	Title	Page No.
GS-01	Project Site	A4-1
GS-02	Newly operated ROW	A4-2
SS-01	Single Line Diagram (Mabibo S/S)	A4-3
SS-02	Overall layout Plan (Mabibo S/S)	A4-4
SS-03	Layout Plan of Control Building	A4-5
SS-04	System Configuration diagram	A4-6
SS-05	Single Line Diagram (Kinyerezi GPP)	A4-7
SS-06	Layout Plan (Kinyerezi GPP)	A4-8
SS-07	Single Line Diagram (UBUNGO 220kV S/S)	A4-9
SS-08	Layout Plan (Ubungo)	A4-10
SS-09	System Configuration diagram (Ubungo S/S)	A4-11
SS-10	Layout Plan of Control Building (Ubungo)	A4-12
SS-11	Section Drawing for New Kinyerezi Line (Ubungo Substation)	A4-12-1
SS-12	Communication Network around Mabibo Substation	A4-12-2
A-01	Ground Floor Plan (Preliminary)	A4-13
A-02	Elevation (Preliminary)	A4-14
TL-01	Tentative 220 kV Transmission Line Route Map	A4-15
TL-02	Work Demarcation for Installation of 220 kV T-off tension tower (Draft)	A4-24
TL-03	Work Demarcation for Installation of 220 kV dead end tower nearby Ubungo substation (Draft)	A4-30
TL-04	Tentative New Mabibo Substation Work Procedure (132kV Transmission Line)(F-GIS)	A4-31
TL-KU-1	220 kV Transmission Line 3 ccts Steel Tower Type A Leg. 15m	A4-39
TL-KU-2	220 kV Transmission Line 3 ccts Steel Tower Type A Leg. 25m, Leg. 30m	A4-40
TL-KU-3	220 kV Transmission Line 3 ccts Steel Tower Type A Leg. 35m	A4-41
TL-KU-4	220 kV Transmission Line 3 ccts Steel Tower Type B Leg. 15m, Leg. 20m	A4-42
TL-KU-5	220 kV Transmission Line 3 ccts Steel Tower Type B Leg. 25m, Leg. 30m	A4-43
TL-KU-6	220 kV Transmission Line 3 ccts Steel Tower Type C Leg. 20m, Leg. 25m	A4-44
TL-KU-7	220 kV Transmission Line 3 ccts Steel Tower Type C Leg. 30m, Leg. 35m	A4-45
TL-KU-8	220 kV Transmission Line 3 ccts Steel Tower Type D-1 No.1 Tower	A4-46
TL-KU-9	220 kV Transmission Line 3 ccts Steel Tower Type D-2 No.15 Tower	A4-47
TL-KU-10	220 kV Transmission Line 2 ccts Steel Tower Type A Leg. 25m, Leg. 30m	A4-48
TL-KU-11	220 kV Transmission Line 2 ccts Steel Tower Type C Leg. 20m	A4-49

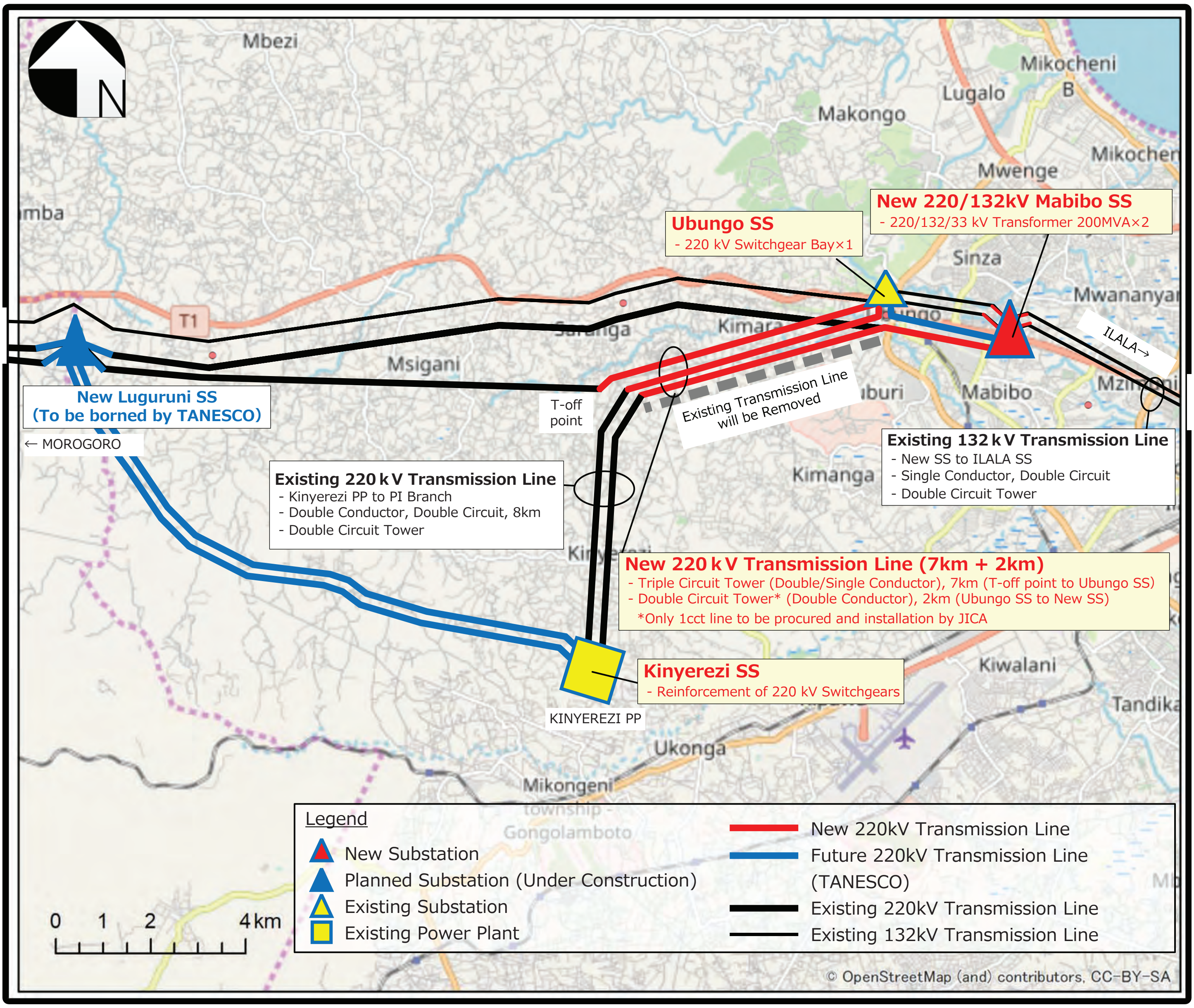
TL-KU-12	220 kV Transmission Line 2 ccts Steel Tower Type C Leg. 45m (No.16 Tower)	A4-50
TL-KU-13	220 kV Transmission Line 2 ccts Steel Tower Type D Leg. 25m	A4-51
TL-KU-14	132 kV Transmission Line 2 ccts Steel Tower Type D Leg. 24m	A4-52
TL-LP-01	Tentative 220 kV Transmission Line Line Profile	A4-53
TL-UI-01	Existing 132 kV Tower (No. 19 and No. 20) between Ubungo and Ilala substation	A4-55

GS-01 Project Site





■Africa

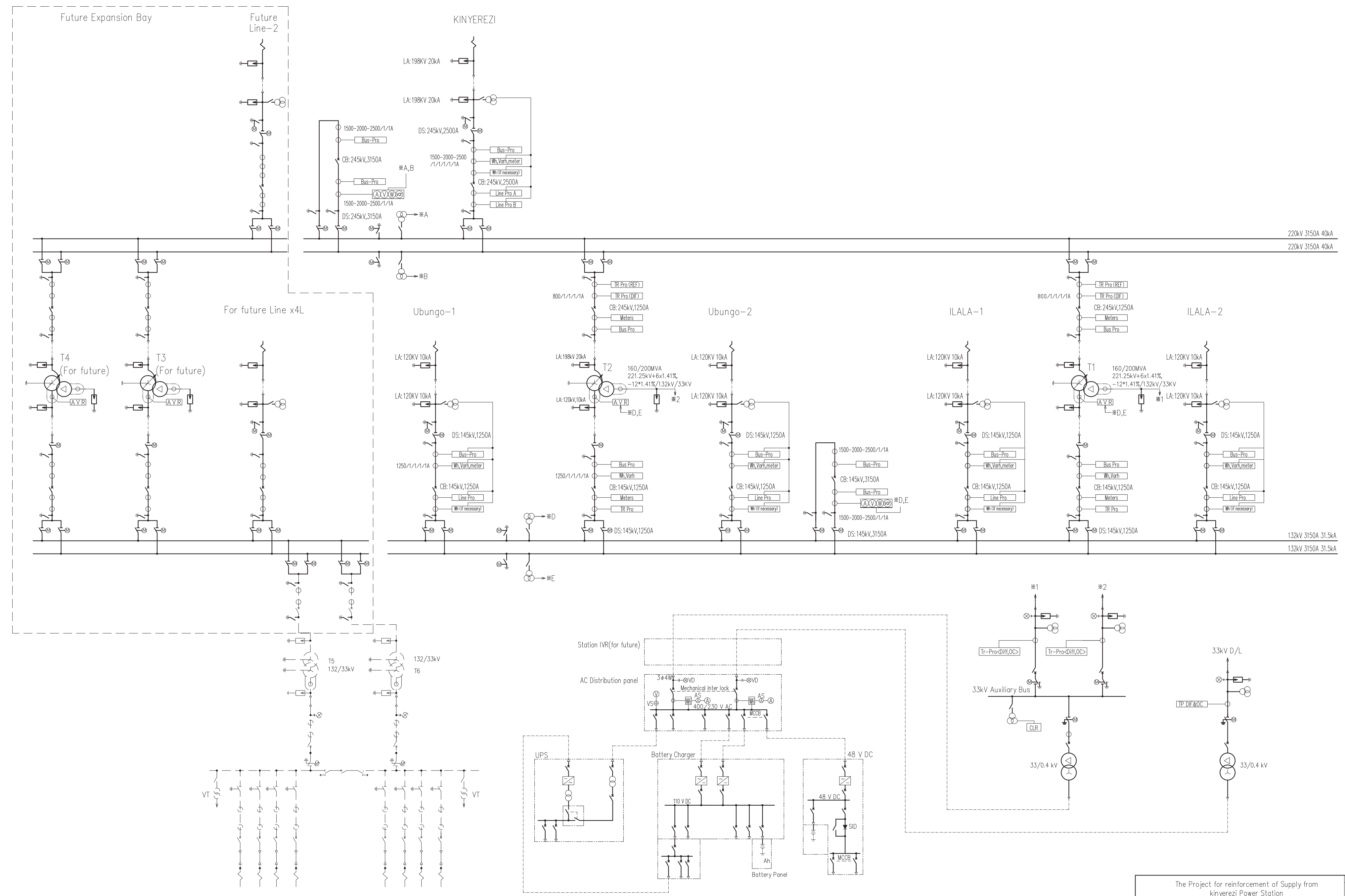


Project Site

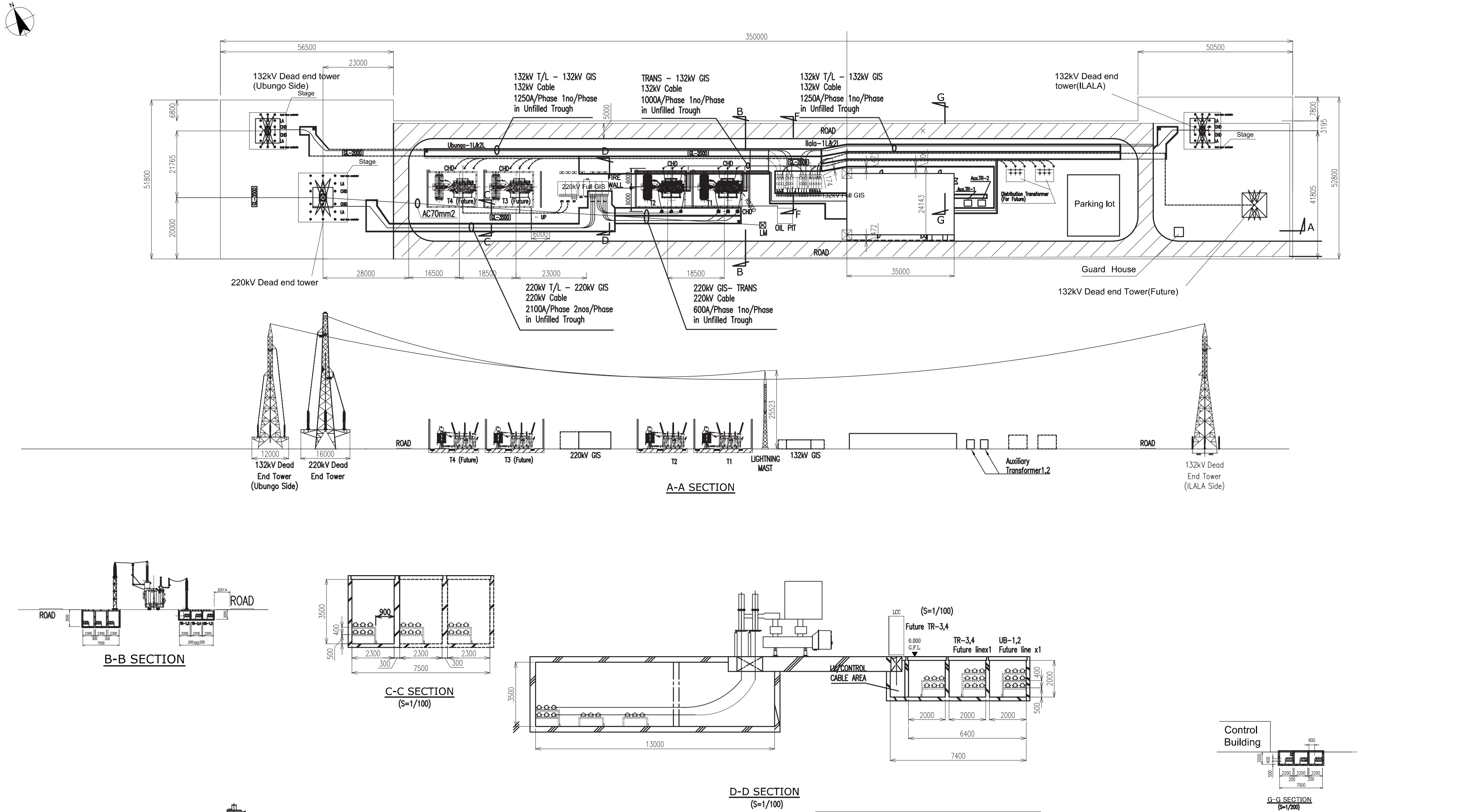
GS-02 Newly operated ROW

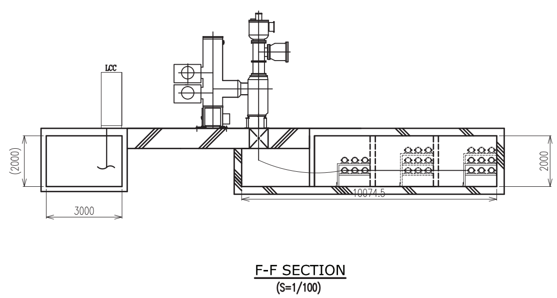
New 220 kV tower to be replaced from Existing tower

The center of 220 kV transmission line



		SCALE
The Project for reinforcement of Supply from kinyerezi Power Station		NON
Title: Single Line Diagram (Mabibo S/S)		DWG.No. SS-01
DATE: August.2021	DESIGNED: T.Nakamura / CHECKED: K.Sakemura / APPROVED: K.OHASHI	REVISION: 2
West Japan Engineering Consultants,INC.		



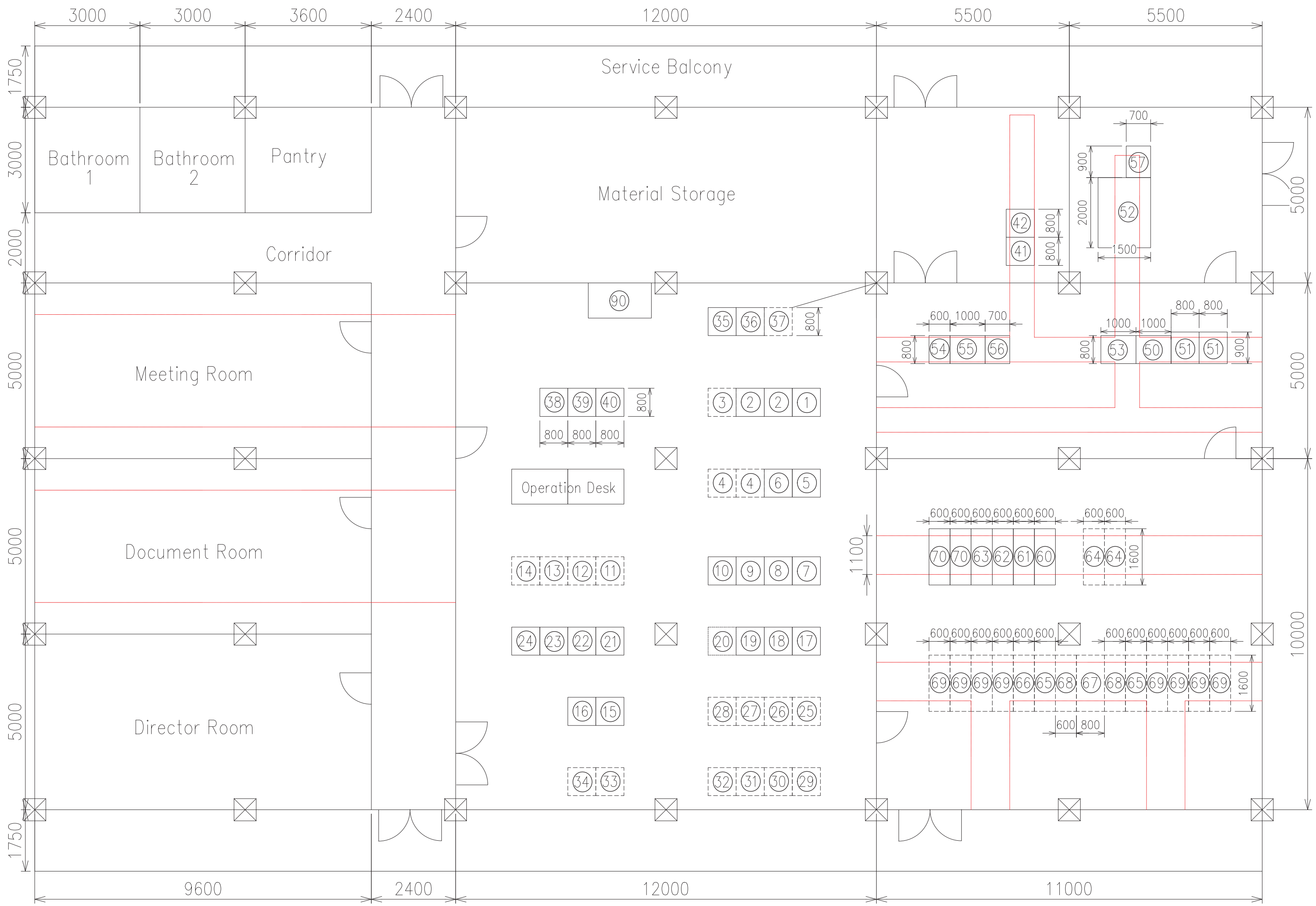


ELECTRICAL DESIGN CRITERIA			
NOMINAL SYSTEM VOLTAGE (PHASE TO PHASE)	kV(rms)	220	132
RATED VOLTAGE	kV(rms)	245	145
RATED SHORT-DURATION POWER-FREQUENCY WITHSTAND VOLTAGE	kV	460	275
LIGHTNING IMPULSE WITHSTAND VOLTAGE (1.2/50 MICRO SECOND)	kVp	1050	650
MINIMUM CLEARANCE BETWEEN LIVE METAL AND EARTHED OBJECT (IEC 61936-1)	mm	2100	1300
MINIMUM CLEARANCE BETWEEN LIVE METAL PHASE TO PHASE (IEC 61936-1)	mm	2100	1300
MINIMUM CREEPAGE DISTANCE CRITERIA	mm/kV	25	25
PHASE SEQUENCE	R-Y-B = A-B-C = U-V-W		

NOTE
- DRAWING WILL BE REVISED BASED ON ENGINEERING PROGRESS.

Preliminary

The project for reinforcement of suuply from Kinyerezi Power Station Power				SCALE 1/600, 1/200, 1/100
Title: GENERAL LAYOUT OF 220/132kV MABIBO SUBSTATION				DWG.No. SS-02
DATE	DESIGNED	CHECKED	APPROVED	REVISION
August.2021	T.NAKAMURA	K.SAKEMURA	K.OHASHI	3
West Japan Engineering Consultans,INC				



Control Room

No.	Panel	Note
1	Kinyerezi-1L Control Panel	
2	Kinyerezi-1L Protection Panel	
3	Future Kinyerezi-2L Control Panel	By TANESCO
4	Future Kinyerezi-2L Protection Panel	By TANESCO
5	220kV Bus Coupler Control Panel	
6	220kV Bus protection Panel	
7	T-1 Control Panel	
8	T-1 Protectionl Panel	
9	T-2 Control Panel	
10	T-2 Protectionl Panel	
11	Future T-3 Control Panel	By TANESCO
12	Future T-3 Protectionl Panel	By TANESCO
13	Future T-4 Control Panel	By TANESCO
14	Future T-4 Protectionl Panel	By TANESCO
15	132kV Bus Coupler Control Panel	
16	132kV Bus Protection Panel	
17	ILALA - 1L Control Panel	
18	ILALA - 1L Protectionl Panel	
19	ILALA - 2L Control Panel	
20	ILALA - 2L Protectionl Panel	
21	Ubungo - 1L Control Panel	
22	Ubungo - 1L Protectionl Panel	
23	Ubungo - 2L Control Panel	
24	Ubungo - 2L Protectionl Panel	
25	Future - 1L Control Panel	By TANESCO
26	Future - 1L Protectionl Panel	By TANESCO
27	Future - 2L Control Panel	By TANESCO
28	Future - 2L Protectionl Panel	By TANESCO
29	Future - 3L Control Panel	By TANESCO
30	Future - 3L Protectionl Panel	By TANESCO
31	Future - 4L Control Panel	By TANESCO
32	Future - 4L Protectionl Panel	By TANESCO
33	Future T-5 Control & Protection Panel	By TANESCO
34	Future T-6 Control & Protection Panel	By TANESCO
35	220kV Metering Panel	
36	132kV Metering Panel	
37	Future 33kV Metering Panel	By TANESCO
38	Substation Control Panel-1	
39	Substation Control Panel-2	
40	Substation Control Panel-3	
90	Lighting Panel	

Telecommunication Room

No.	Panel	Note
41	Communication Panel-1	
42	Communication Panel-2	

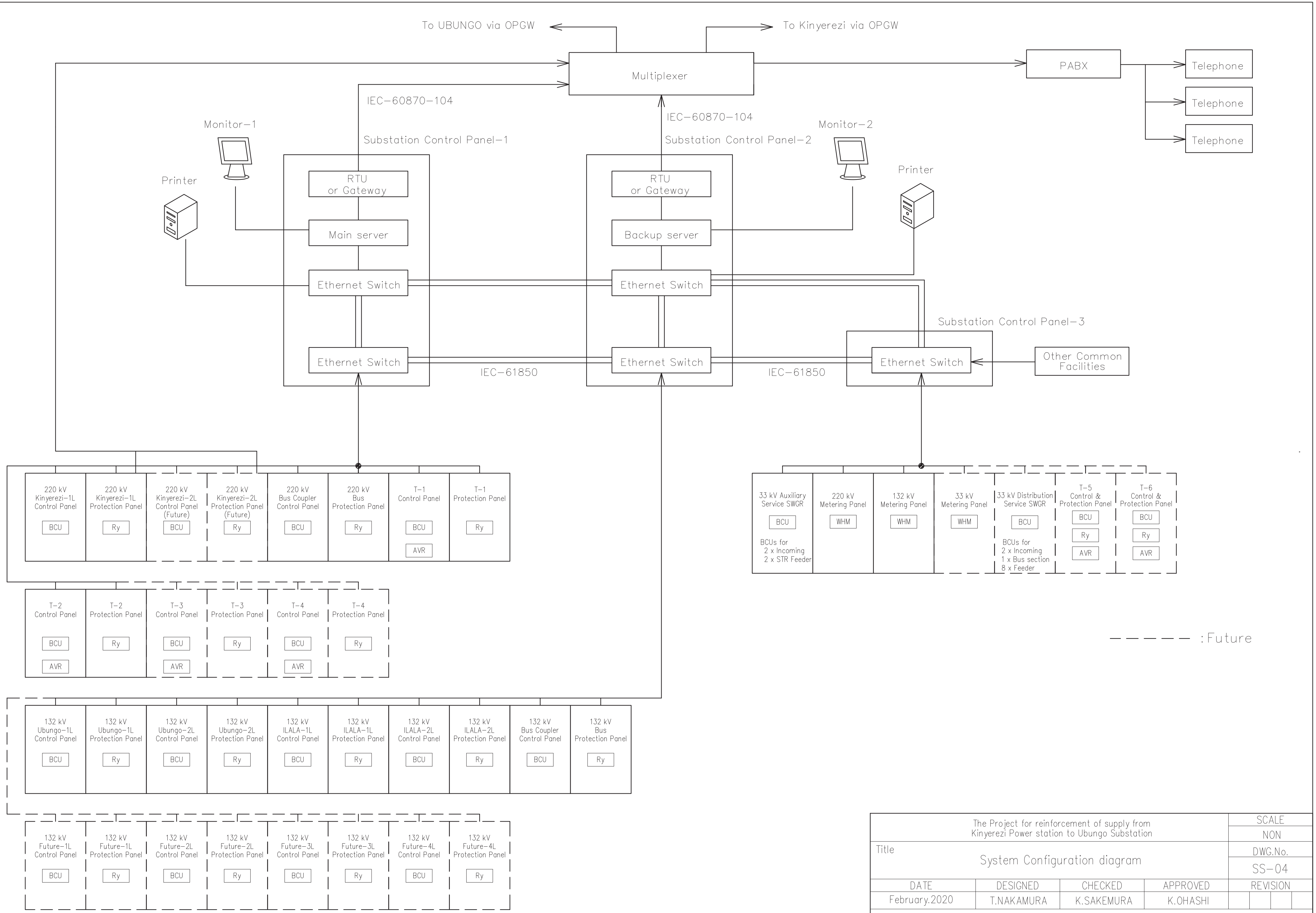
Battery Room

No.	Panel	Note
50	AC Distibution Panel	
51	110V DC Charger Panel	
52	110V DC Battery	
53	DC Distibution Panel	
54	UPS Battery Charger	
55	UPS Inverter	
56	48V DC Charger Panel	
57	48V DC Battery Panel	

