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

FINAL REPORT ON THE PROJECT FOR FORMULATION OF POWER SYSTEM MASTER PLAN IN DAR ES SALAAM AND COAST REGIONS AND REVIEW OF POWER SYSTEM MASTER PLAN 2012 IN THE UNITED REPUBLIC OF TANZANIA

POWER SYSTEM MASTER PLAN IN DAR ES SALAAM

MARCH 2017

JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

YACHIYO ENGINEERING CO., LTD.

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Abbreviations

AfDB	African Development Bank
AIS	Air-insulated Switchgear
CCGT	Combined Cycle Gas Turbine
CIF	Climate Investment Funds
DOE	Director of Environment
DSMP	Dar es Salaam Power System Master Plan
EAC	East African Community
EAR	Environmental Audit Report
EHS guidelines	Environmental, Health, and Safety guidelines
EIA	Environmental Impact Assessments
EIS	Environmental Impact Statement
EMA	Environmental Management Act
EMF	Electric and Magnetic Field
ESMF	Environmental and Social Management Framework
EPZ	Export Processing Zone
F/S	Feasibility Study
FYDP	Five Year Develpoment Plan
GHG	Greenhouse Gas
GIS	Gas-insulated Switchgear
ICNIRP	the International Commission on Non-Ionizing Radiation Protection
IFC	International Finance Corporation
SADC	Southern African Development Community
SAPP	the Southern African Power Pool
SEA	Strategic Environmental Assessments
SEs	Sector Environment sections
SEZ	Special Economic Zone
SR	Scorping Report
JICA	Japan International Cooperation Agency
LH	Korea Land & Housing Corporation
MEM	Ministry of Energy and Minerals
MLHHSD	Ministry of Lands Housing and Human Settlements Development
MNRT	Ministry of Natural Resources and Tourism
NEAC	National Environmental Advisory
NEMC	National Environmental Management Council
PSMP	Power System Master Plan
RCP	Representative Concentration Pathways
REA	Regional Energy Agency
REME	Regional Environmental Management Expert
RERE	Renewable Energy for Rural Electrification
ROW	Right of Way

RTU	Remote terminal Unit
TANESCO	Tanzania Electric Supply Company Limited
TBS	Tanzania Bureau of Standards
TDV2025	Tanzania Development Vision 2025
TEDAP	Tanzania Energy Development and Access Project
TOL	Tanzania Oxygen Limited
TOR	Terms of Reference
VPO	Vice President's Office
WB	World Bank

Chapter 1 Introduction

1-1 Background of the Study

Tanzania has marked a steady economic growth rate of 6 to 7% a year as the government strives to realize strong economy by indicating the direction of the country's development in the “Tanzania Development Vision 2025”. “The Tanzania Five Year Development Plan” announced in 2016 attempts to take advantage of the country's environment blessed with natural gas and mineral resources, which sets a goal of shifting the focus of agriculture economic base to industrial economy.

As of May 2014, TANESCO cumulatively owns 1,583 MW (561MW hydroelectric, 1,022 MW thermal) of power generation output, 4,866km of high-voltage line (220kV, 132kV and 66kV, as of November 2013) and 22,396km of medium-voltage transmission line and distribution line (33 and 11kV, as of November 2013). Despite the expansion of its electric power system utilizing domestic and donor funds to cope with the acceleration of demand for electric power in the recent years, large gap between demand and supply continues to exist. Dissatisfaction is voiced by the consumers of electric power as alleged causes of such power shortage included persistently high purchasing price of electric power from IPPs (independent power producers) and EPPs (emergency rental power generator operators) and financial distress of TANESCO.

In 2007, the Government of Tanzania developed a plan for the 25 years period starting in 2008 entitled the Power System Master Plan (PSMP) to improve the situation. The plan was updated in 2009 with the assistance of outside consultants in technical areas to reinforcement of power generation facilities and upgrading of key transmission line. PSMP updated in 2012 (hereafter "PSMP 2012") formulated a master plan that continued to 2035 in accordance with technical updates made among Ministry of Energy and Minerals (hereafter "MEM"), TANESCO and Tanzanian government officials.

However, PSMP 2012 is inadequate in terms of its power demand estimation, power supply development, system analysis and system planning analysis in addition to its reliance on premature methods. Proper update and establishment of update method unique to Tanzania is therefore needed in order to stabilize the quality and quantity of power supply amid TANESCO's current financial distress. As increase in demand for electricity following economic development is expected to continue in Dar es Salaam, Tanzania's largest commercial city which is about 10% of Tanzania's population and believed to account for nearly 50% of country's demand, the Government of Tanzania is aiming for strategic national policy with focus on shifting its commercial and industrial activities to adjacent coastal area.