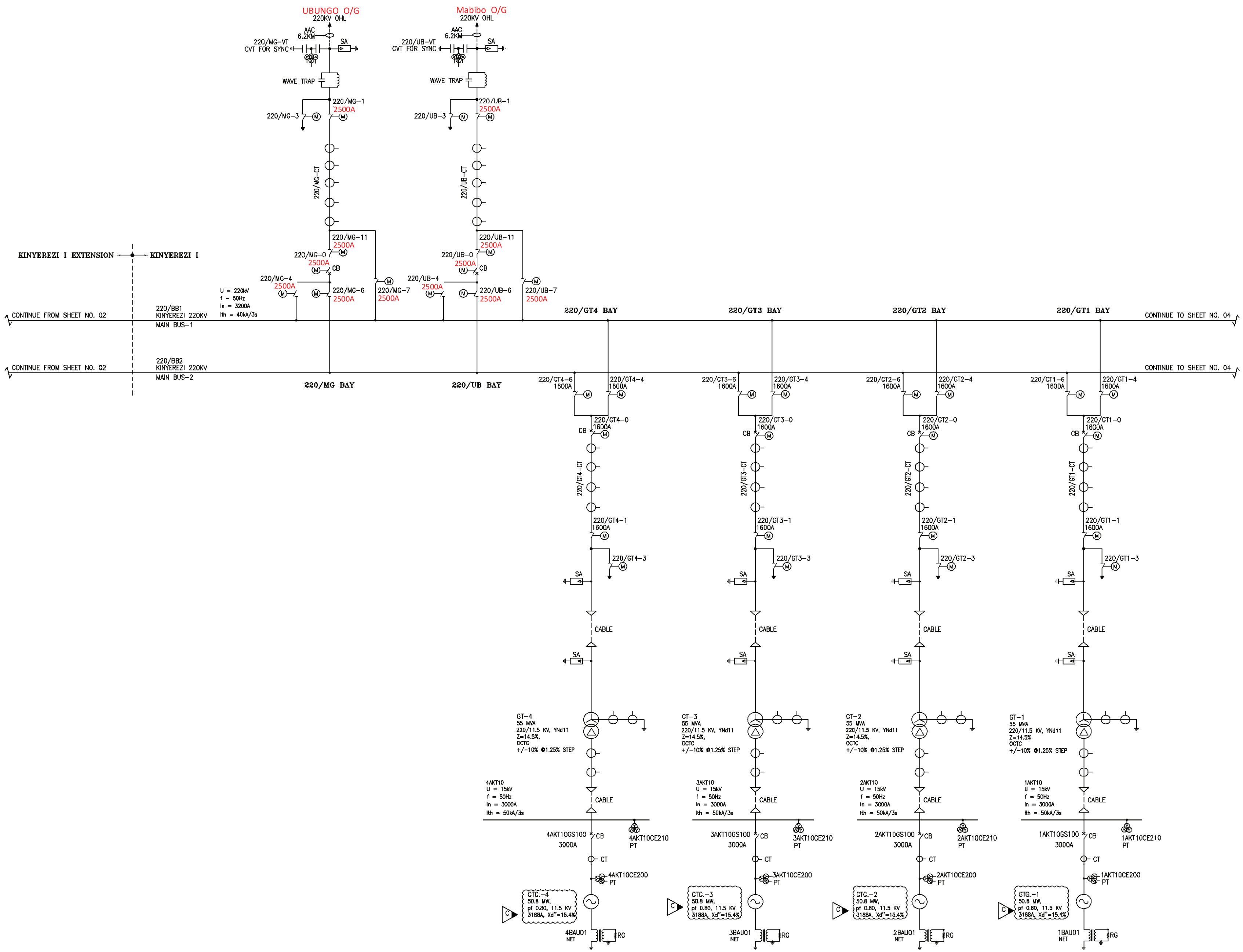
Switchgear Room

No.	Panel	Note
60	Auxiliary switchgear Incoming feeder Panel -1	
61	Auxiliary switchgear Incoming feeder Panel -2	
62	Auxiliary switchgear VT Panel	
63	Auxiliary switchgear Outgoing feeder	
64	Reactor feeder	By TANESCO
65	33kV Main Incoming feeder Panel-1	By TANESCO
66	33kV Main Incoming feeder Panel-2	By TANESCO
67	33kV Main Bus section panel	By TANESCO
68	33kV VT Panel	By TANESCO
69	33kV Feeder Panel x8	By TANESCO
70	Back UP Ayxiliary Switchgear	

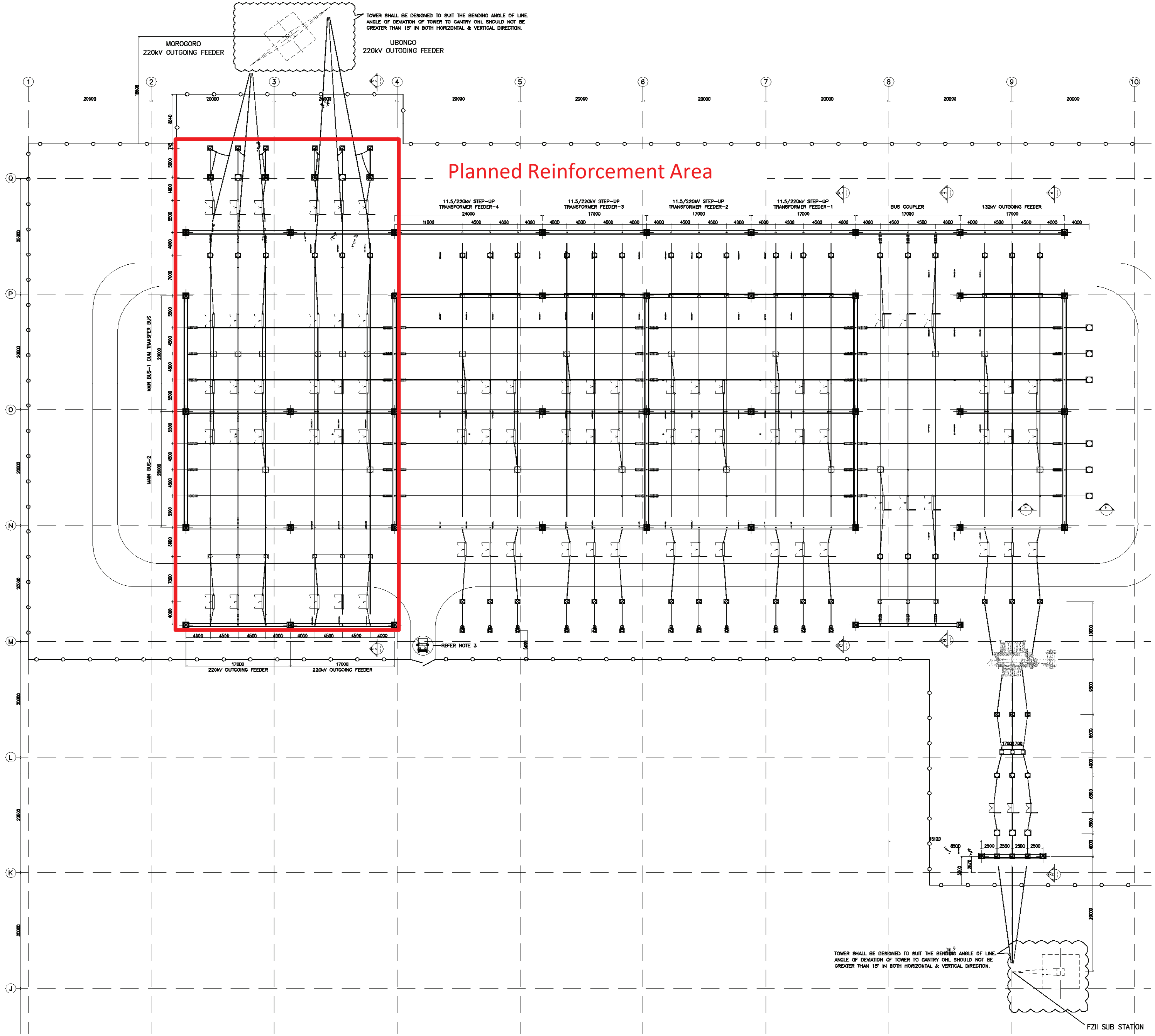
project for reinforcement of supply from Kinyerezi Power Station				SCALE: NON
Title: Layout Plan of Control Building				DWG.No.: SS-03
DATE	DESIGNED	CHECKED	APPROVED	REVISION
August.2021	T.NAKAMURA	K.SAKEMURA	K.OHASHI	1
West Japan Engineering Consultans,INC				



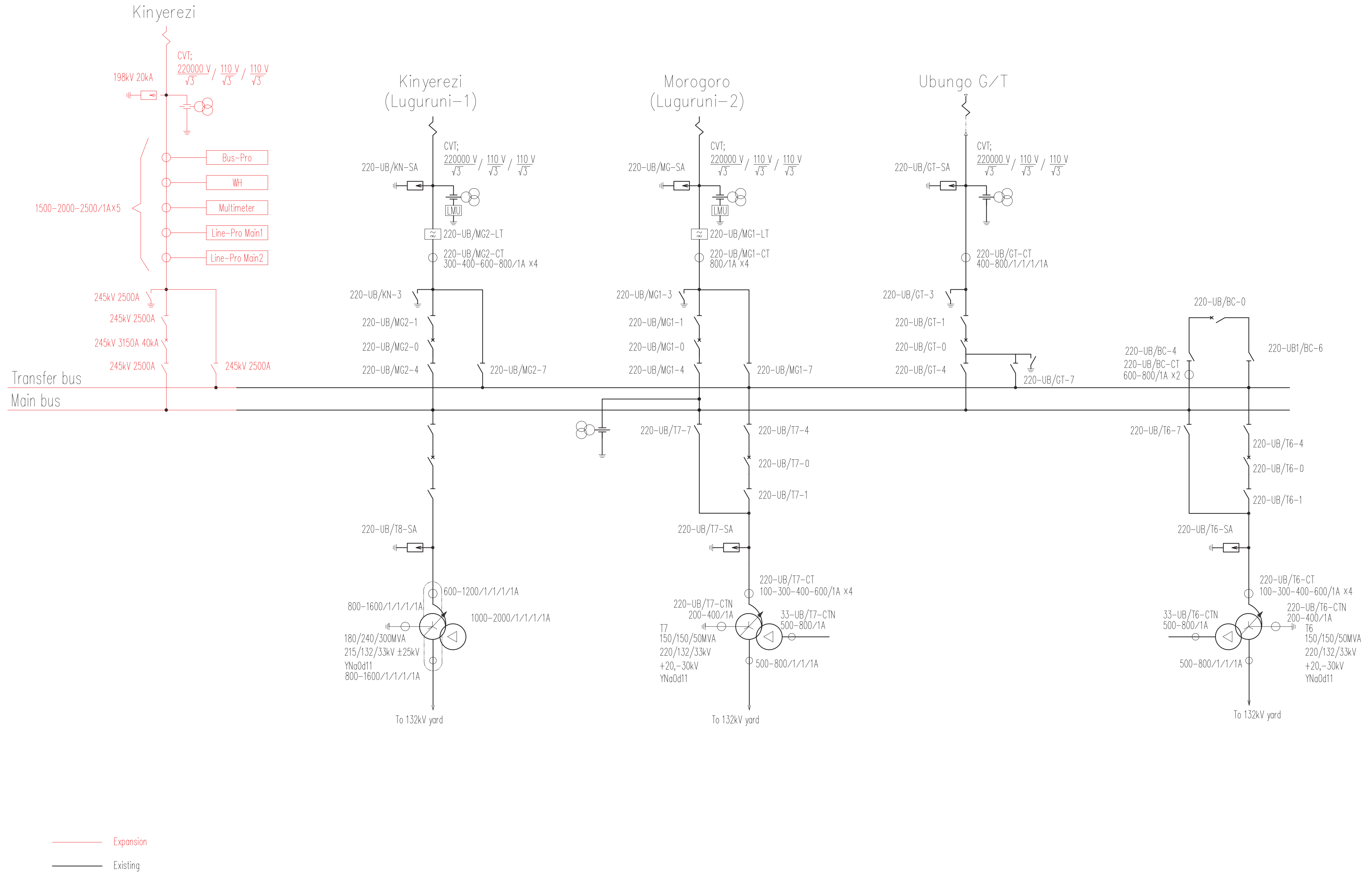
The Project for reinforcement of supply from Kinyerezi Power station to Ubungo Substation				SCALE
				NON
Title	System Configuration diagram			DWG.No.
				SS-04
DATE	DESIGNED	CHECKED	APPROVED	REVISION
February.2020	T.NAKAMURA	K.SAKEMURA	K.OHASHI	
West Japan Engineering Consultans,INC				



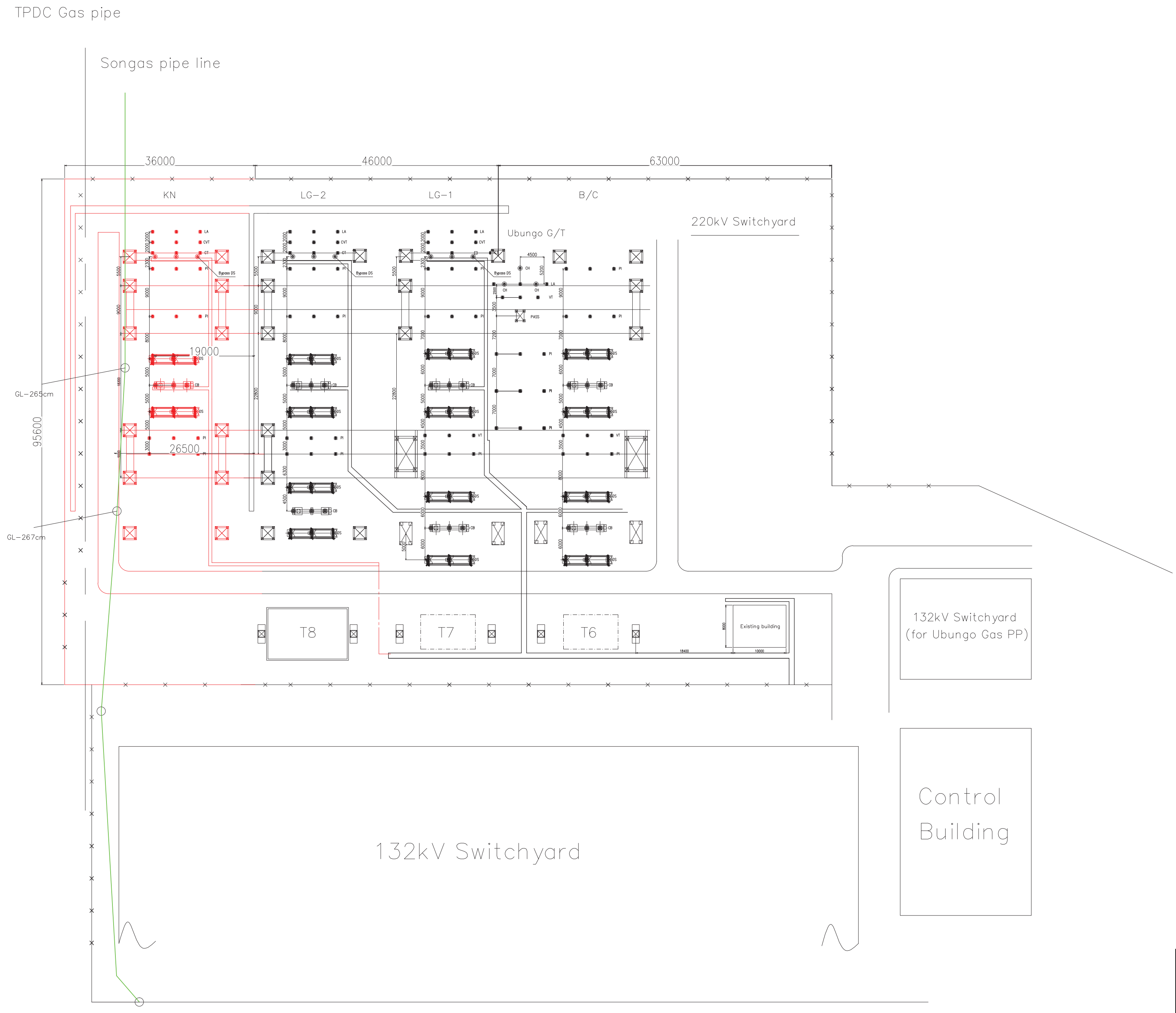
The Projectfor reinforcement of Supply from Kinyerezi Power Station to Ubungo Substation				SCALE: NON
Title: Single Line Diagram (Kinyerezi GPP)				DWG.NO.: SS-05
DATE	DESIGNED	CHECKED	APPROVED	REVISION
January.2020	T.NAKAMURA	K.SAKEMURA	K.OHASHI	



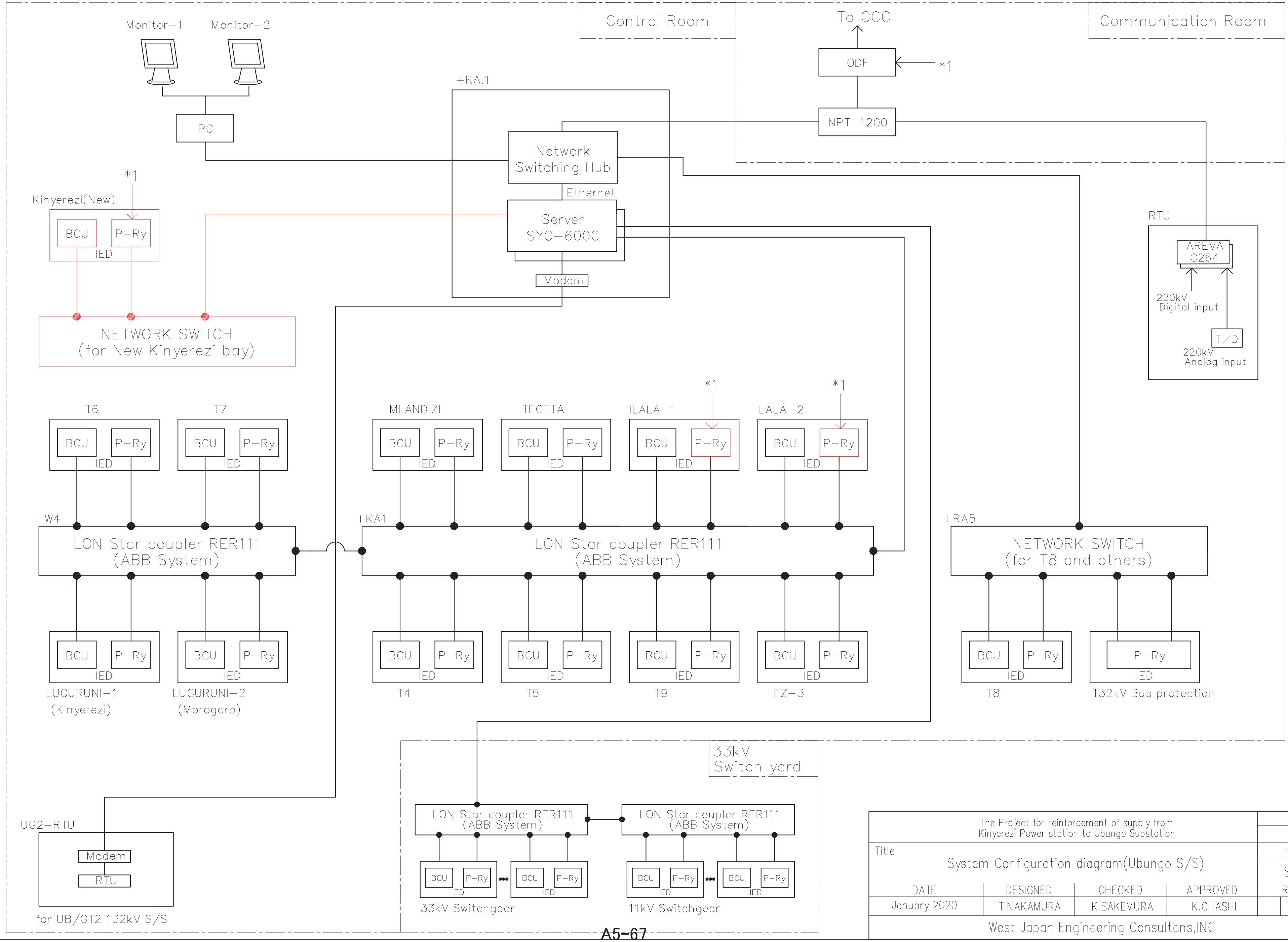
The Project for reinforcement of Supply from Kinyerezi Power Station to Ubungo Substation				SCALE: NON
Title: Layout Plan (Kinyerezi GPP)				DWG.NO.: SS-06
DATE	DESIGNED	CHECKED	APPROVED	REVISION
January.2020	T.NAKAMURA	K.SAKEMURA	K.OHASHI	



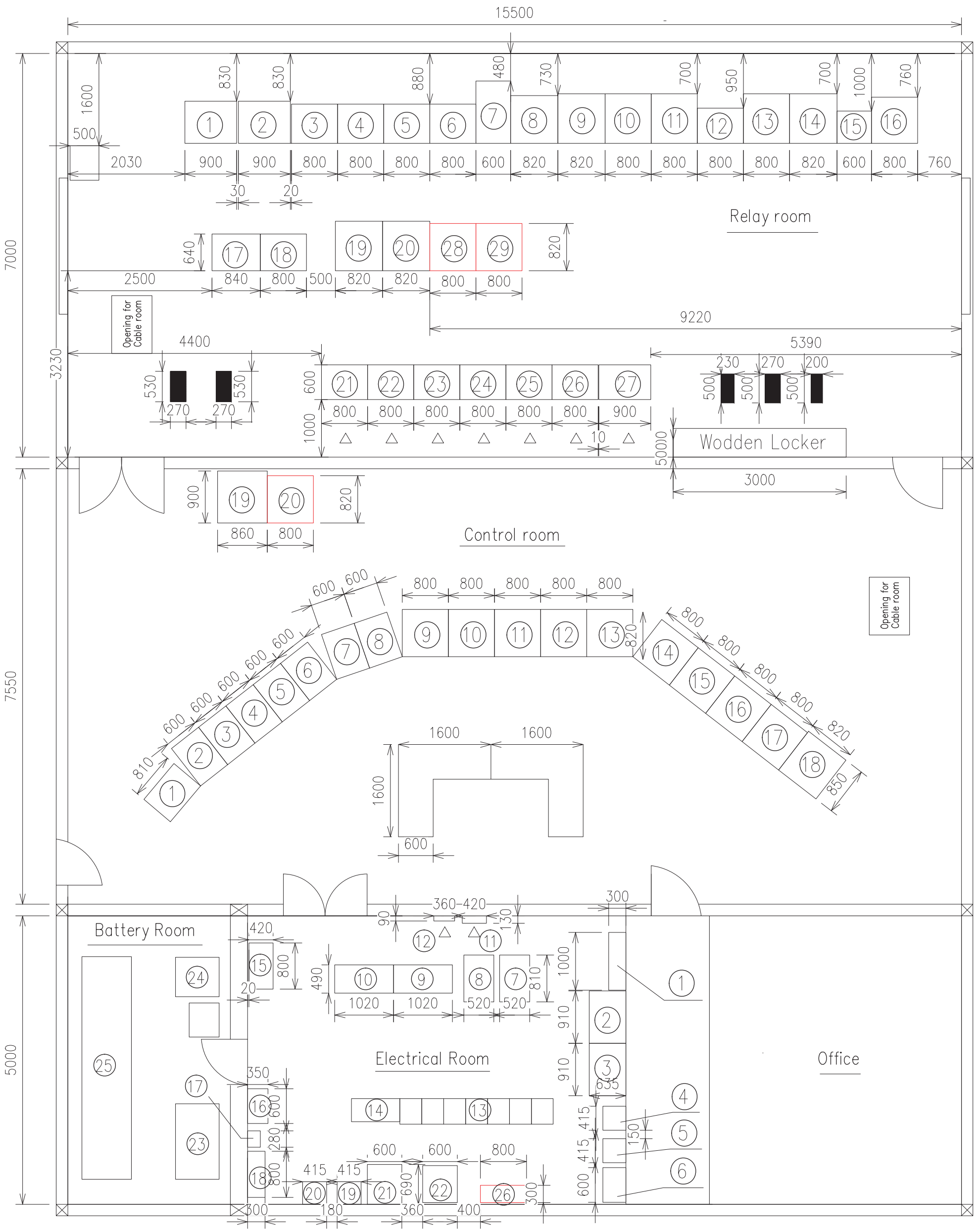
				SCALE
The Project for reinforcement of Supply from kinyerezi Power Station to Ubungo Substation				NON
Title				DWG.No.
Single Line Diagram(UBUNGO 220kV S/S)				SS-07
DATE	DESIGNED	CHECKED	APPROVED	REVISION
February,2020	T.Nakamura	K.Sakemura	K.OHASHI	
West Japan Engineering Consultants, INC.				



The Project for reinforcement of Supply from kinyerezi Power Station to Ubungo Substation				SCALE 1:500 1:200 1:50
Title: Layout Plan (Ubungo)				DWG.No. SS-08
DATE	DESIGNED	CHECKED	APPROVED	REVISION
February 2020	T.NAKAMURA	K.SAKEMURA	K.OHASHI	
West Japan Engineering Consultans,INC				



The Project for reinforcement of supply from Kinyerezi Power station to Ubungo Substation				SCALE: NON
Title: System Configuration diagram(Ubungo S/S)				DWG.No. SS-09
DATE	DESIGNED	CHECKED	APPROVED	REVISION
January 2020	T.NAKAMURA	K.SAKEMURA	K.OHASHI	
West Japan Engineering Consultans,INC				



■ Hole after backfill

Relay Room

No.	Panel name	Panel No
1	48V DC Charger-2	
2	48V DC Charger-1	
3	Station RTU	UG2/RTU
4	132kV Buszone Protection Panel	RP-3
5	132kV Extention Sub Protection Panel	
6	GSU TRF'S Incomer Protection Panel	RP-1
7	SEL Contact Transfer Module cabinet	
8	Morogoro-1	R.10
9	Line Morogoro-2	+R.11
10	Line Morogoro-2	+R.12
11	Line Morogoro-1	+R.13
12	220kV Busbar Protection	RP.14
13	WH Meter Panel	+Q1
14	WH Meter Panel	+Q2
15	EPP-Feeder Protection Relay	
16	WH Meter Panel	MA.1
17	Line morogoro-2 Line morogoro-1	+XY1
18	New 132kV Revenue Metering Panel	+EP001
19	T8 TR Protection Panel	
20	T8 TR Control Panel	
21	Auxiliary Remote Terminal Unit	CMA1(BBC)
22	Auxiliary Remote Terminal Unit	CMA2(BBC)
23	Auxiliary Remote Terminal Unit	CMA3(BBC)
24	Remote terminal Unit	CRA1(BBC)
25	Remote terminal Unit	CRA2(BBC)
26	Terminal Panel	+YV1
27	DC 110V Charger-1(Hoppelke battery)	
28	Kinyerezi -1(New)	
29	Kinyerezi -2(New)	

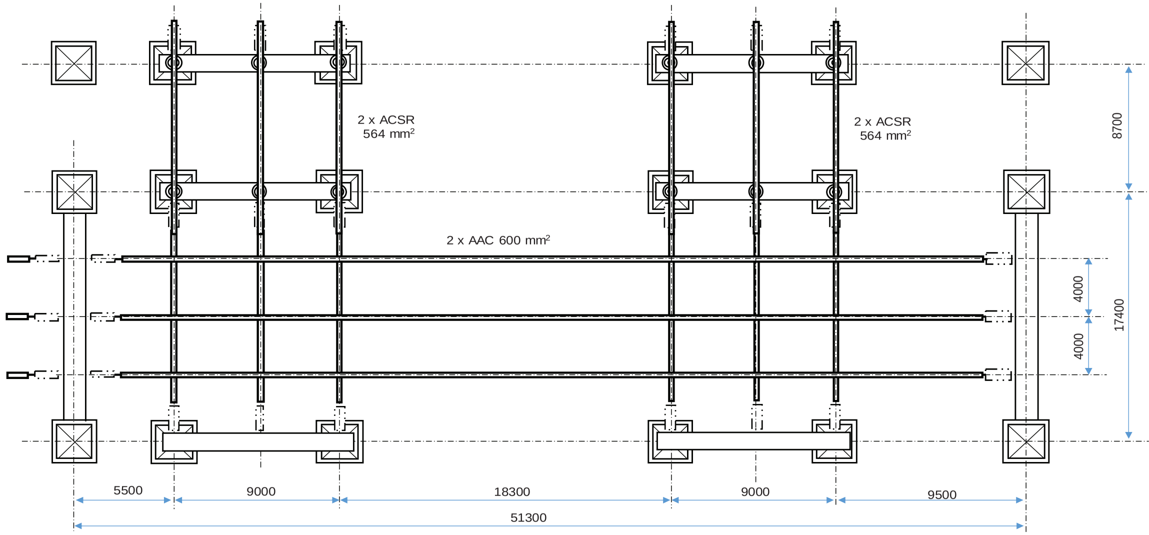
Control Room

No.	Panel name	Panel No
1	220kV Cable Feeder	RP01
2	Alarem Panel	W1
3	Morogoro-2	W2
4	Transformer T7	W3
5	Bus Coupler	W4
6	33kV Reactors	W5
7	Transfomrmer T6	W6
8	Morogoro-1	W7
9	DOWANS	RA.1
10	Factory zone3/ ILALA1	RA.2
11	ILALA2/ Transformer T5	RA.3
12	Transformer T7 /Bus section	RA.4
13	Blank Panel(Network switch for New T8)	RA.5
14	Transformer T4 /Transformer T6	RA.6
15	TEGETA / Mlandizi	RA.7
16	Transformer T9/MAKMBUSHO	RA.8
17	Alarm	KA.1
18	TEGETA-2	RA.10
19	Kurasini	
20	Kinyerezi(NEW)	

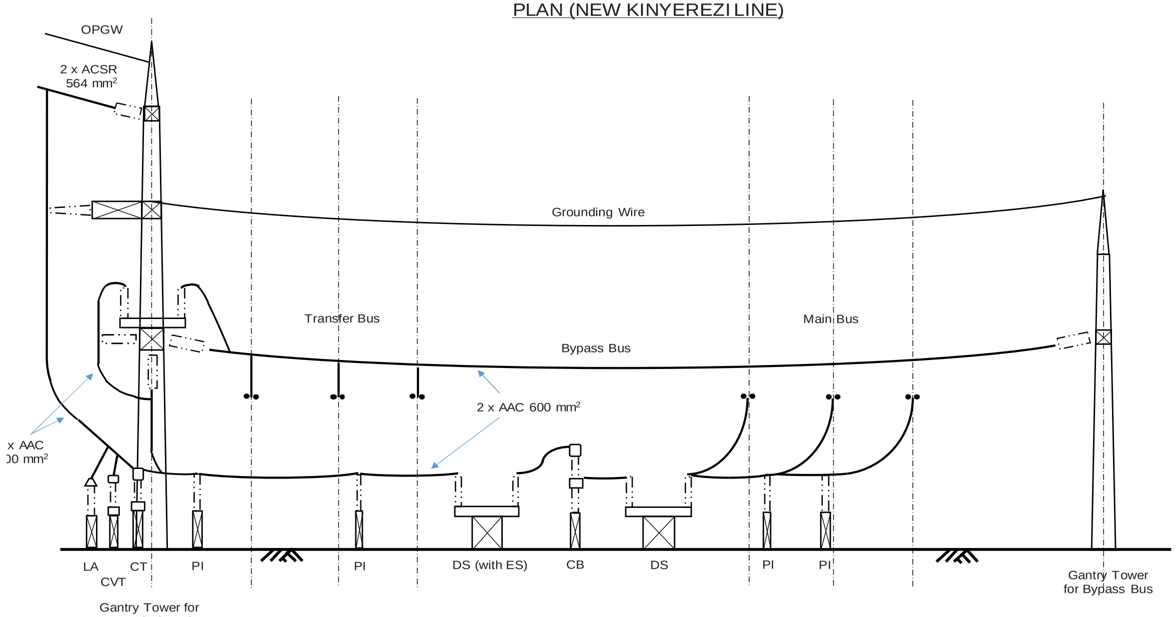
Power Supply Room

No.	Panel name	Panel No
1	DC Distribution panel	SD1
2	Battery Charger	
3	Battery Charger	
4	Battery Charger / Rectifier (Wall mounted)	
5	Battery Charger / Rectifier (Wall mounted)	
6	DC Distribution panel (Wall mounted)	
7	UPS (Schneider)	
8	UPS (Schneider)	
9	Distribution Panel (110 V DC) (2)	
10	Distribution Panel (110 V DC) (1)	
11	400/230 V AC DP(for outdoor lighting)	+DLP
12	DP for A/C, Lighting and receptacles	
13	Control Center	
14	Distribution Panel (for 230 V AC)	
15	Distribution Panel	
16	15 V DC Battery Charger (Wall mounted)	
17	Fuse (Wall mounted)	
18	AC/DC Distribution Panel (Wall mounted)	+SD3
19	48 V DC Charger / Rectifier (Wall mounted)	
20	48 V DC Charger / Rectifier (Wall mounted)	
21	Unknown (operating?)	
22	Communication ODF Cabinet (not in use)	
23	48 V DC Batteries (Ni-Cd)	
24	110 V DC Batteries (Ni-Cd)	
25	Batteries (Ni-Cd)	
26	AC/DC Distribution Panel(New kinyerezi Bay)	

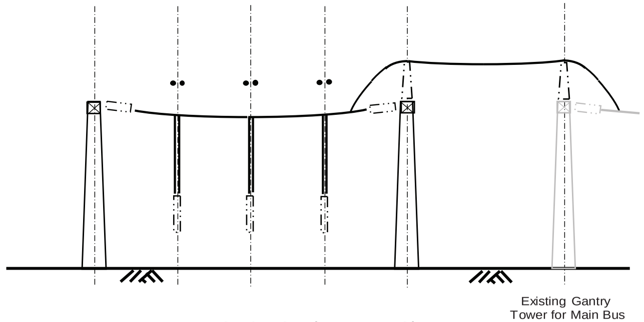
The project for reinforcement of suuply from Kinyerezi Power Station to Ubungo Substation				SCALE: NON
Title: Layout Plan of Control Building (Ubungo)				DWG.No. SS-10
DATE	DESIGNED	CHECKED	APPROVED	REVISION
February.2020	T.NAKAMURA	K.SAKEMURA	K.OHASHI	
West Japan Engineering Consultans,INC				



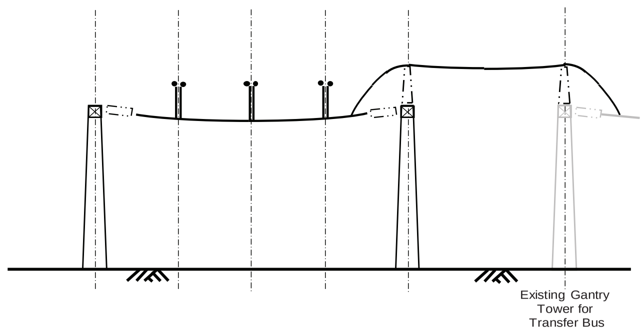
PLAN (NEW KINYEREZI LINE)



SECTION (NEW KINYEREZI LINE)

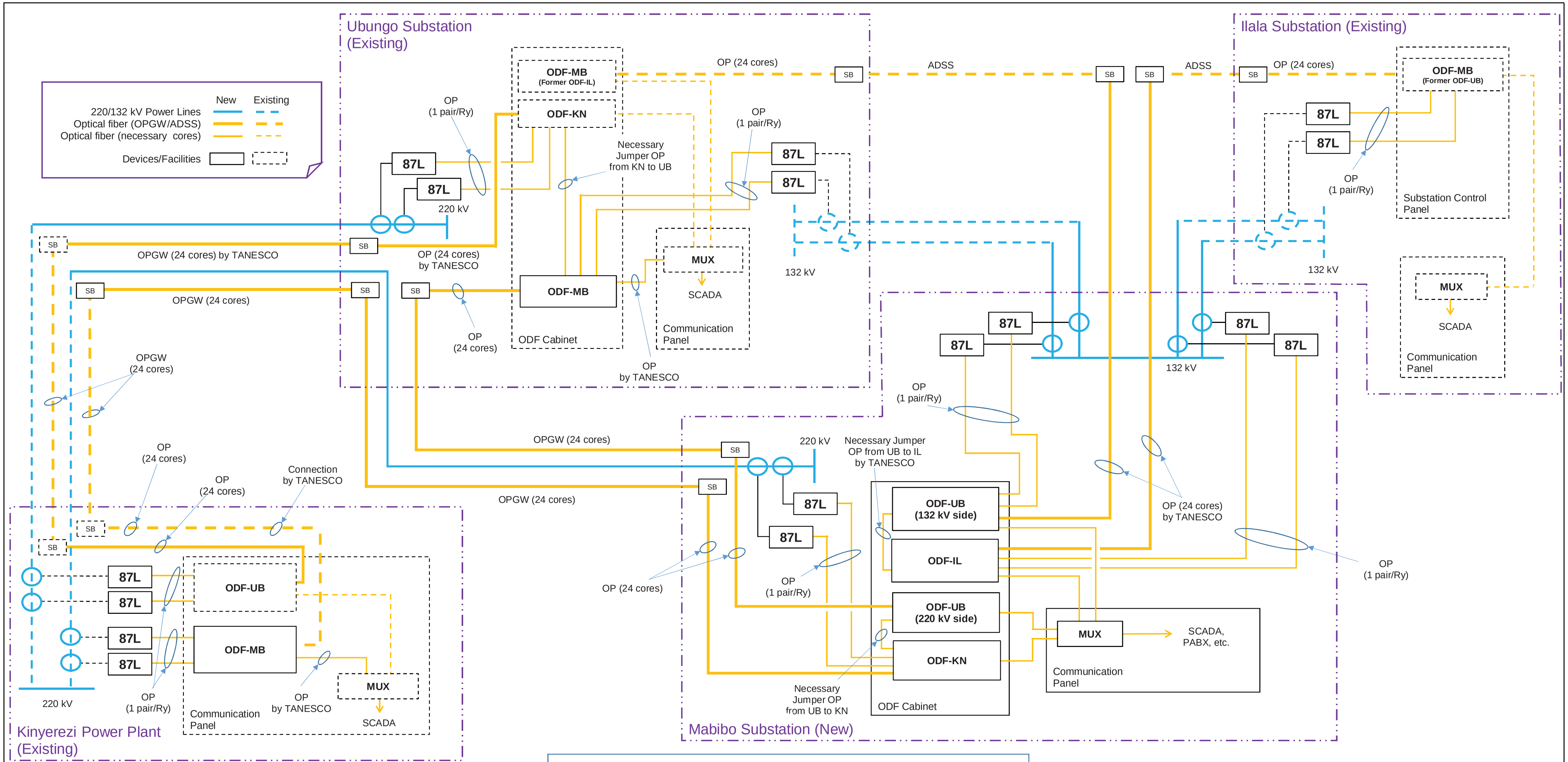


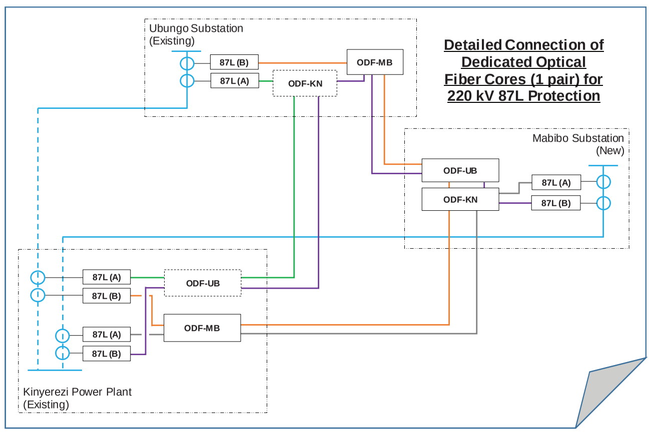
SECTION (MAIN BUS)



SECTION (TRANSFER BUS)

The Projectfor reinforcement of Supply from Kinyerezi Power Station to Ubungo Substation				SCALE	NON
Title: Section Drawing for New Kinyerezi Line (Ubungo Substation)				DWG.NO.	SS-11
DATE	DESIGNED	CHECKED	APPROVED	REVISION	
January.2020	T.NAKAMURA	K.SAKEMURA	K.OHASHI		

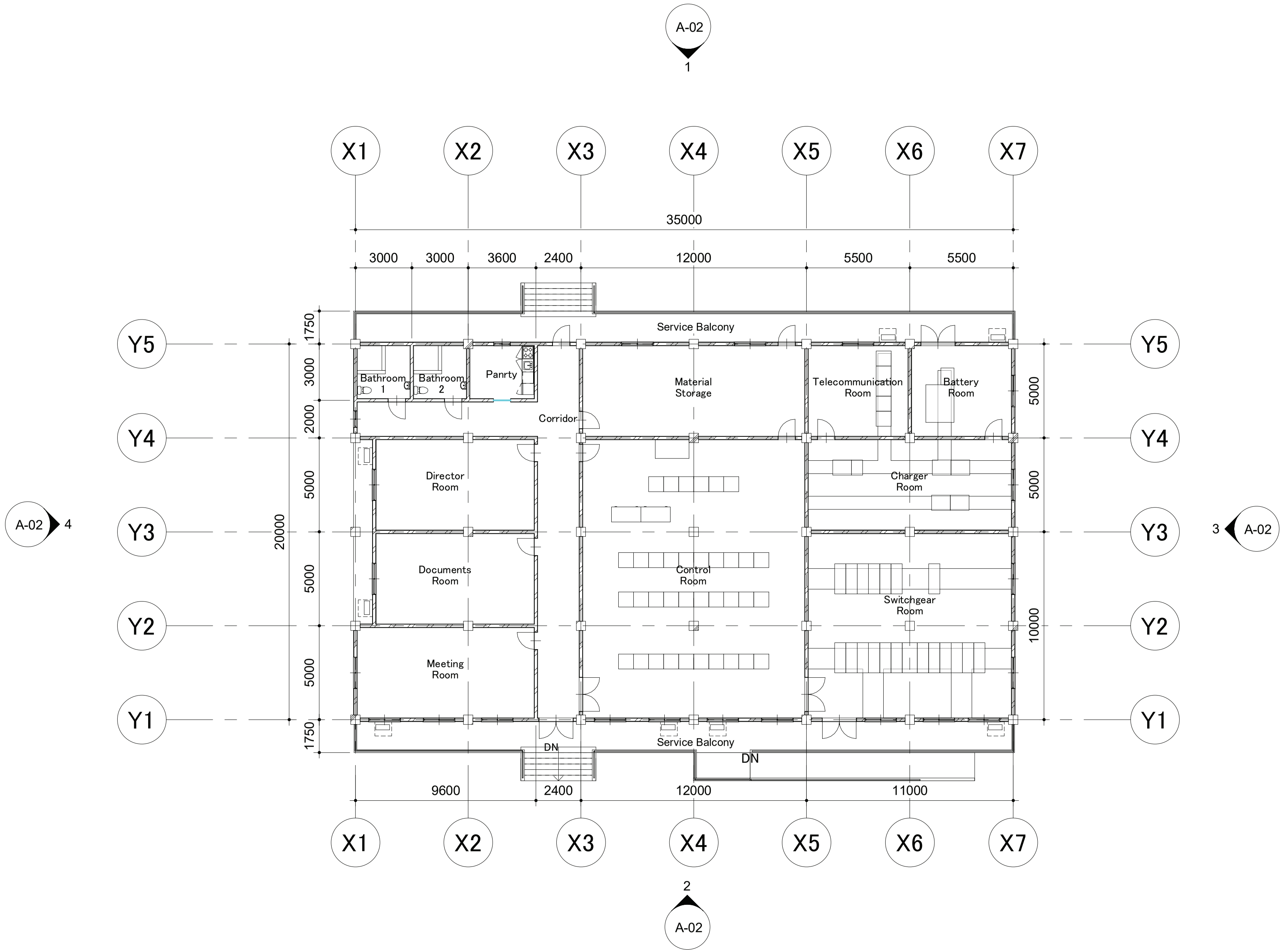




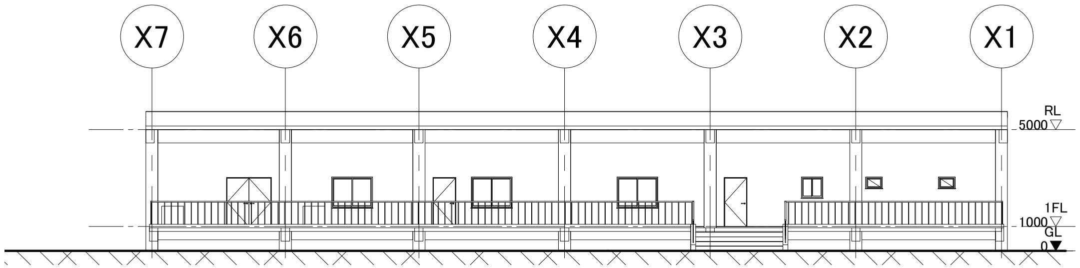
Legend

ODF	Optical fiber Distibution Frame (24 terminals)
MUX	Multiplexer
SB	Splice Box
OPGW	Grounding Wire with Optical cable
ADSS	All-Dielectric Self-Supporting optical fiber cable
OP	Optical fiber cable
87L	Current Differential Relay
MB	Mabibo Substation
UB	Ubungo Substation
KN	Kinyerezi Power Plant
IL	Ilala Substation

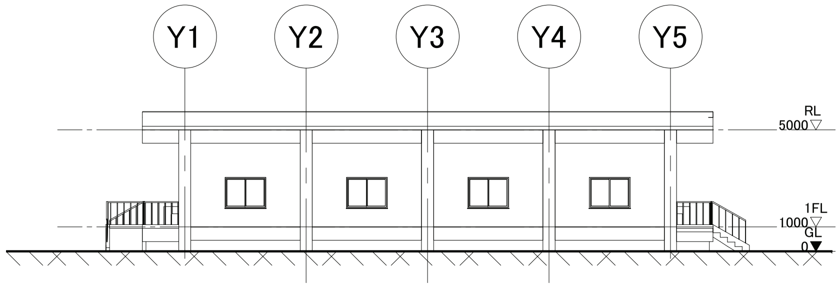
The Projectfor reinforcement of Supply from Kinyerezi Power Station to Ubungo Substation				SCALE: NON
Title: Communication Network around Mabibo Substation				DWG.NO.: SS-12
DATE	DESIGNED	CHECKED	APPROVED	REVISION
March.2020	T.NAKAMURA	K.SAKEMURA	K.OHASHI	0



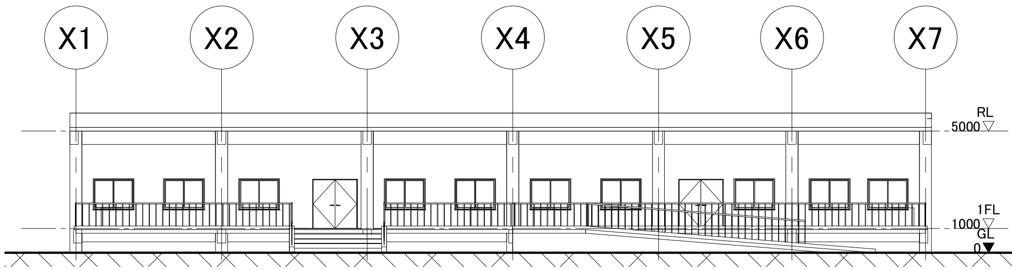
Project	Location	Title	Approved by	Checked by	Designed by	Drawn by	Date	Dwg No.
Project for Reinforcement of Supply from Kinyerezi Power Station to Ubungo Substation	Dar es Salaam	Ground Floor Plan (Preliminary)					11/10/19	A-01
			Consultant: YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					Scale 1 : 200 (for A3 paper)



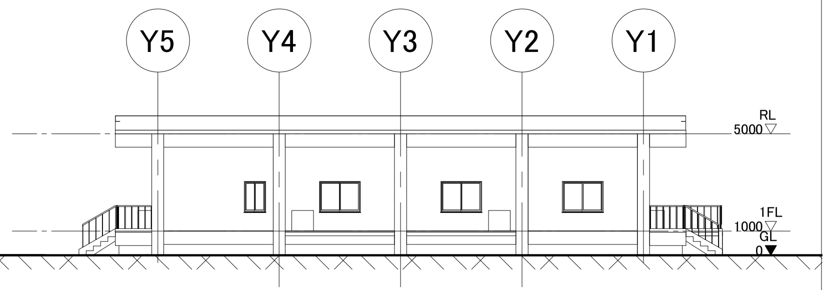
1 North Elevation
1 : 200



3 East Elevation
1 : 200



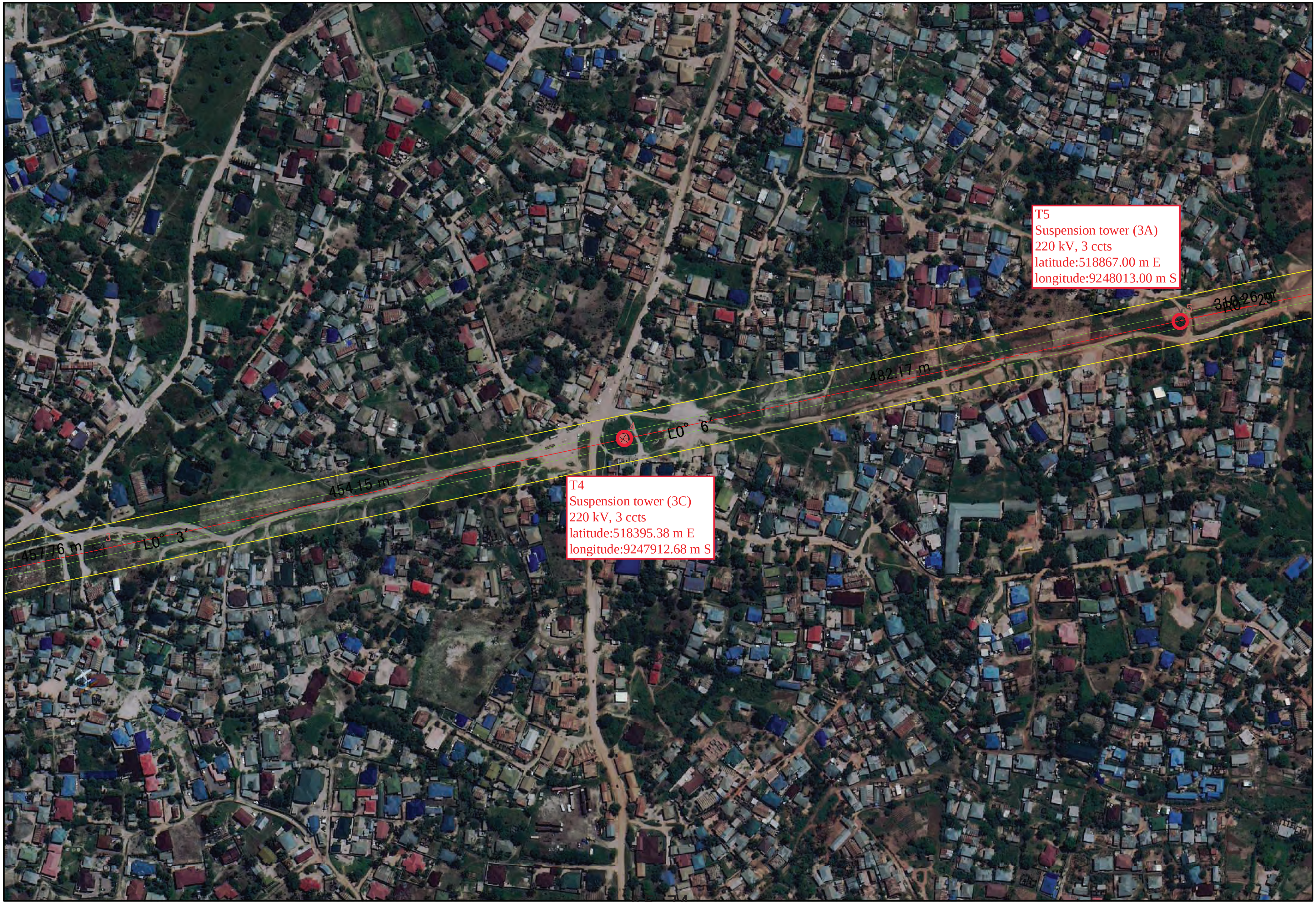
2 South Elevation
1 : 200



4 West Elevation
1 : 200

Project	Location	Title	Approved by	Checked by	Designed by	Drawn by	Date	Dwg No.
Project for Reinforcement of Supply from Kinyerezi Power Station to Ubungo Substation	Dar es Salaam	Elevation (Preliminary)					11/10/19	A-02
			Consultant: YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					Scale 1 : 200 (for A3 paper)

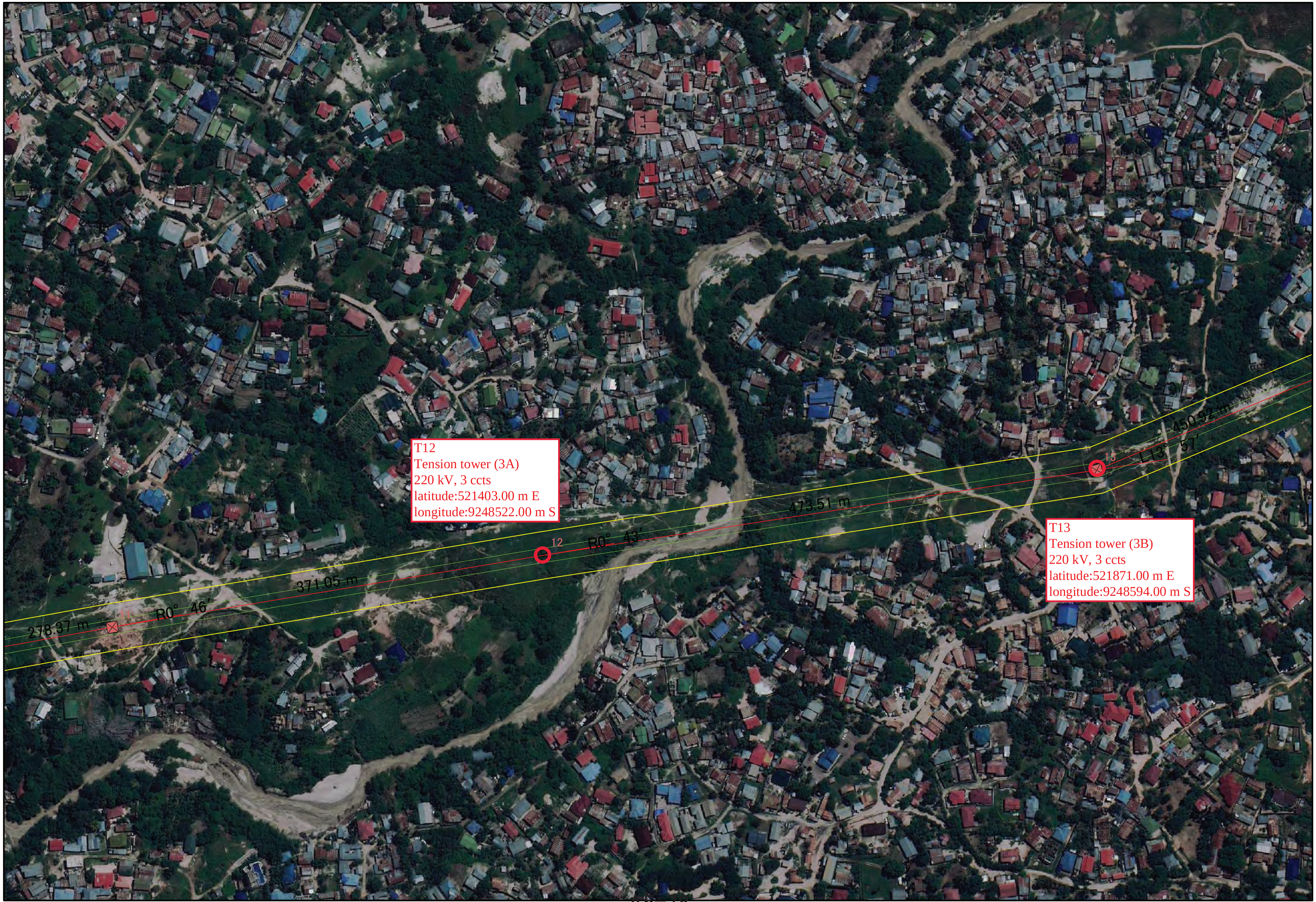

T1
T-off point
Dead end tower (3D-1)
220 kV, 3 ccts
latitude:517321.95 m E
longitude:9247688.36 m S
T2
Tension tower (3B)
220 kV, 3 ccts
latitude:517503.00 m E
longitude:9247725.00 m S
T3
Suspension tower (3A)
220 kV, 3 ccts
latitude:517951.00 m E
longitude:9247819.00 m S
184.72 m
L0° 25′
457.76 m
L0° 3′
454.15 m

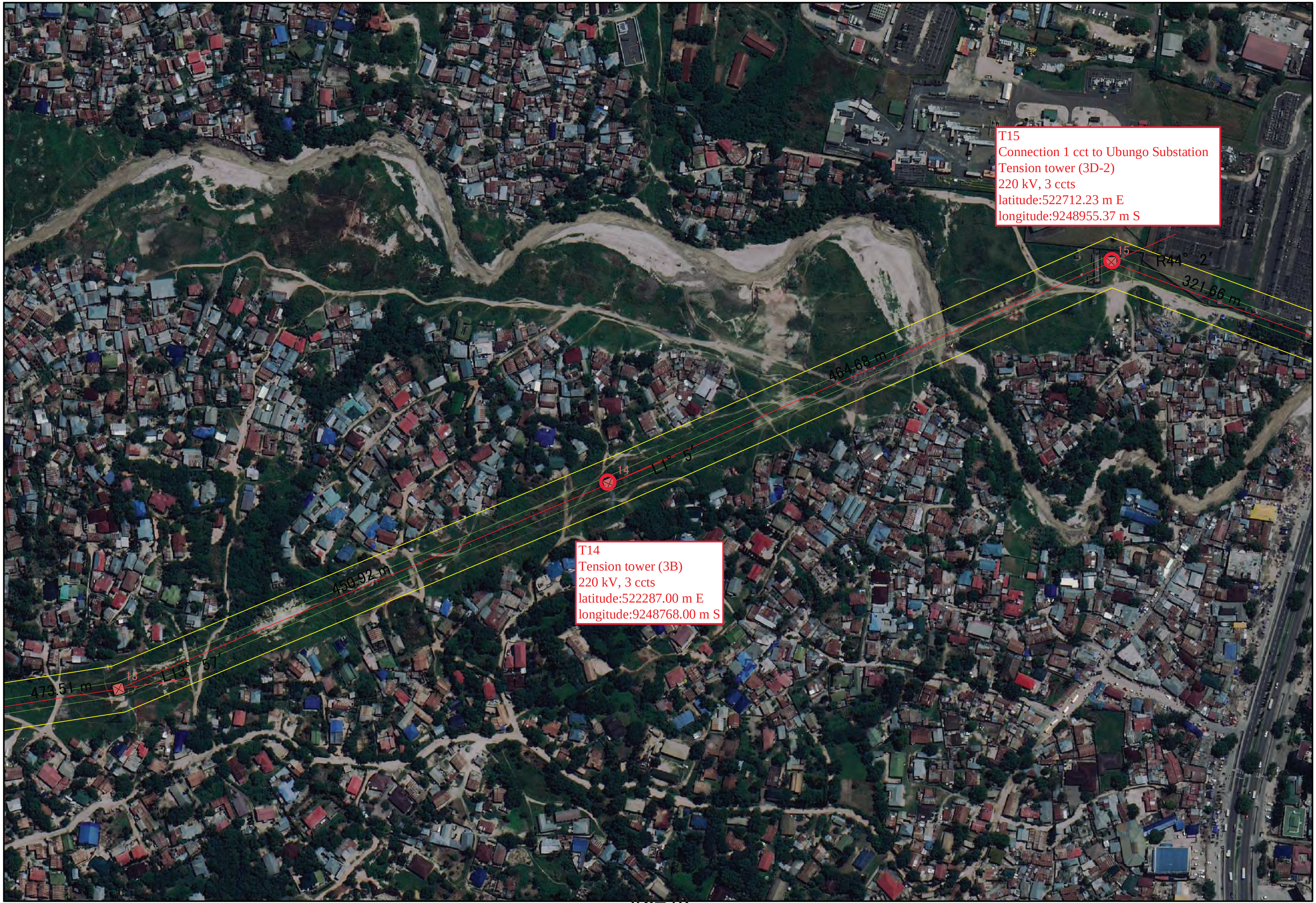

T5
Suspension tower (3A)
220 kV, 3 ccts
latitude:518867.00 m E
longitude:9248013.00 m S
482.17 m
L0° 6′
T4
Suspension tower (3C)
220 kV, 3 ccts
latitude:518395.38 m E
longitude:9247912.68 m S
454.15 m
L0° 3′
457.76 m

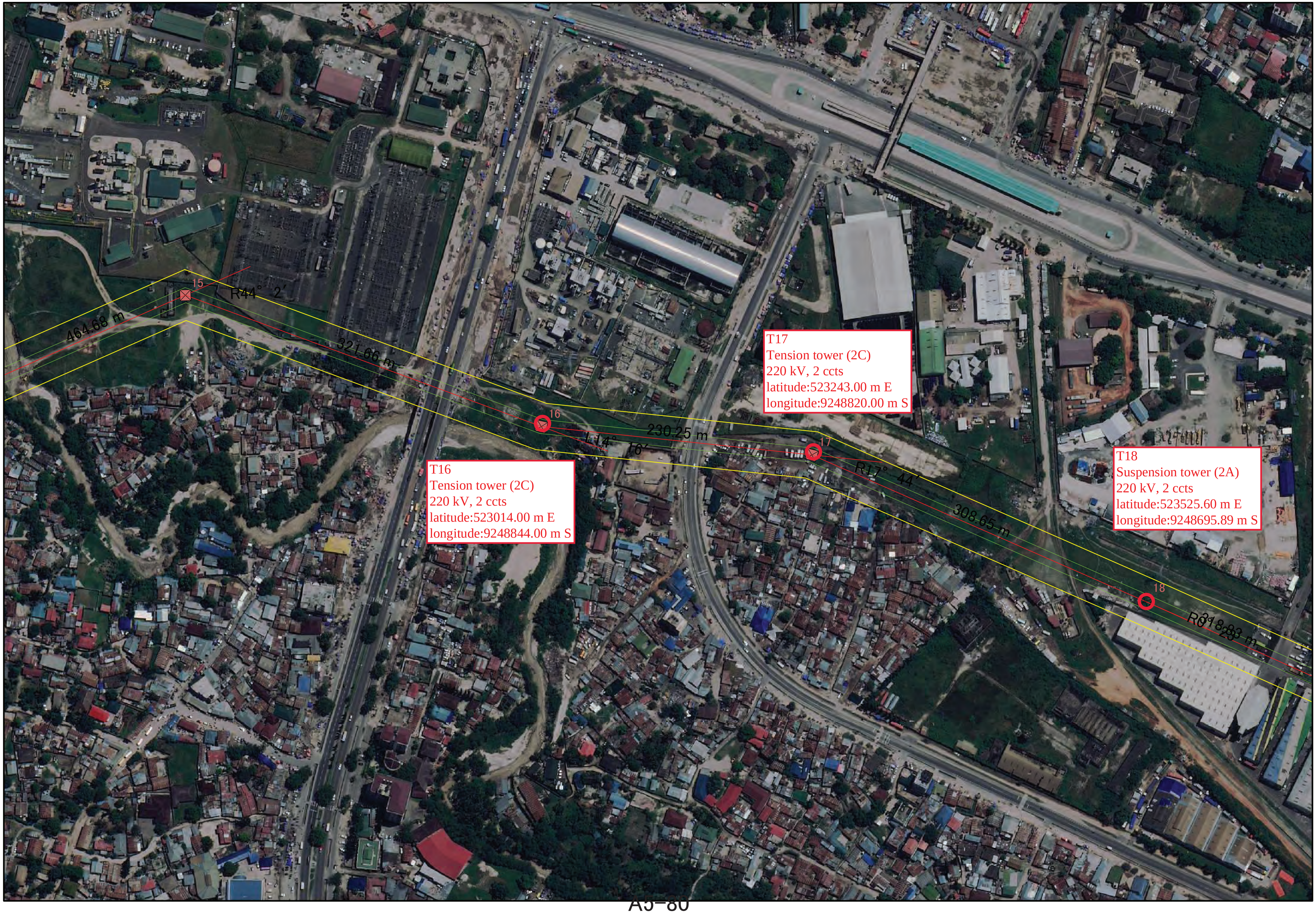

T7
Tension tower (3C)
220 kV, 3 ccts
latitude:519587.50 m E
longitude:9248160.89 m S
393.59 m
L0° 41′
T6
Suspension tower (3A)
220 kV, 3 ccts
latitude:519171.00 m E
longitude:9248075.00 m S
425.27 m
L0° 8′
310.26 m
R0° 29′
482.17 m


T9
Suspension tower (3A)
220 kV, 3 ccts
latitude:520297.11 m E
longitude:9248310.91 m S
476.68 m
L0° 44′
331.73 m
R0° 53′
393.59 m
425.27 m
L0° 41′
T8
Suspension tower (3A)
220 kV, 3 ccts
latitude:519972.00 m E
longitude:9248245.00 m S


T10
Tension tower (3C)
220 kV, 3 ccts
latitude:520763.04 m E
longitude:9248411.59 m S
T11
Suspension tower (3A)
220 kV, 3 ccts
latitude:521037.00 m E
longitude:9248461.00 m S
371.05 m
R0° 46
278.37 m
R1° 58
476.68 m
L0° 44
31.73 m


T12
Tension tower (3A)
220 kV, 3 ccts
latitude:521403.00 m E
longitude:9248522.00 m S
T13
Tension tower (3B)
220 kV, 3 ccts
latitude:521871.00 m E
longitude:9248594.00 m S
278.37 m
R0° 46'
371.05 m
12
R0° 43'
473.51 m
13
L13° 57'
450.92 m


T15
Connection 1 cct to Ubungo Substation
Tension tower (3D-2)
220 kV, 3 ccts
latitude:522712.23 m E
longitude:9248955.37 m S
15
R44° 2′
321.66 m
464.68 m
14
L1° 5′
T14
Tension tower (3B)
220 kV, 3 ccts
latitude:522287.00 m E
longitude:9248768.00 m S
450.92 m
13
L13° 57′
473.51 m

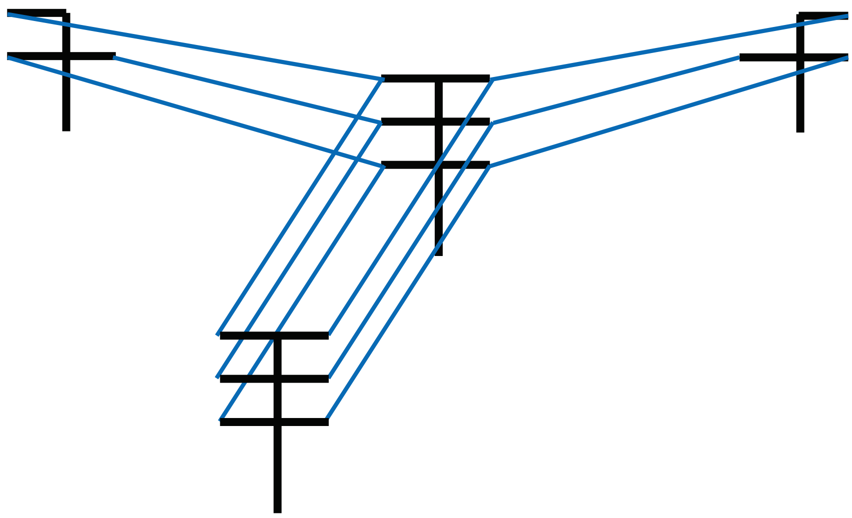

T16
Tension tower (2C)
220 kV, 2 ccts
latitude:523014.00 m E
longitude:9248844.00 m S
T17
Tension tower (2C)
220 kV, 2 ccts
latitude:523243.00 m E
longitude:9248820.00 m S
T18
Suspension tower (2A)
220 kV, 2 ccts
latitude:523525.60 m E
longitude:9248695.89 m S
464.68 m
321.66 m
230.25 m
308.65 m
R44° 2′
R17° 44′
15
16
17
18

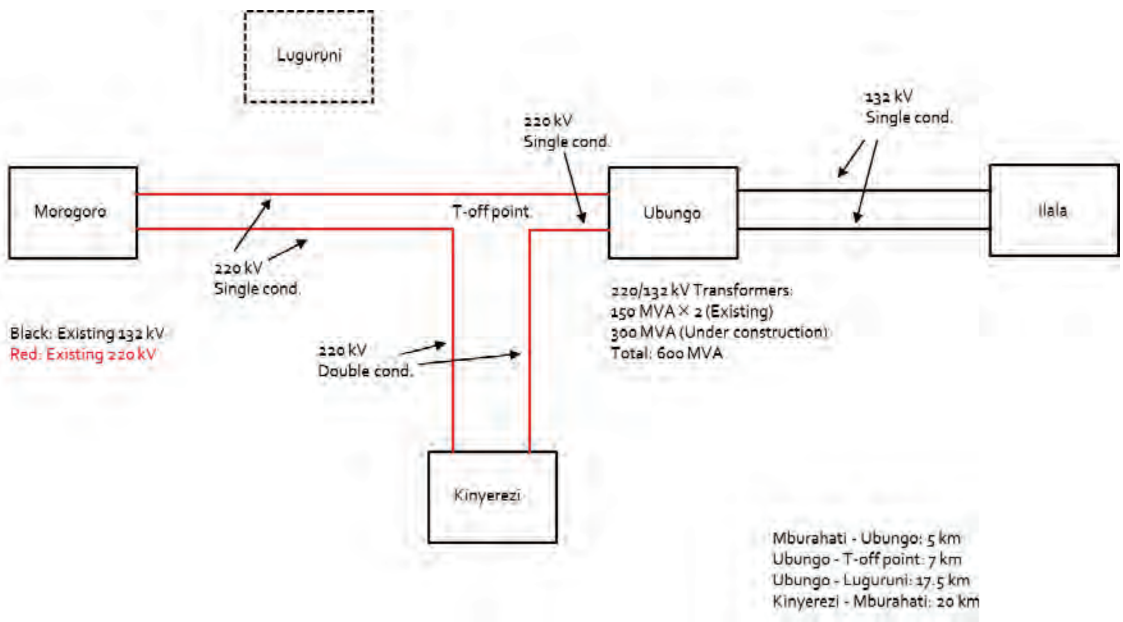
A5–80


T19
Suspension tower (2A)
220 kV, 2 ccts
latitude:523818.00 m E
longitude:9248558.00 m S
318.64 m
19
R0° 44´
323.54 m
T20
Suspension tower (2A)
220 kV, 2 ccts
latitude:524107.00 m E
longitude:9248425.00 m S
20
R0° 30´
332.7 m
T21
Tension tower (2A)
220 kV, 2 ccts
latitude:524411.00 m E
longitude:9248288.00 m S
21
101.14 m
L0° 39´
T22
Tension tower (2D)
220 kV, 2 ccts
latitude:524514.00 m E
longitude:9248237.00 m S
22

Work Demarcation for Installation of 220 kV T-off tension tower (Draft)

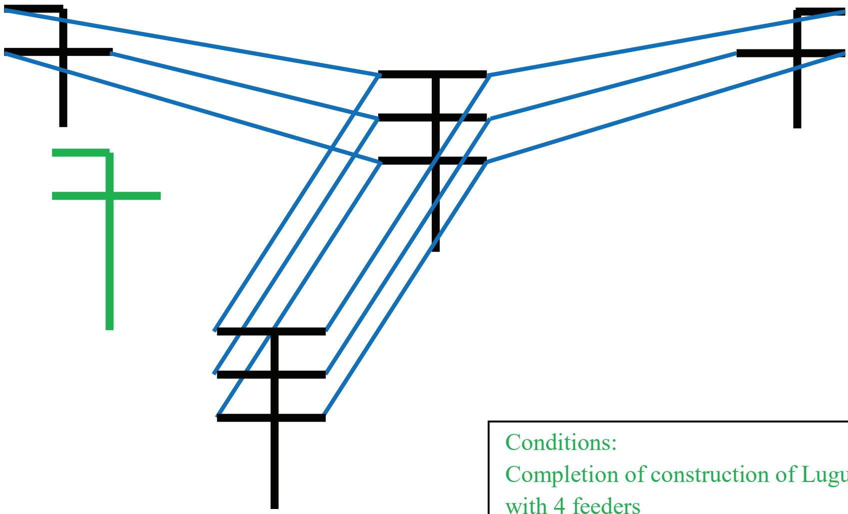
・Existing tower position





Present configuration in 2019

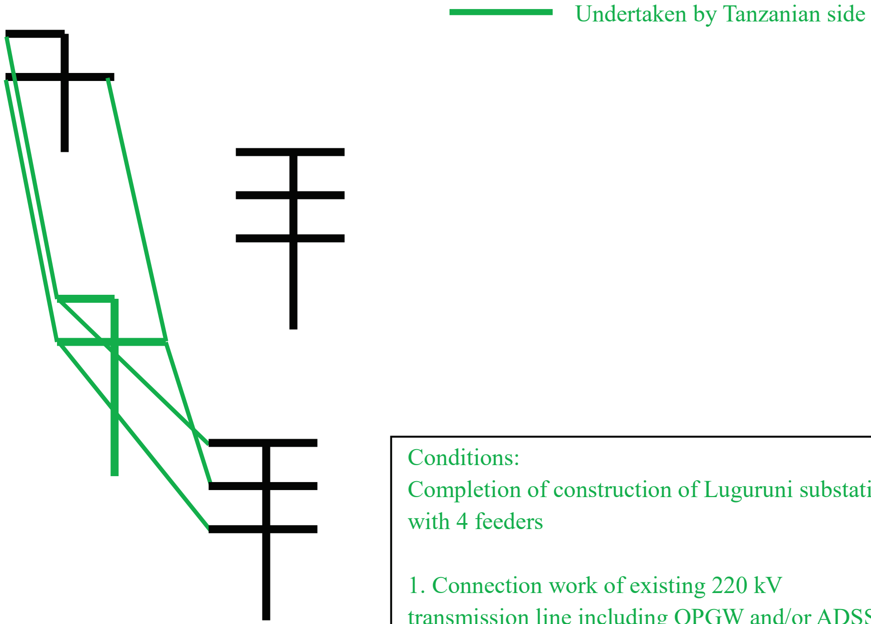
・Step 1



Conditions:
Completion of construction of Luguruni substation with 4 feeders

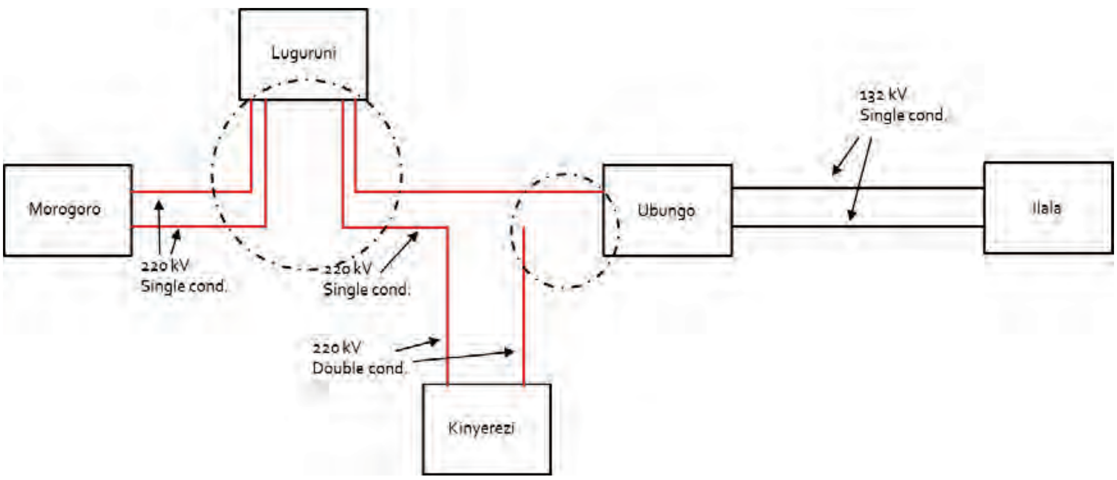
1. Construction of temporary tower

・Step 2



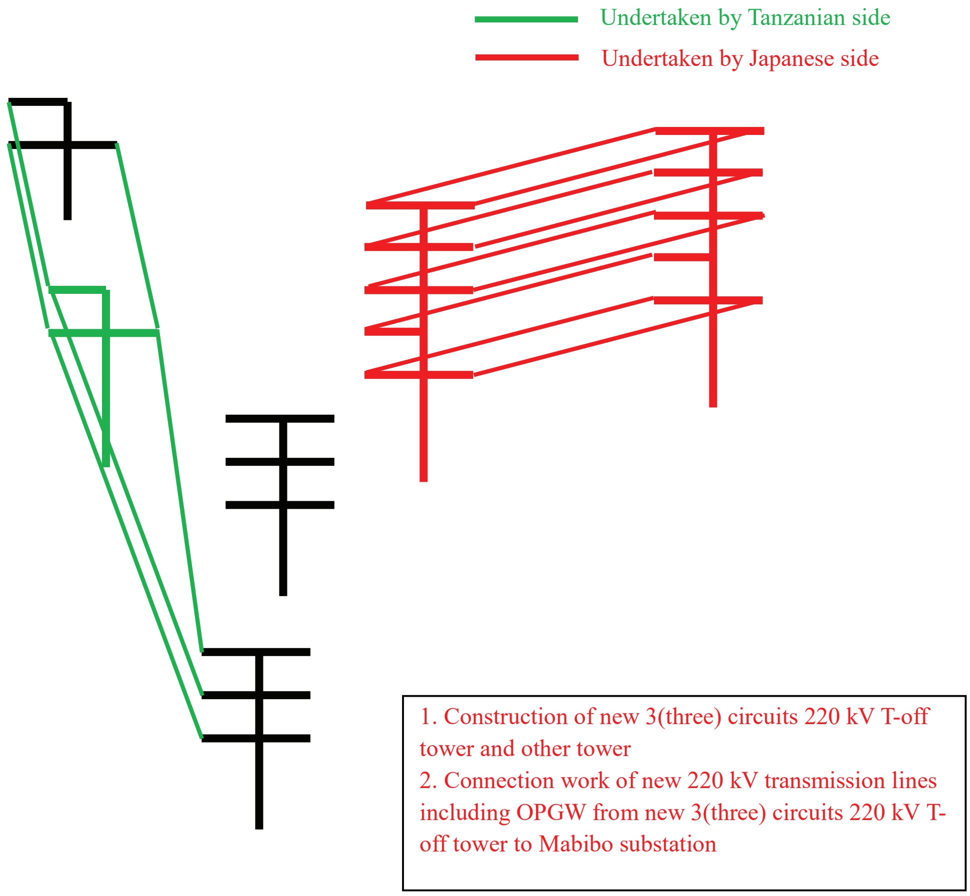
Conditions:
Completion of construction of Luguruni substation with 4 feeders

1. Connection work of existing 220 kV transmission line including OPGW and/or ADSS
2. Demolition of existing tower, foundation, conductor and other accessories



Configuration as of 2020 + α

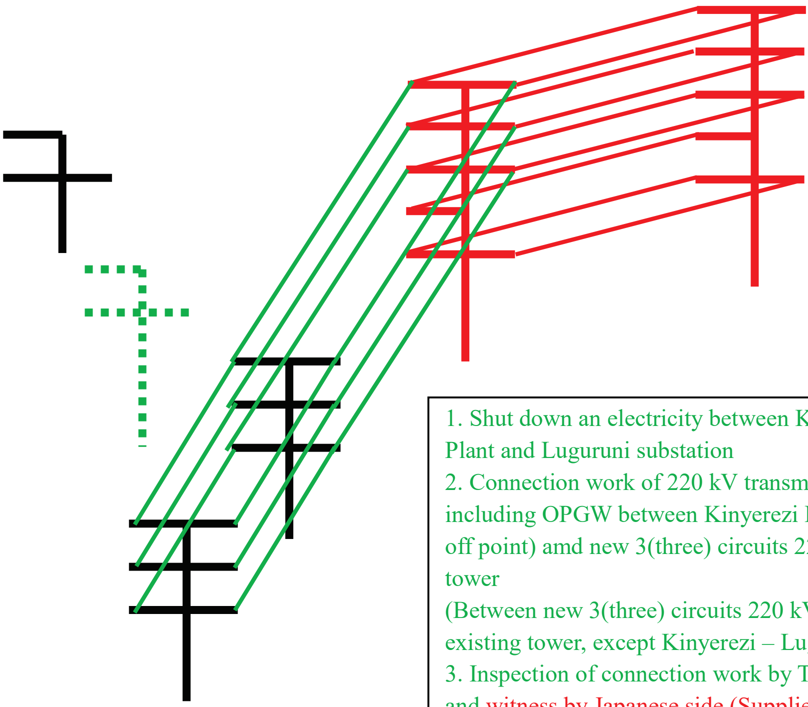
・Step 3


Undertaken by Tanzanian side
Undertaken by Japanese side
1. Construction of new 3(three) circuits 220 kV T-off tower and other tower
2. Connection work of new 220 kV transmission lines including OPGW from new 3(three) circuits 220 kV T-off tower to Mabibo substation

・Step 4

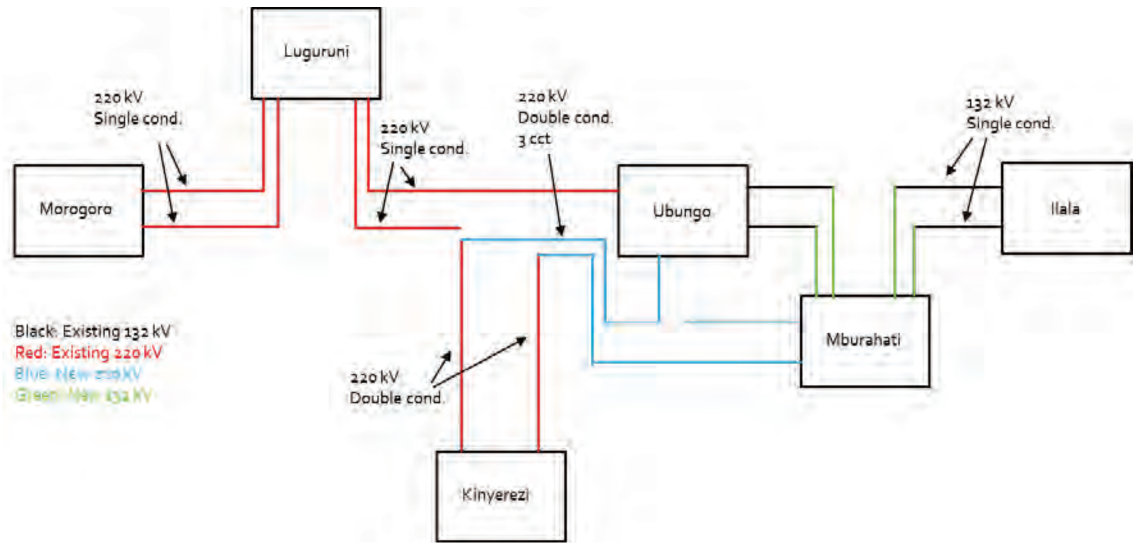
Undertaken by Tanzanian side

Undertaken by Japanese side



1. Shut down an electricity between Kinyerezi Power Plant and Luguruni substation
2. Connection work of 220 kV transmission lines including OPGW between Kinyerezi Power Plant (T-off point) amd new 3(three) circuits 220 kV T-off tower
(Between new 3(three) circuits 220 kV T-off tower to existing tower, except Kinyerezi – Luguruni line)
3. Inspection of connection work by Tanzanian side and witness by Japanese side (Supplier)
4. Demolition of temporary tower, foundation, conductor and other accessories

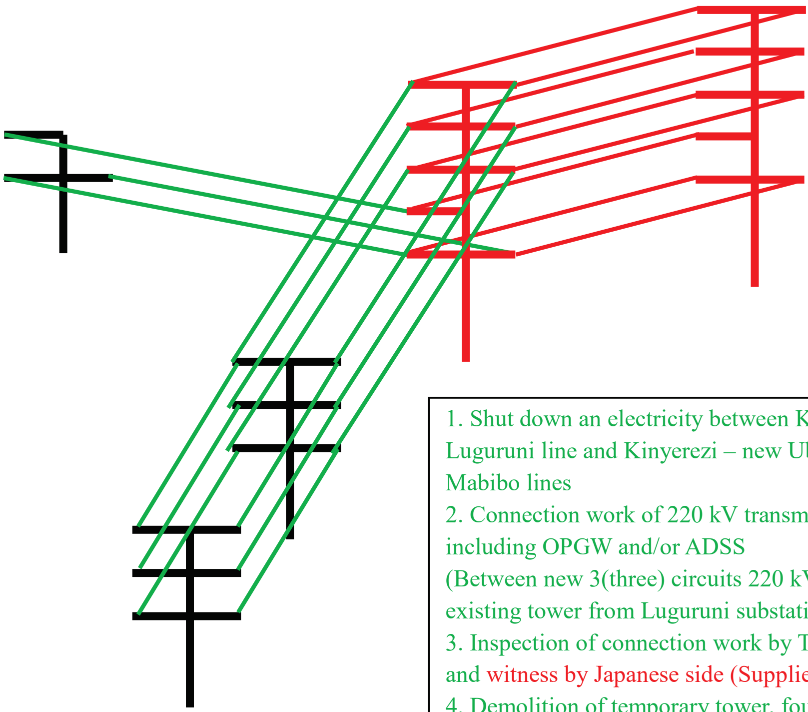
Configuration as of 2025



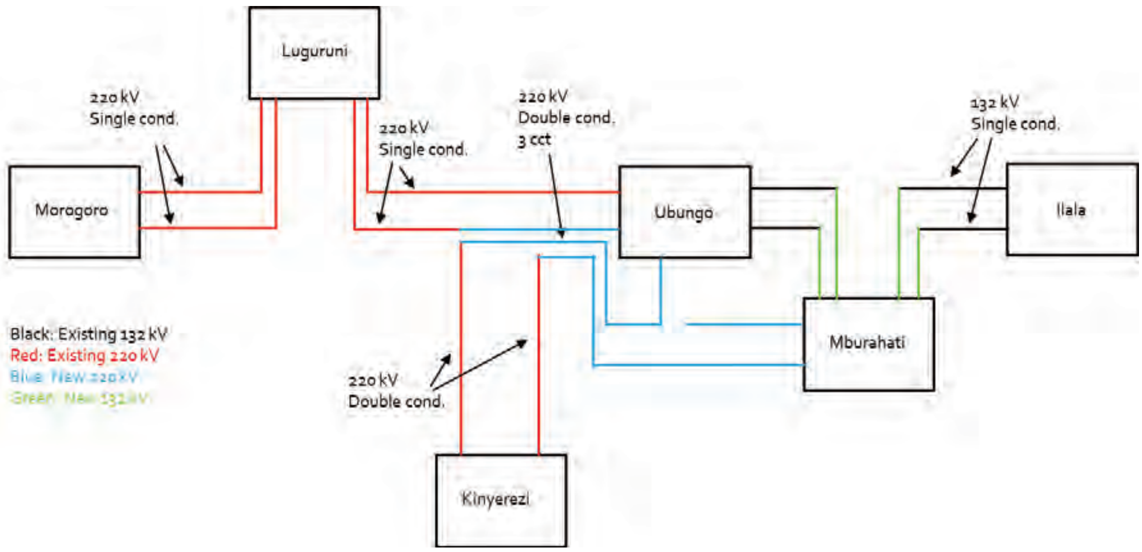
・Step 5

Undertaken by Tanzanian side

Undertaken by Japanese side



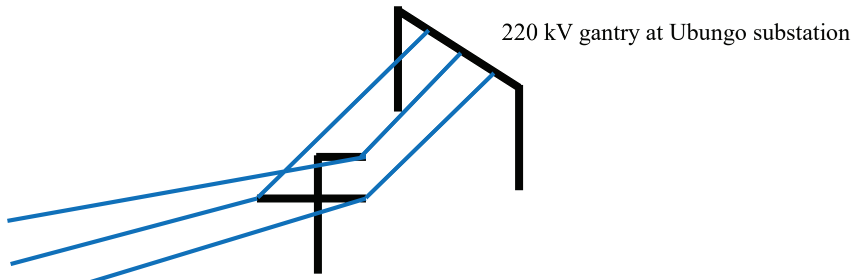
1. Shut down an electricity between Kinyerezi – Luguruni line and Kinyerezi – new Ubungo and Mabibo lines
2. Connection work of 220 kV transmission line including OPGW and/or ADSS (Between new 3(three) circuits 220 kV T-off tower to existing tower from Luguruni substation)
3. Inspection of connection work by Tanzanian side and witness by Japanese side (Supplier)
4. Demolition of temporary tower, foundation, conductor and other accessories



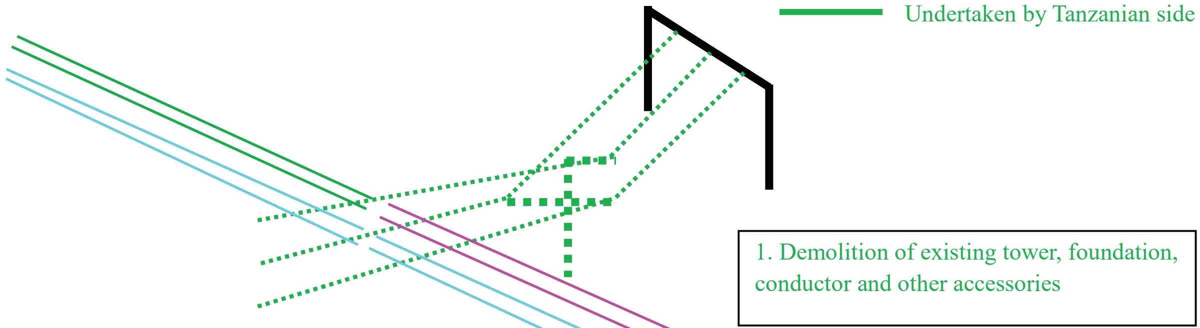
Configuration as of 2025

Work Demarcation for Installation of 220 kV dead end tower nearby Ubungo substation (Draft)

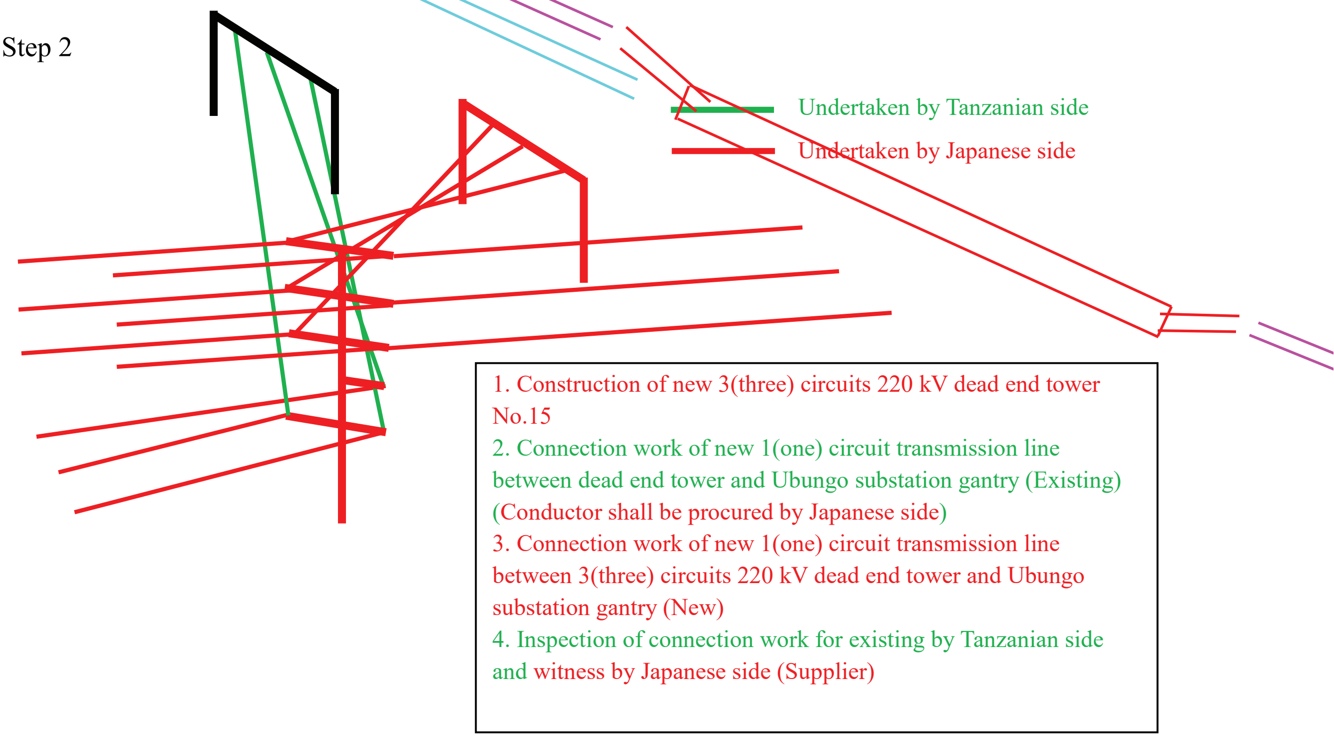
・Existing tower position



・Step 1



・Step 2




Current conditions
Green 132 kV TL 2 ccts
Blue 132 kV 1 cct
Orange 33 kV 3 ccts
T21
T20
T19
T18


Step 1
Tanzanian side work (Black)
a. Demolition and removal of the existing 132 kV 1 cct line
b. Demolition and removal of the existing 33 kV 3 cct lines
T18
T19
T20
T21
Green Existing 132 kV TL 2 ccts
Blue Existing 132 kV 1 cct
Orange Existing 33 kV 3 ccts


Step 2
Tanzanian side work (Black)
a. Construction of the temporary gantry No. TG1 and TG2 for supporting a conductor from T20 and T18
b. Construction of the temporary 132 kV 1cct (or 2cct) towers temporary 1 and 2 and connection of string
T21
T20
TG1
Temporary 1
T19
Temporary 2
TG2
T18

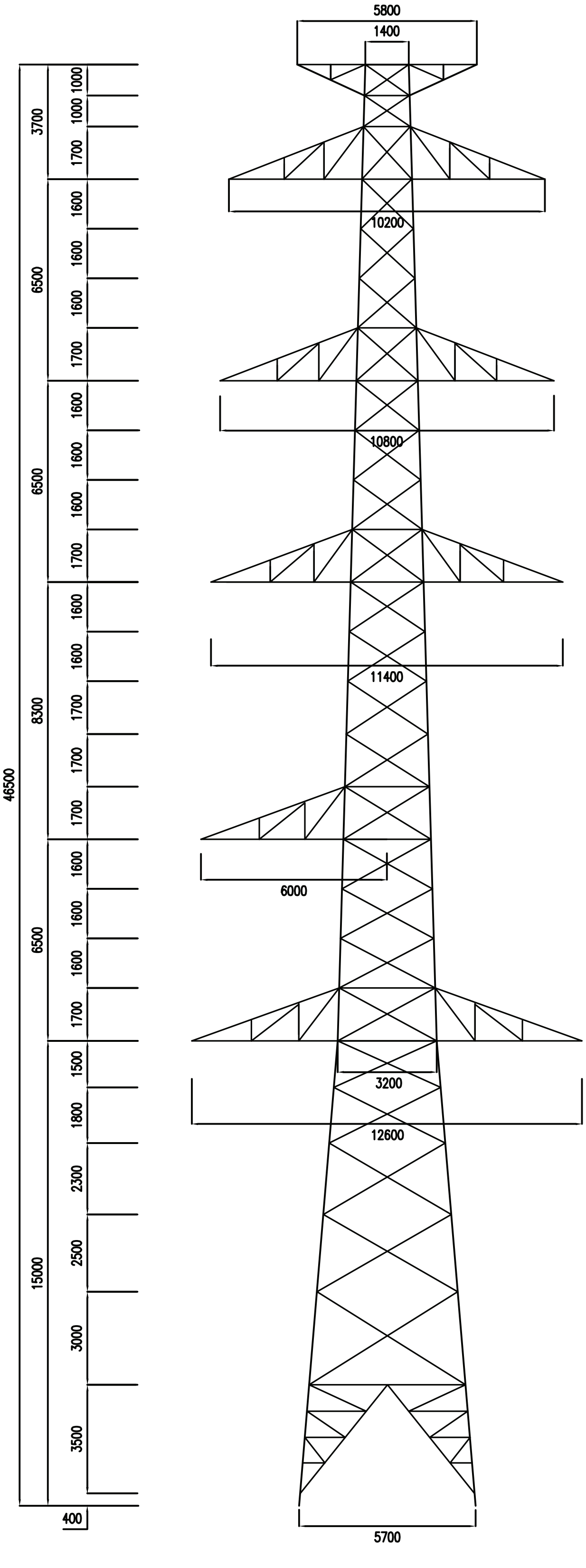

Step 3
Tanzanian side work (Black)
a. Shut down an electricity between Ubungo and Ilala line
b. Connection of a conductor between T20 and TG1
c. Connection of a conductor between TG2 and T18
(Equipment and materials shall be procured by Tanzania side)
T21
T20
TG1
Temporary 1
T19
Temporary 2
TG2
T18


Step 4
Japanese side work (Red)
a. Demolition and removal of the existing 132 kV tower T19 (including foundation)
b. Construction of 132 kV 2 ccts dead end tower (permanent) NT20 and NT19
c. Connection work of 132 kV temporary conductor (TACSR) between NT20 and NT19
T21
NT20
TG1
Temporary 1
NT19
Temporary 2
TG2
T18


Step 5
Tanzanian side work (Black)
a. Shut down an electricity between Ubungo and Ilala line
b. Connection work of 132 kV conductor between T20 and NT20
c. Connection work of 132 kV conductor between T18 and NT19
(Materials, such as conductor, etc, between T20 and NT20 and between NT19 and T18 shall be procured by Japanese side except insulator and etc. at T20 and T18)
d. Demolition and removal of a conductor between T20 and TG1
e. Demolition and removal of a conductor between T18 and TG2
T21
NT20
T20
TG1
Temporary 1
NT19
Temporary 2
TG2
T18


Step 6
Tanzanian side work (Black)
a. Demolition and removal of TG1, TG2, temporary tower 1, 2, conductor and accessories
Japanese side work (Red)
b. Construction of Mabibo substation
T21
NT20
NT19
T18
Green Existing 132 kV 2 ccts
Purple New 132 kV 2 ccts
Red New 132 kV 2ccts


Step 7
Tanzanian side work
a. Shut down an electricity between Ubungo and Ilala substation
Japanese side work (Red)
b. Removal of 132 kV temporary conductor (TACSR) between NT20 and NT19
c. Connection of 132 kV under ground cable between NT20 and new Mabibo substation
d. Connection of 132 kV under ground cable between NT19 and new Mabibo substation
T21
T20
NT20
NT19
T18
Green Existing 132 kV 2 ccts
Purple New 132 kV 2 ccts
Red New 132 kV 2ccts
Light bule 220 kV 2 ccts



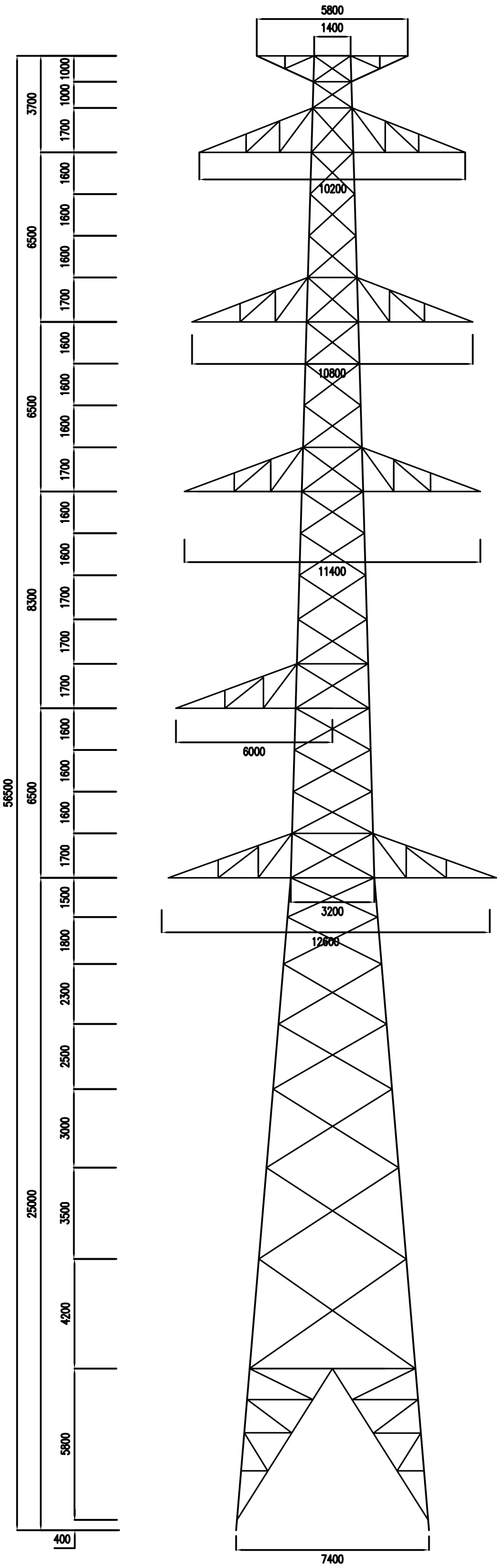
15m Leg

REFERENCE ONLY

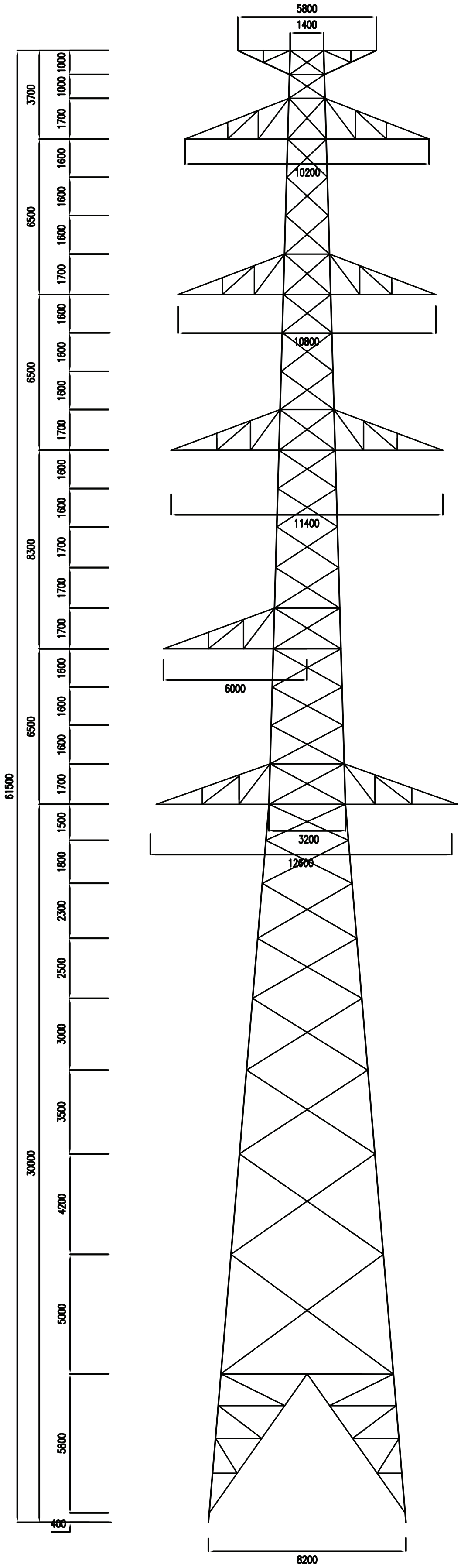
THE PROJECT FOR REINFORCEMENT OF SUPPLY FROM KINYEREZI POWER STATION TO UBUNGO SUBSTATION IN DAR ES SALAAM IN THE UNITED REPUBLIC OF TANZANIA		SCALE
Title: 220 kV Transmission Line 3 ccts Steel Tower Type A Leg. 15m		DWG. No. TL-KU-1
DATE	DESIGNED	CHECKED	APPROVED	REVISION

A5-97

YACHIYO ENGINEERING CO., LTD.
TOKYO, JAPAN



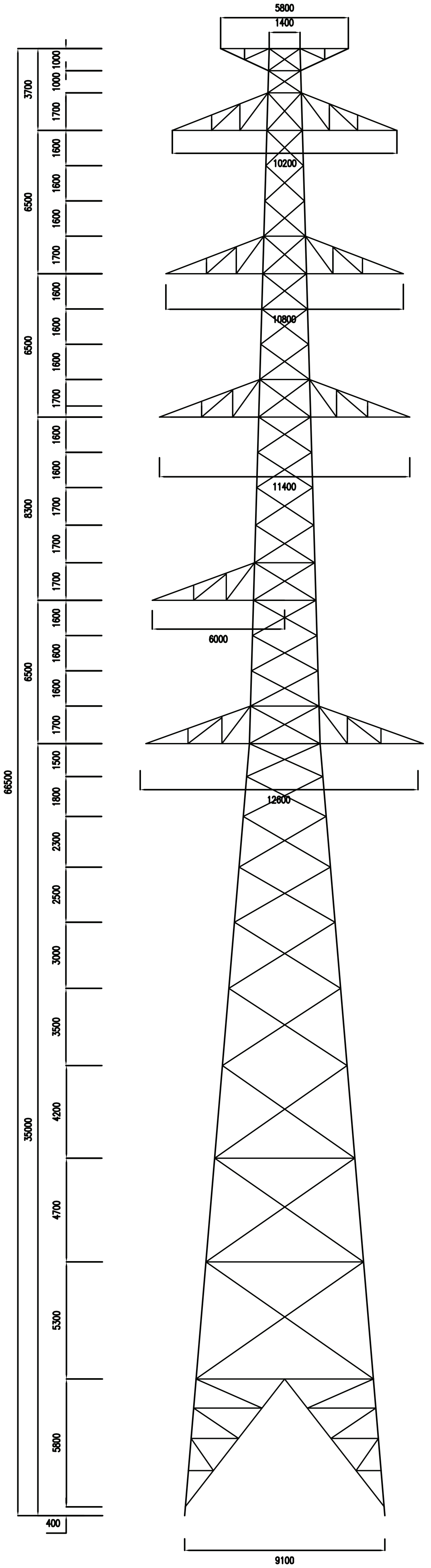
25m Leg



30m Leg

REFERENCE ONLY

THE PROJECT FOR REINFORCEMENT OF SUPPLY FROM KINYEREZI POWER STATION TO UBUNGO SUBSTATION IN DAR ES SALAAM IN THE UNITED REPUBLIC OF TANZANIA				SCALE
Title 220 kV Transmission Line 3 ccts Steel Tower Type A Leg. 25m, Leg. 30m				DWG. No. TL-KU-2
DATE	DESIGNED	CHECKED	APPROVED	REVISION
YEC YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				

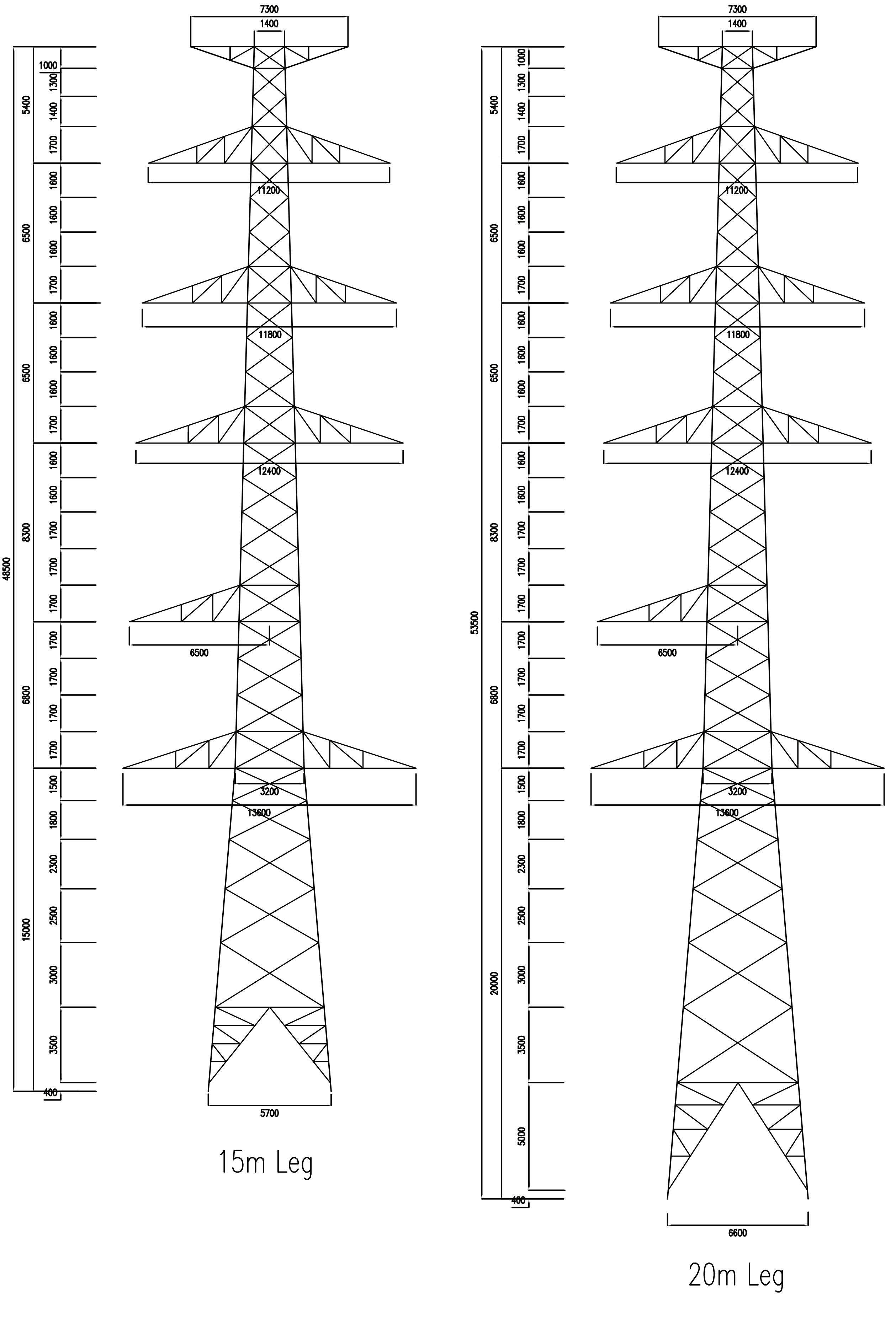


35m Leg

REFERENCE ONLY

THE PROJECT FOR REINFORCEMENT OF SUPPLY FROM KINYEREZI POWER STATION TO UBUNGO SUBSTATION IN DAR ES SALAAM IN THE UNITED REPUBLIC OF TANZANIA				SCALE
Title 220 kV Transmission Line 3 ccts Steel Tower Type A Leg. 35m				DWG. No. TL-KU-3
DATE	DESIGNED	CHECKED	APPROVED	REVISION
YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				

A5-99



REFERENCE ONLY

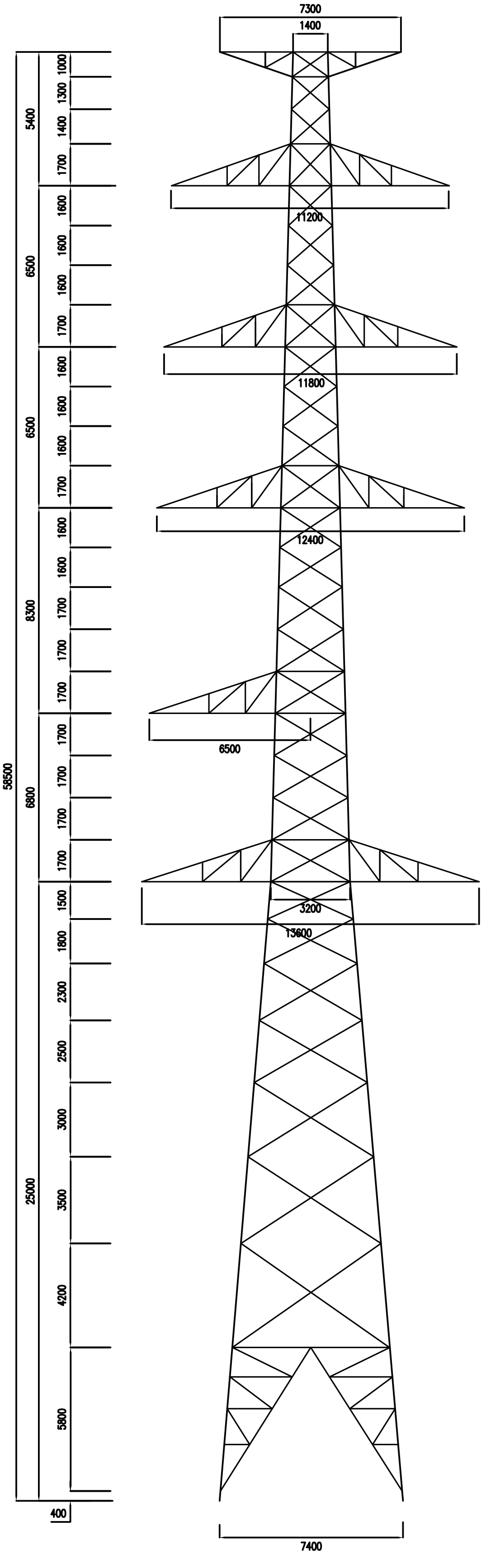
THE PROJECT FOR REINFORCEMENT OF SUPPLY FROM
KINYEREZI POWER STATION TO UBUNGO SUBSTATION
IN DAR ES SALAAM
IN THE UNITED REPUBLIC OF TANZANIA

Title: 220 kV Transmission Line 3 ccts Steel Tower Type B Leg. 15m, Leg. 20m	SCALE
	DWG. No. TL-KU-4

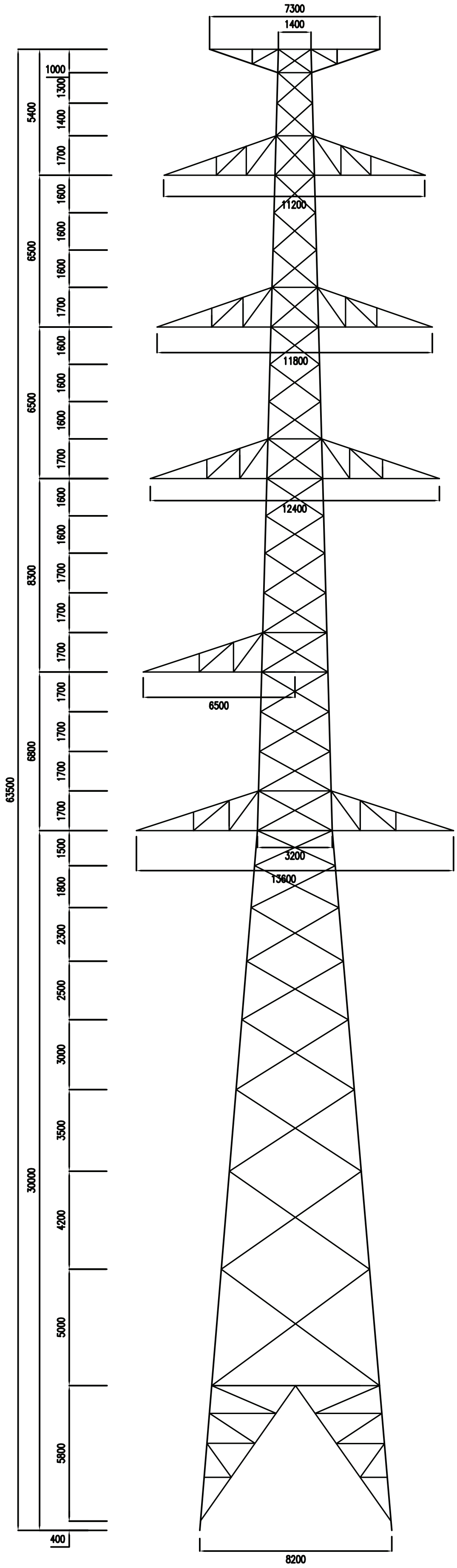
DATE	DESIGNED	CHECKED	APPROVED	REVISION

A5-100

YACHIYO ENGINEERING CO., LTD.
TOKYO, JAPAN



25m Leg



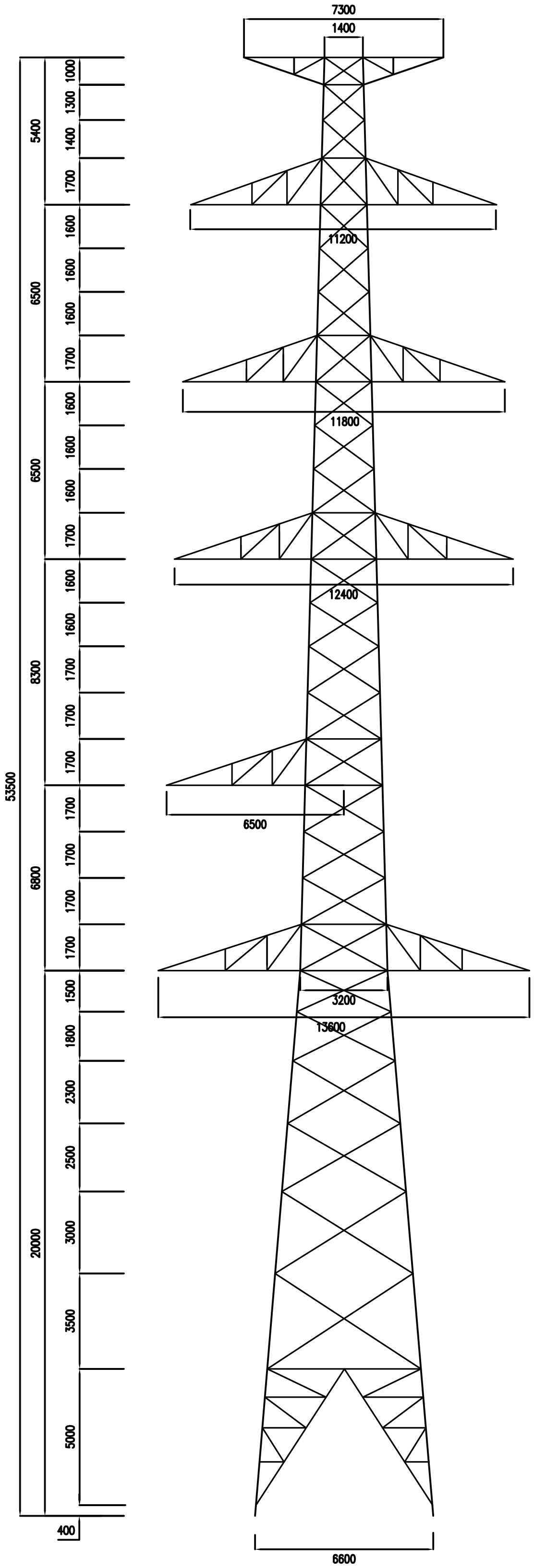
30m Leg

REFERENCE ONLY

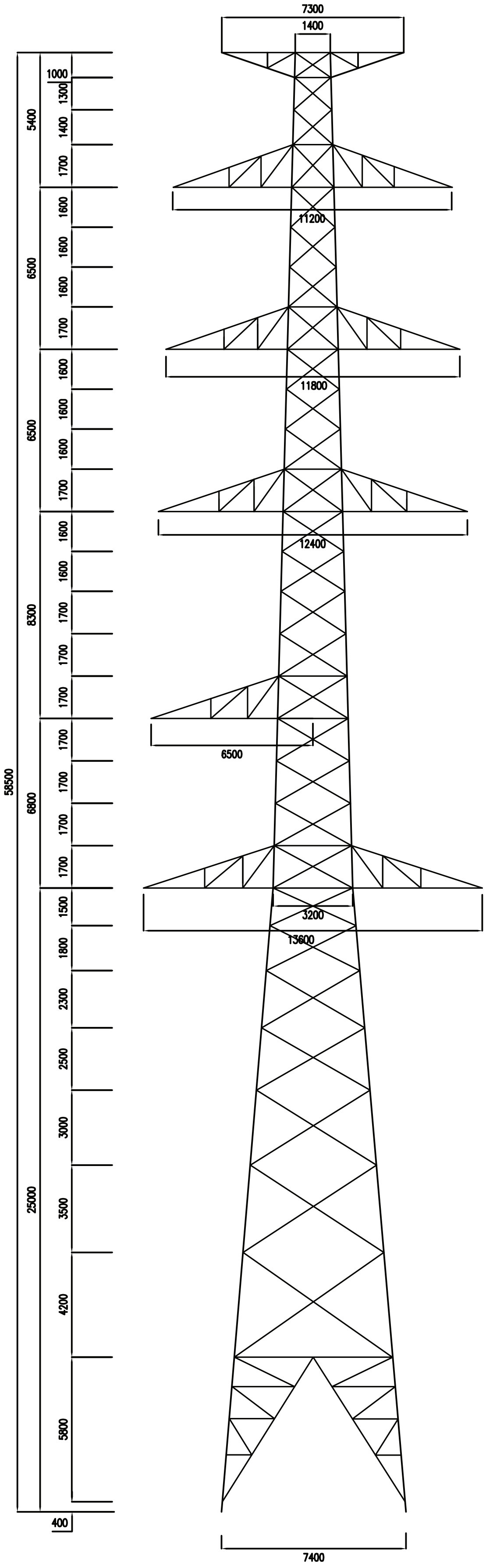
A5-101

THE PROJECT FOR REINFORCEMENT OF SUPPLY FROM KINYEREZI POWER STATION TO UBUNGO SUBSTATION IN DAR ES SALAAM IN THE UNITED REPUBLIC OF TANZANIA				SCALE
Title: 220 kV Transmission Line 3 ccts Steel Tower Type B Leg. 25m, Leg. 30m				DWG. No. TL-KU-5
DATE	DESIGNED	CHECKED	APPROVED	REVISION

YACHIYO ENGINEERING CO., LTD.
TOKYO, JAPAN



20m Leg

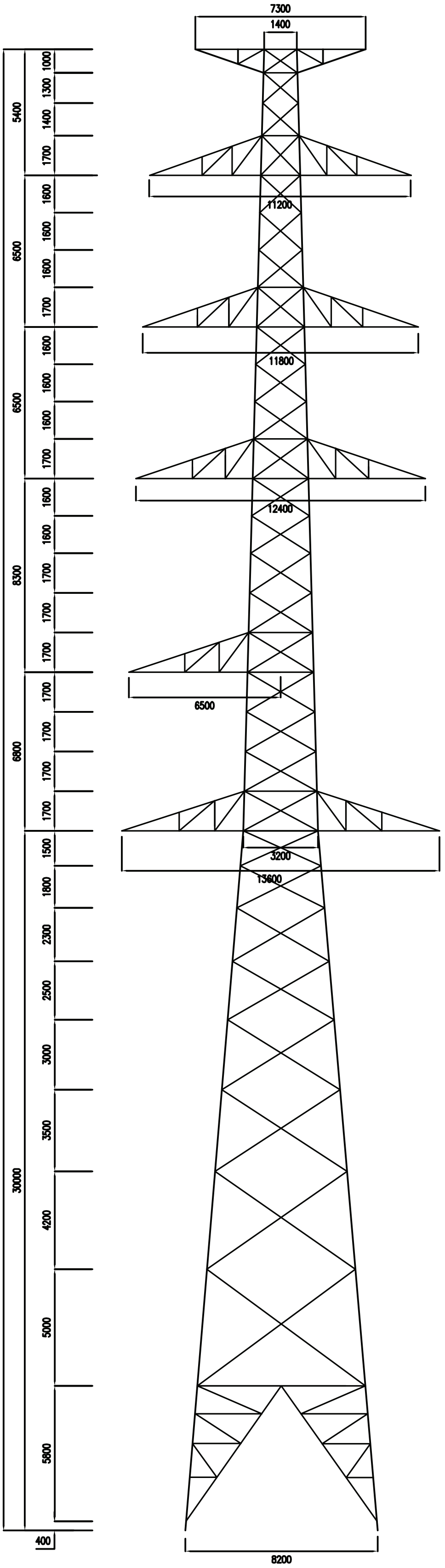


25m Leg

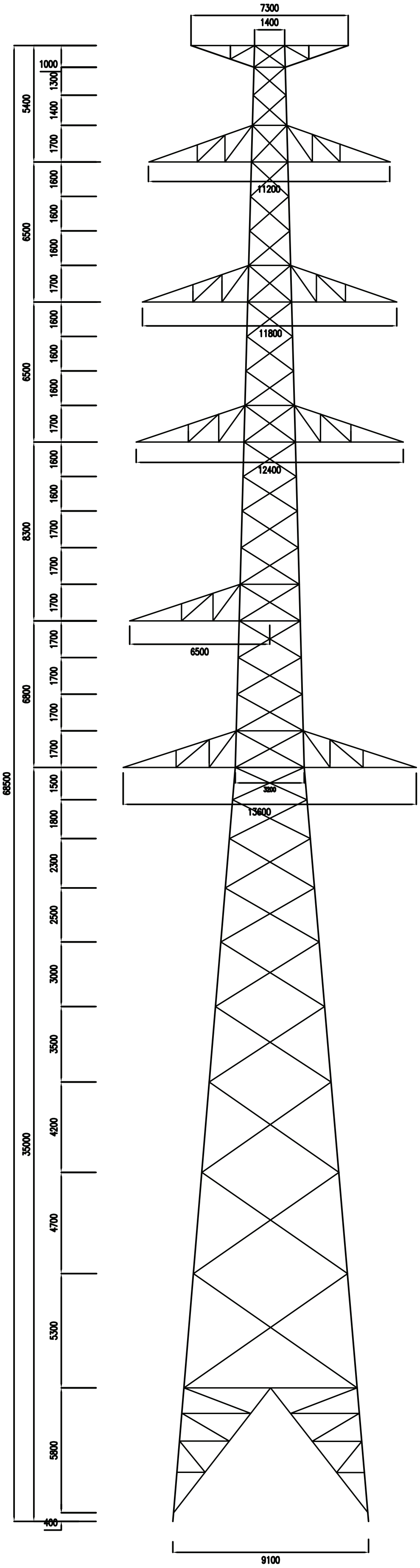
REFERENCE ONLY

THE PROJECT FOR REINFORCEMENT OF SUPPLY FROM KINYEREZI POWER STATION TO UBUNGO SUBSTATION IN DAR ES SALAAM IN THE UNITED REPUBLIC OF TANZANIA				SCALE
Title 220 kV Transmission Line 3 ccts Steel Tower Type C Leg. 20m, Leg. 25m				DWG. No. TL-KU-6
DATE	DESIGNED	CHECKED	APPROVED	REVISION
YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				

A5-102



30m Leg



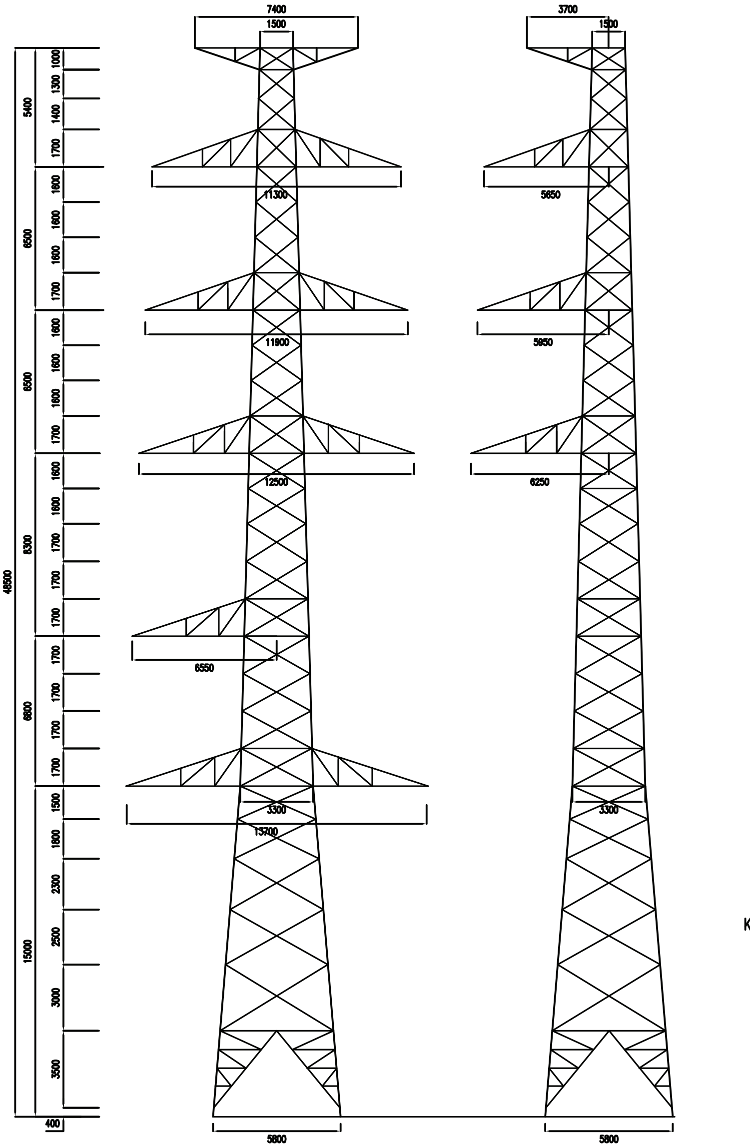
35m Leg

REFERENCE ONLY

THE PROJECT FOR REINFORCEMENT OF SUPPLY FROM KINYEREZI POWER STATION TO UBUNGO SUBSTATION IN DAR ES SALAAM IN THE UNITED REPUBLIC OF TANZANIA	SCALE
Title 220 kV Transmission Line 3 ccts Steel Tower Type C Leg. 30m, Leg. 35m	DWG. No. TL-KU-7
DATE | DESIGNED | CHECKED | APPROVED	REVISION

YACHIYO ENGINEERING CO., LTD.
TOKYO, JAPAN

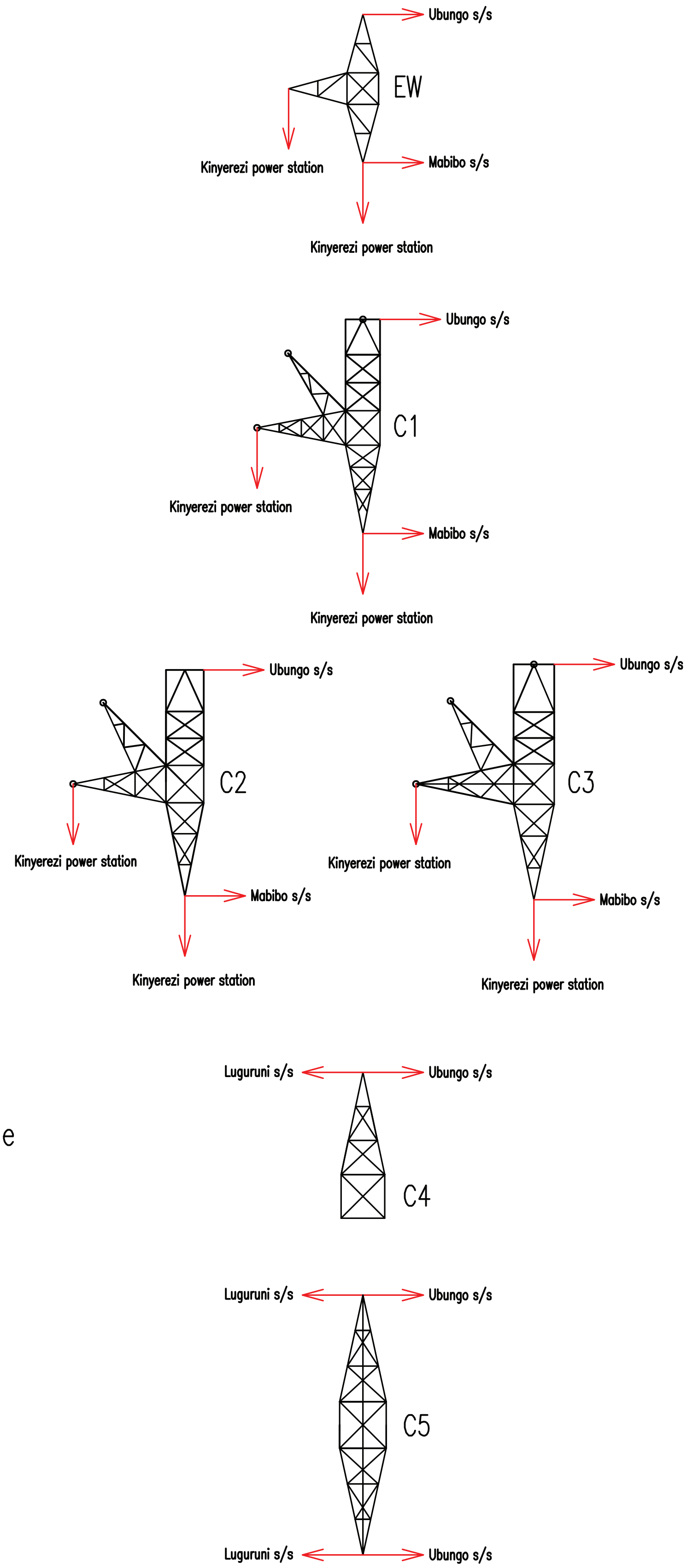
A5-103



Front : Luguruni side

Front : Kinyerezi side

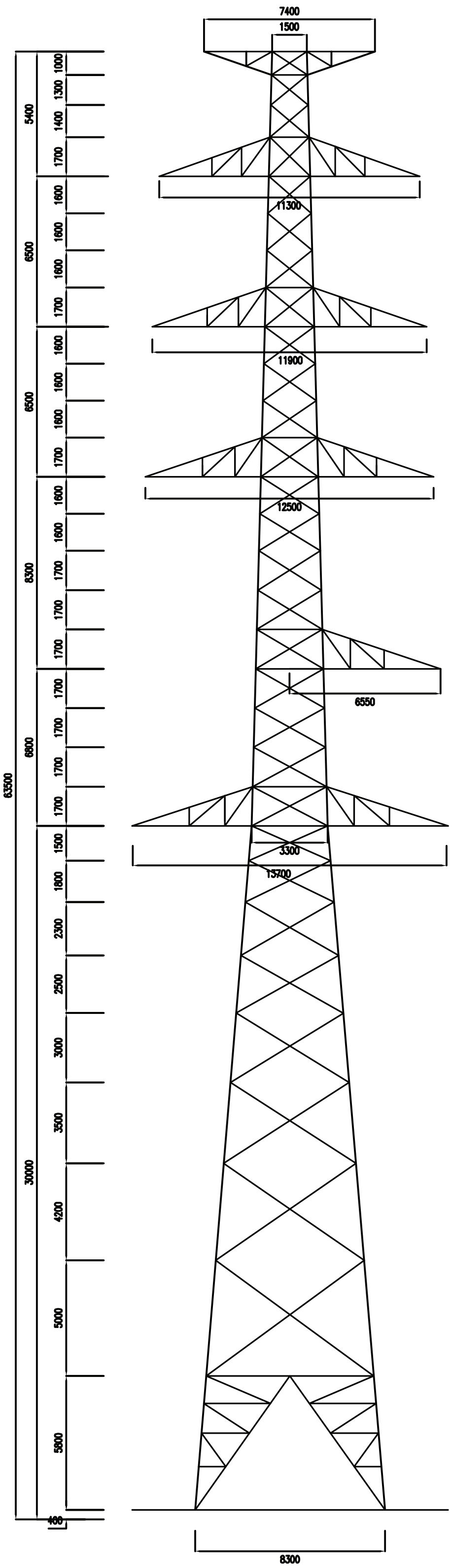
15m Leg



REFERENCE ONLY

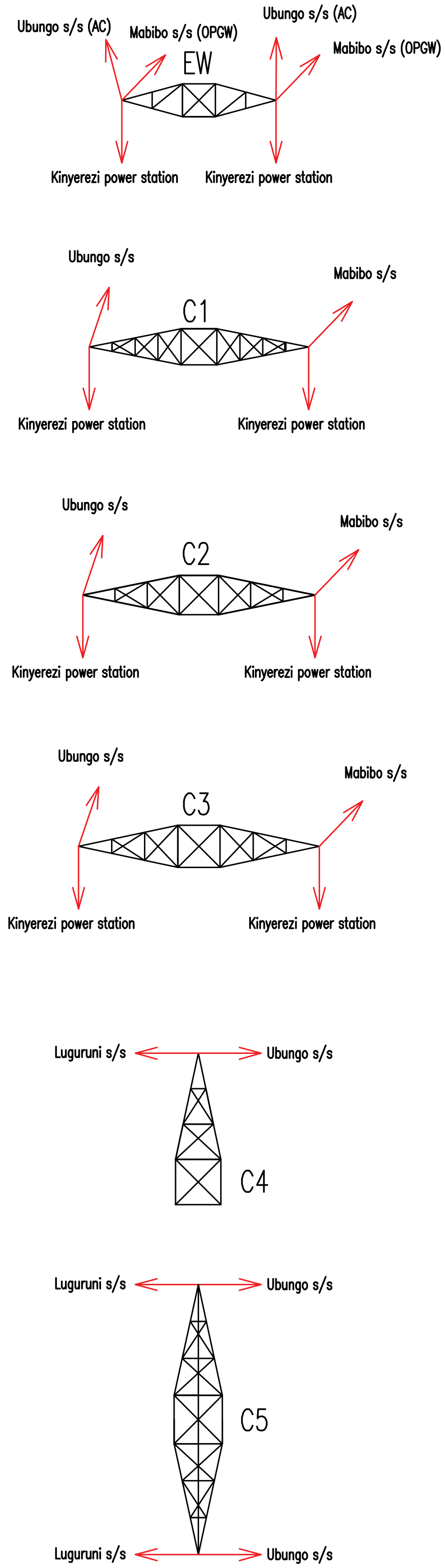
THE PROJECT FOR REINFORCEMENT OF SUPPLY FROM KINYEREZI POWER STATION TO UBUNGO SUBSTATION IN DAR ES SALAAM IN THE UNITED REPUBLIC OF TANZANIA	SCALE
Title: 220 kV Transmission Line 3 ccts Steel Tower Type D-1 No.1 Tower	DWG. No. TL-KU-8
DATE / DESIGNED / CHECKED / APPROVED	REVISION

YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN



Front : Kinyerezi side

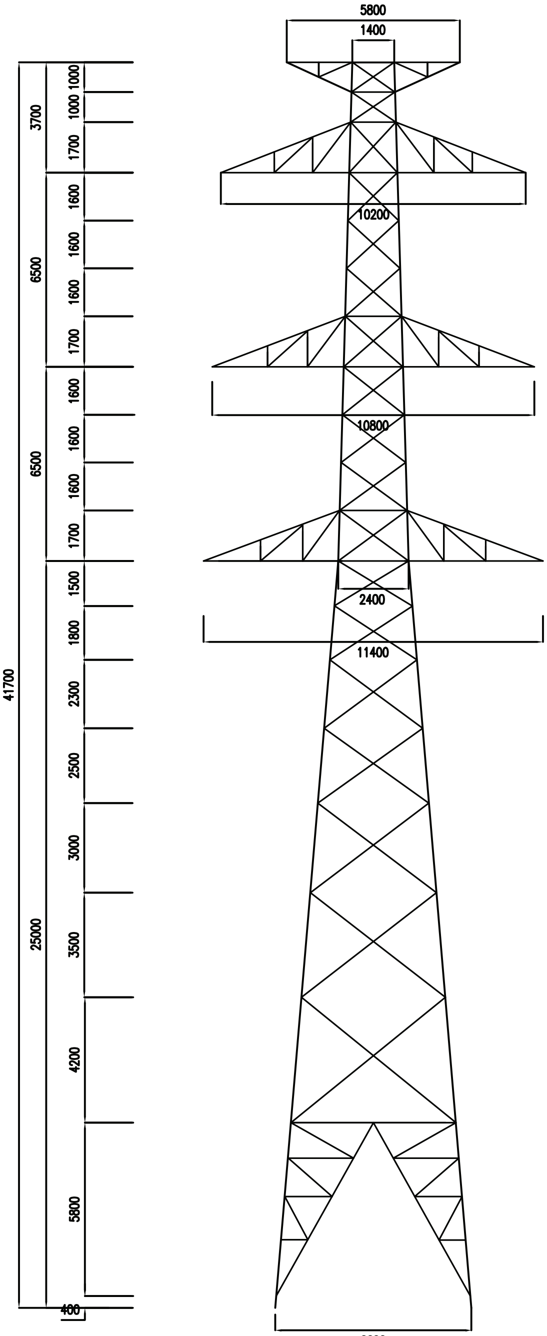
30m Leg



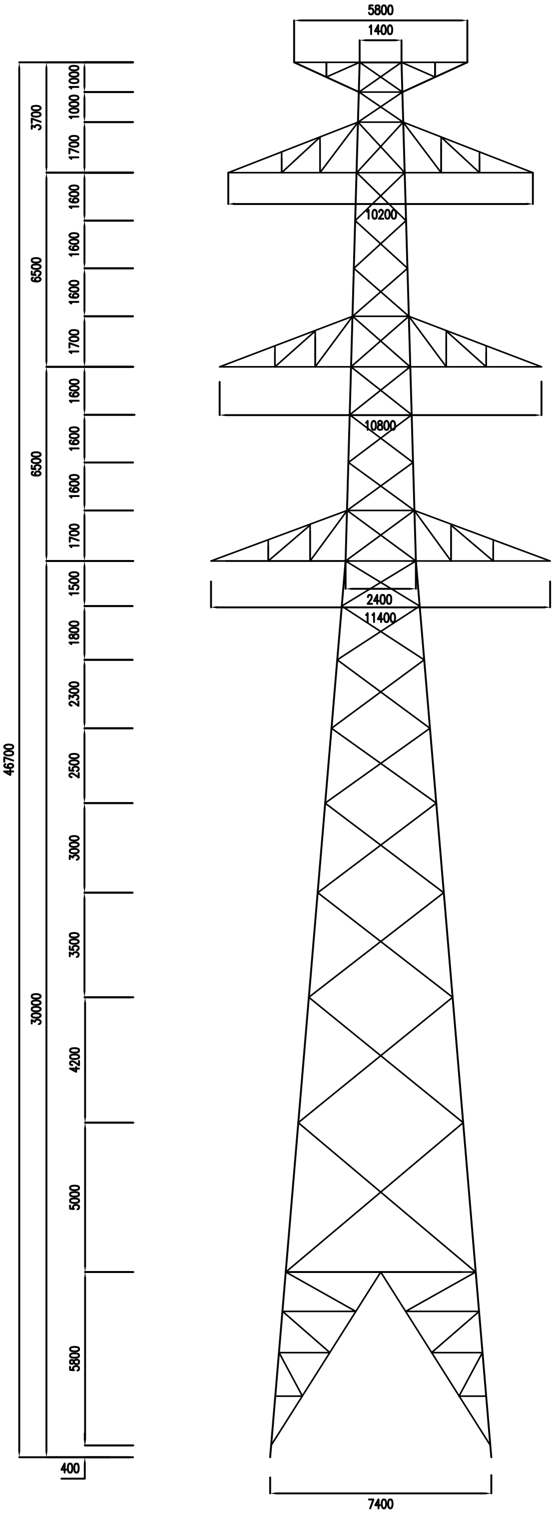
REFERENCE ONLY

THE PROJECT FOR REINFORCEMENT OF SUPPLY FROM KINYEREZI POWER STATION TO UBUNGO SUBSTATION IN DAR ES SALAAM IN THE UNITED REPUBLIC OF TANZANIA	SCALE
Title: 220 kV Transmission Line 3 ccts Steel Tower Type D-2 No.15 Tower	DWG. No. TL-KU-9
DATE / DESIGNED / CHECKED / APPROVED	REVISION

YACHIYO ENGINEERING CO., LTD.
TOKYO, JAPAN



25m Leg



30m Leg

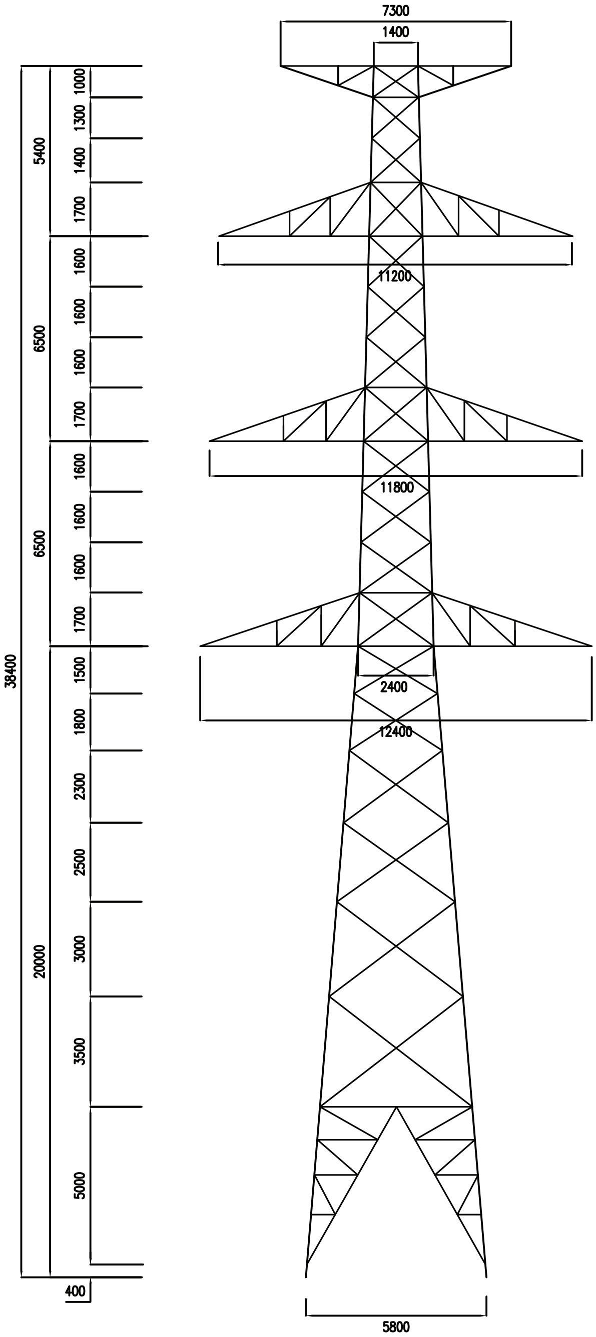
REFERENCE ONLY

THE PROJECT FOR REINFORCEMENT OF SUPPLY FROM
KINYEREZI POWER STATION TO UBUNGO SUBSTATION
IN DAR ES SALAAM
IN THE UNITED REPUBLIC OF TANZANIA

Title	SCALE
220 kV Transmission Line 2 ccts Steel Tower Type A Leg. 25m, Leg. 30m	DWG. No. TL-KU-10

DATE	DESIGNED	CHECKED	APPROVED	REVISION

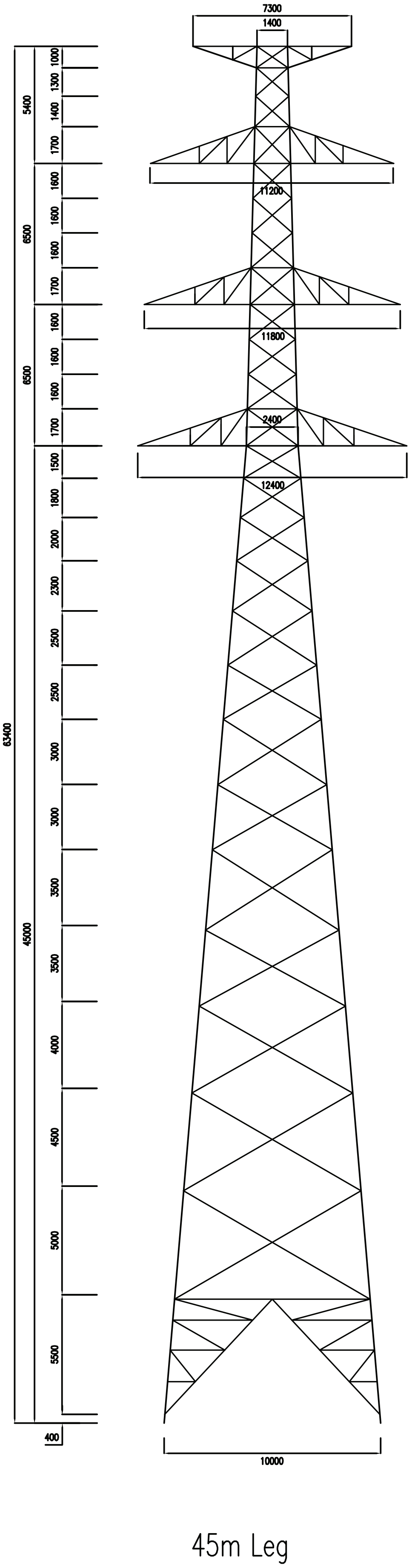
YACHIYO ENGINEERING CO., LTD.
TOKYO, JAPAN



20m Leg

REFERENCE ONLY

THE PROJECT FOR REINFORCEMENT OF SUPPLY FROM KINYEREZI POWER STATION TO UBUNGO SUBSTATION IN DAR ES SALAAM IN THE UNITED REPUBLIC OF TANZANIA				SCALE
Title 220 kV Transmission Line 2 ccts Steel Tower Type C Leg. 20m				DWG. No. TL-KU-11
DATE	DESIGNED	CHECKED	APPROVED	REVISION
YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				

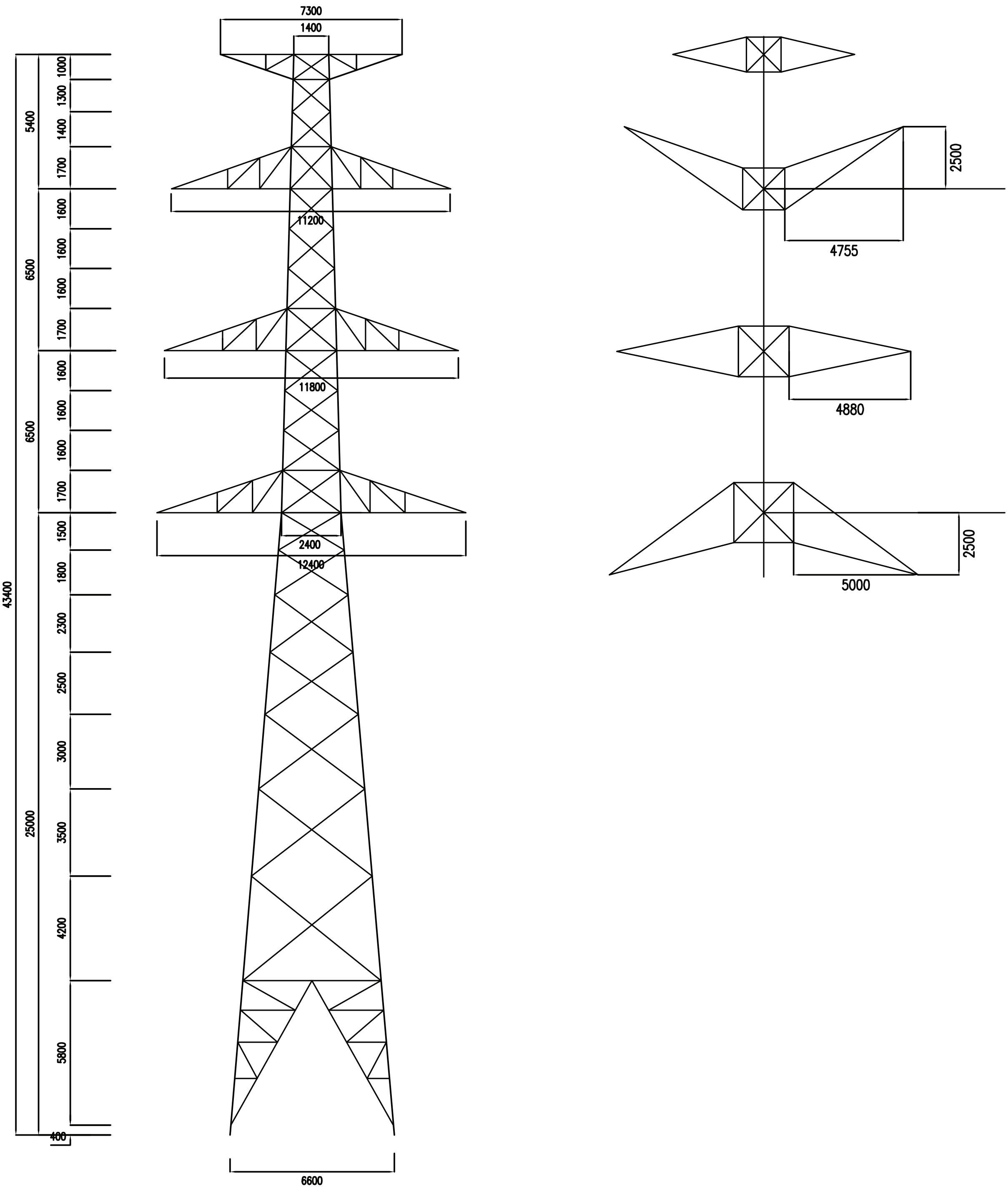


45m Leg

REFERENCE ONLY

THE PROJECT FOR REINFORCEMENT OF SUPPLY FROM KINYEREZI POWER STATION TO UBUNGO SUBSTATION IN DAR ES SALAAM IN THE UNITED REPUBLIC OF TANZANIA	SCALE
Title 220 kV Transmission Line 2 ccts Steel Tower Type C Leg. 45m (No.16 Tower)	DWG. No. TL-KU-12
A5-108 DATE / DESIGNED / CHECKED / APPROVED	REVISION

YACHIYO ENGINEERING CO., LTD.
TOKYO, JAPAN

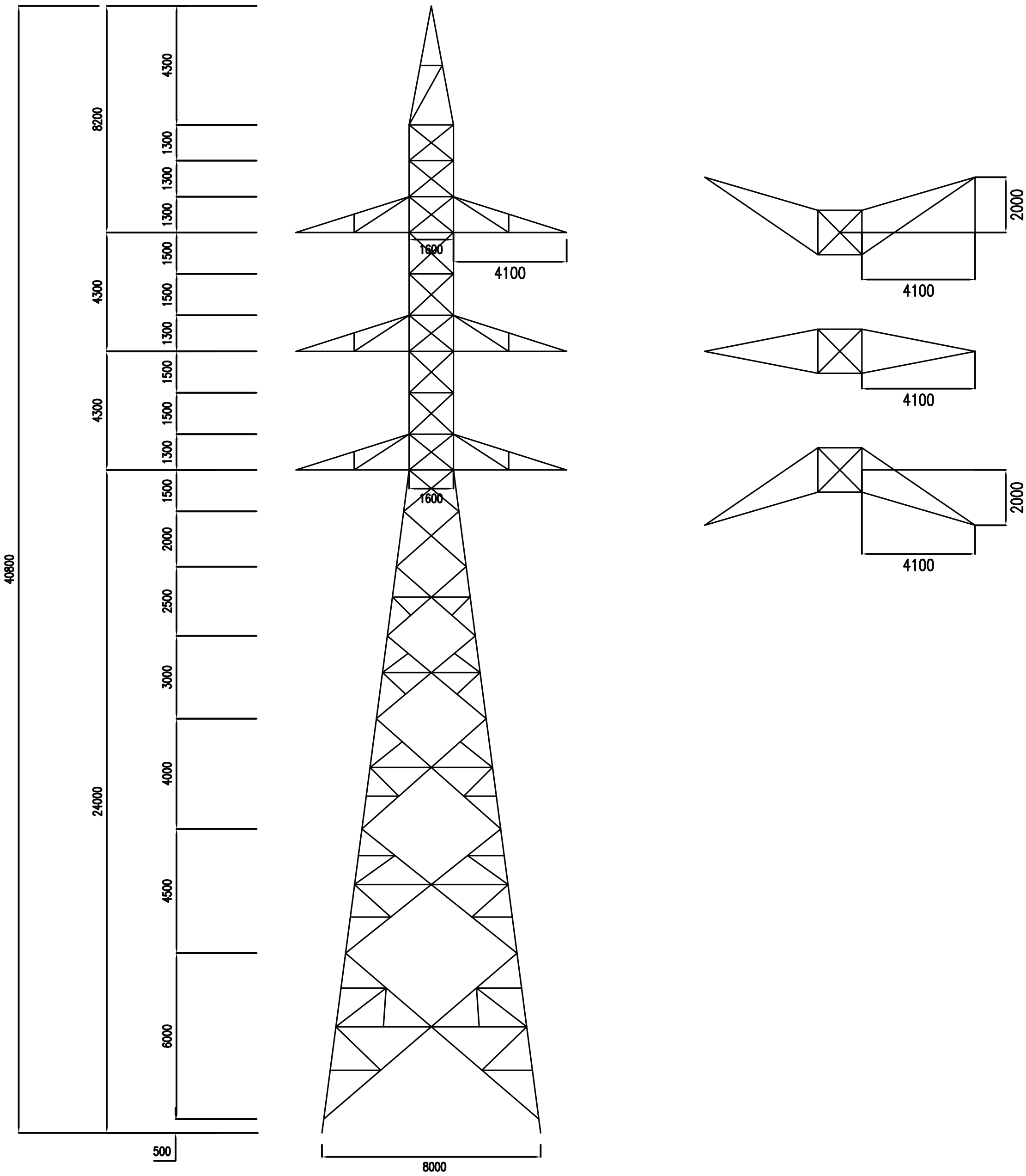


25m Leg

REFERENCE ONLY

THE PROJECT FOR REINFORCEMENT OF SUPPLY FROM KINYEREZI POWER STATION TO UBUNGO SUBSTATION IN DAR ES SALAAM IN THE UNITED REPUBLIC OF TANZANIA	SCALE
Title 220 kV Transmission Line 2 ccts Steel Tower Type D Leg. 25m	DWG. No. TL-KU-13
DATE / DESIGNED / CHECKED / APPROVED	REVISION

YACHIYO ENGINEERING CO., LTD.
TOKYO, JAPAN



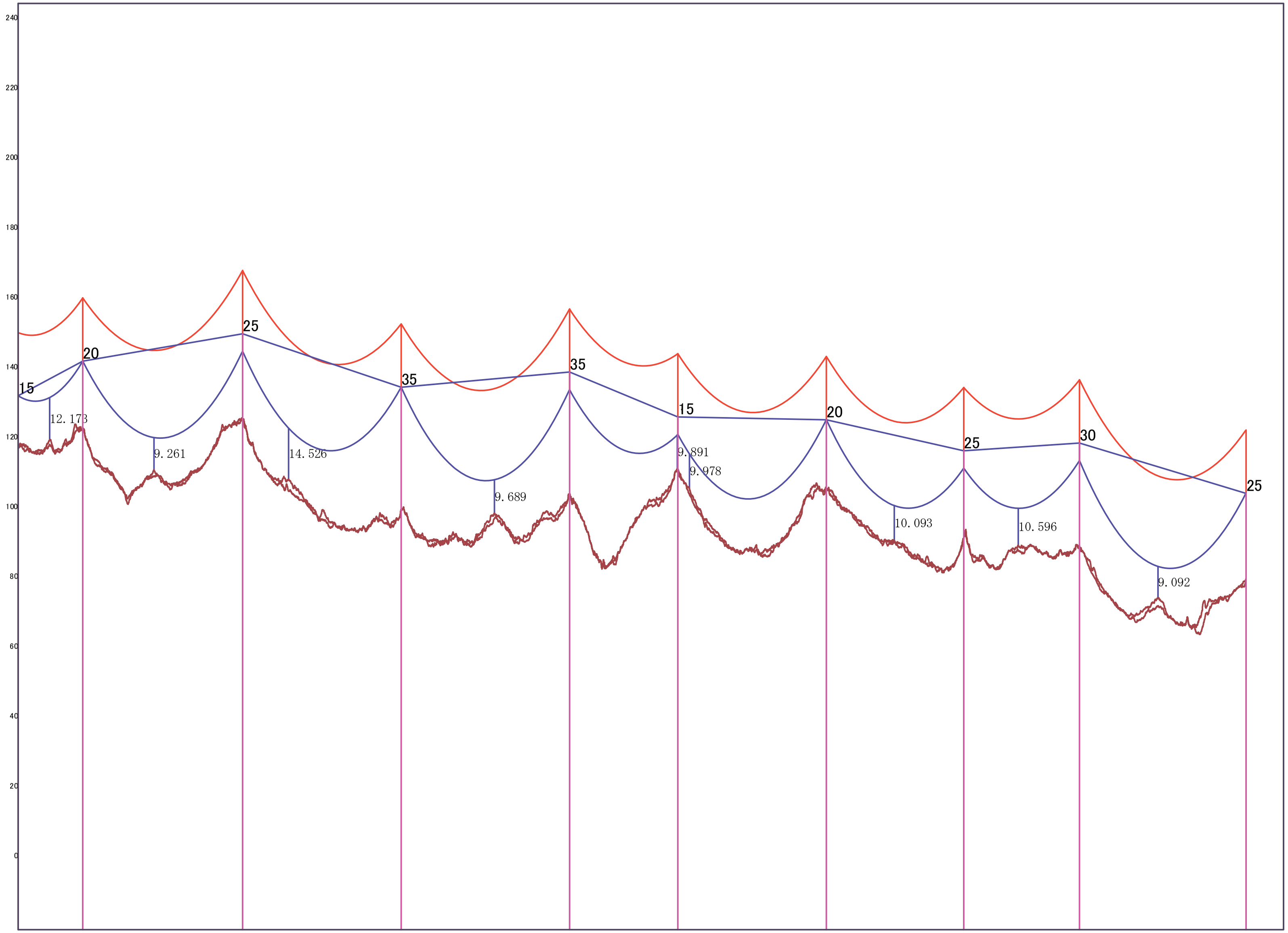
24m Leg

REFERENCE ONLY

THE PROJECT FOR REINFORCEMENT OF SUPPLY FROM KINYEREZI POWER STATION TO UBUNGO SUBSTATION IN DAR ES SALAAM IN THE UNITED REPUBLIC OF TANZANIA	SCALE
Title: 132 kV Transmission Line 2 ccts Steel Tower Type D Leg. 24m	DWG. No. TL-KU-14

DATE	DESIGNED	CHECKED	APPROVED	REVISION

YACHIYO ENGINEERING CO., LTD.
TOKYO, JAPAN

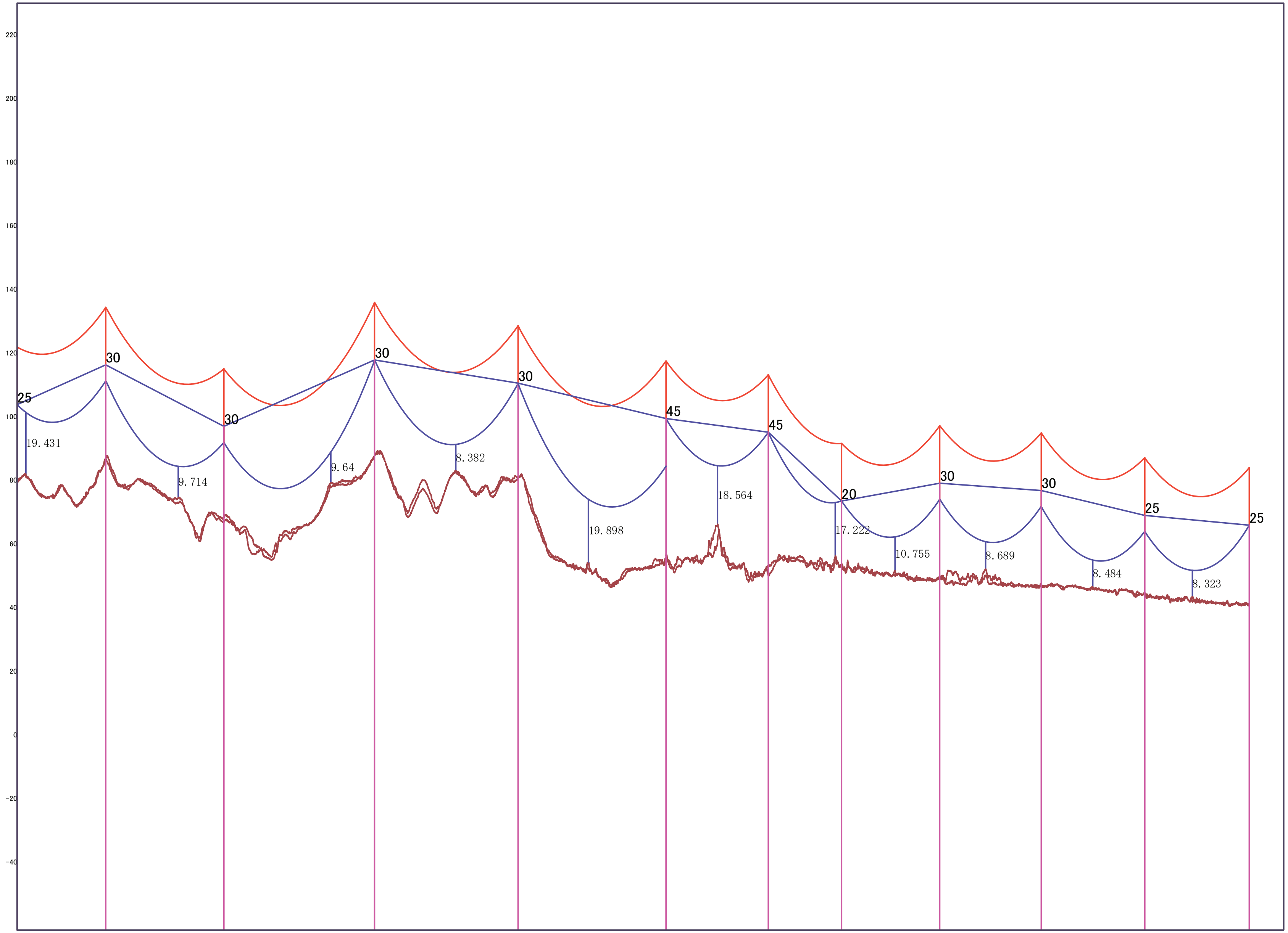


Conductor (mm2)	ACSR 603
Max. working tension	3,479kgf
SCALE (H)	10000
SCALE (V)	1000

Tower No.	1	2	3	4	5	6	7	8	9	10
Span		184.72	457.75	454.15	482.17	310.26	425.27	393.59	331.73	476.68
Line Angle		L0° -25′	L0° -3′	L0° -6′	R0° -29′	L0° -8′	L0° -41′	R0° -53′	L0° -44′	R1° -58′
Ground level difference		+4.95	+2.83	-25.31	+4.33	+7.18	-5.83	-13.88	-2.79	-9.39
Ground level	114	122	124	100	103	110	106	91	89	81
X (Easting) (m)	517321.95	517503.00	517951.00	518395.38	518867.00	519171.00	519587.50	519972.00	520297.11	520763.04
Y (Northing) (m)	9247688.36	9247725.00	9247819.00	9247912.68	9248013.00	9248075.00	9248160.89	9248245.00	9248310.91	9248411.59
Leg Height (m)	15	20	25	35	35	15	20	25	30	25

A5-111

TL-LP-01 Tentative 220 kV Transmission Line Line Profile

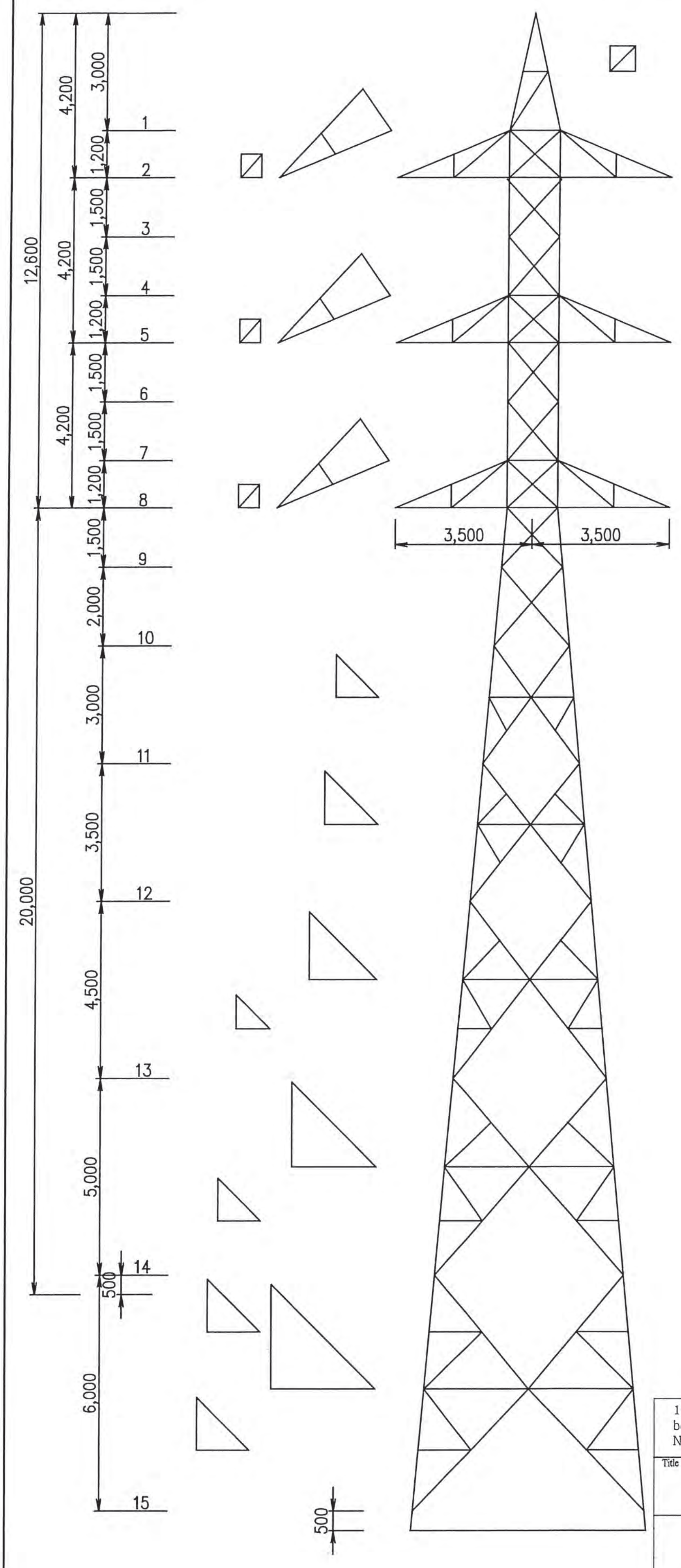


Conductor (mm2)	ACSR 603
Max. working tension	3,479kgf
SCALE (H)	10000
SCALE (V)	1000

Tower No.	10	11	12	13	14	15	16	17	18	19	20	21
Line Angle	R1° -58′	R0° -46′	R0° -43′	L13° -57′	L1° -5′	R44° -2′	L14° -16′	R17° -44′	R0° -23′	L0° -9′	R0° -43′	
Ground level difference	-9.39	+7.55	-19.38	+20.88	-7.31	-26.05	-4.31	+3.35	-4.4	-2.27	-2.82	-3.09
Ground level	81	87	69	89	81	54	50	52	49	47	44	42
X (Easting) (m)	520763.04	521037.00	521403.00	521871.00	522287.00	522712.23	523014.00	523243.00	523525.60	523818.00	524109.00	524406.00
Y (Northing) (m)	9248411.59	9248461.00	9248522.00	9248594.00	92487[illegible].00	9248955.37	9248844.00	9248820.00	9248695.89	9248558.00	9248423.00	9248289.00
Leg Height (m)	25	30	30	30	30	45	45	20	30	30	25	25

Span	10–11	11–12	12–13	13–14	14–15	15–16	16–17	17–18	18–19	19–20	20–21
Span	278.37	371.05	473.51	450.92	464.68	321.66	230.25	308.65	318.83	325.05	328.98

A5-112



Reference only

132 kV Transmission Line between Ubungo and Ilala substation No.19, No.20 Tower	SCALE
Title Existing 132 kV Tower (No. 19 and No. 20) between Ubungo and Ilala substation	DWG. No. TL-UI-01