JICA implemented a Study on “Rehabilitation of Power Distribution Facilities in Major Cities of Tanzania (hereafter "Master Plan for Power Transmission and Distribution in Major Cities")” in 2002 and formulated the master plan for upgrading the power transmission and distribution system in Dar es Salaam, Arusha and Kilimanjaro. However, the plan has not been updated since then, and does not fully reflect the recent power demand in Dar es Salaam where considerable economic development has taken place in the recent years. Preparation of master plan for power system including expansion, rehabilitation and new plans for the power transmission and distribution system in the Dar es Salaam region including the aforementioned coastal area that fully reflects the power demand in the recent years will be indispensable.

Under these circumstances, the Government of Tanzania has requested technical assistance to Japan for enhancing the capacity for PSMP formulation. JICA implemented a detailed plan formulation study in October 2013 in response to this request, and this project was launched after R/D (Record of Discussions) was exchanged between JICA and the Tanzania side in January 2014.

Thereafter, Tanzania requested JICA to update PSMP in line with the manifesto of the new government, i.e., achieving 4,915 MW generation capacity by 2020.

1-2 Objectives of the Study

Formulation of Dar es Salaam and Coastal regions Power System Master Plan through collaboration between JICA experts and TANESCO so as to improve TANESCO's capacity to develop master plans for other major cities following technology transfer.

1-3 Basic Policy for the Plan

Basic policy for the plan are to secure adequate power supply area incorporate city/regional development plan, improvement of power accessibility and determination of facility scale and new facility location considering future national power system. Transmission and Distribution planning will be determined and formulated with the following matters comprehensively;

- To consider upper-level plans in power sector and power policy
- To incorporate city/regional development plans
- To precede existing power system expansion plans
- To coordinate with national power system and higher-voltage system
- To adapt existing facilities effectively
- To determine adequate facilities and coverage area of power supply by preliminary study
- To consider future operation and maintenance
- To consider maintenance and improvement of power supply quality and reliability and transmission and distribution loss
- To consider environmental issues
- To plan safe and economical power system
- To consider future power demand flexibly
- To comply with TANESCO’s technical standards, international standards and other related laws.

1-4 Outline of the Study

1-4-1 Basic Concept of the Study

Table 1-4.1 shows the basic concept.

Table 1-4.1 Basic Concept of the Study

Item	Description
Objectives	Formulation of Dar es salaam and Coastal Regions Power System Development for 15 years Technical Transfer to the counterparts of Tanzania
Target Facility	Electric Power generation facilities and power system facilities of not less than 132kV substation facilities and transmission system owned by TANESCO
Implementation Agency	Tanzania Electric Supply Company Ltd. (TANESCO)
Scope of Work	Formulation of Dar es Salaam and Coastal Regions Power System Development including power demand forecast, power system development and investment plan.

Source: JICA Study Team

1-4-2 Outline of the Study Contents

Table 1-4.2 shows contents of the Study and its outline.

Table 1-4.2 Contents of the Study

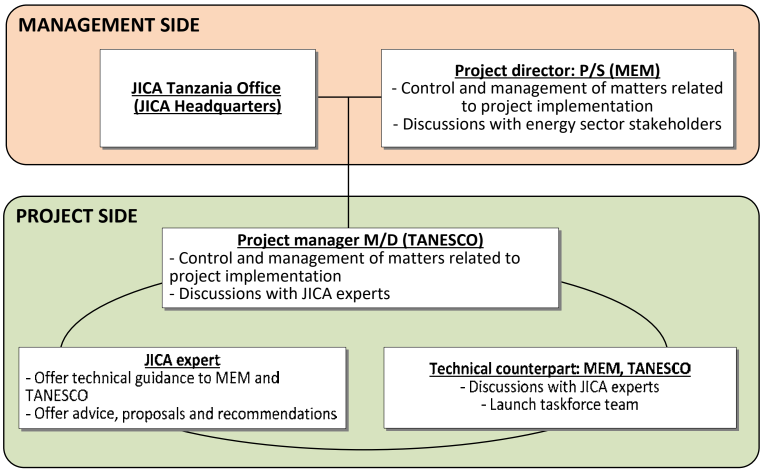
Contents	Outline
1. Review of the Power Sector	■ Review and analysis of the current power supply situation ■ Review of the existing power supply facilities
2. Power Demand Forecast	■ Review of method for power demand forecast ■ Formulation of power demand forecast ■ Power demand forecasting up to 2030
3. Formulation of Transmission System Planning	■ Data collection of the existing transmission system ■ Data collection and analysis of planned new / expansion plan for transmission and substation facilities ■ Coordination with “PSMP2016Update” ■ Study of Transmission System Planning and Cost Estimation
4. Formulation of Distribution System Planning	■ Data collection of the existing distribution system ■ Data collection and analysis of planned new / expansion plan for distribution facilities ■ Study for Actual load, Load characteristics ■ Study of Distribution System Planning and Cost Estimation
5. Environmental social considerations	■ Data collection of organizational structure and regulation framework for environmental social considerations ■ Data collection and analysis of prioritized projects
6. Formulation of Master Plan on National Power System Development	■ Formulation of Transmission and Distribution System Planning for 15 years. ■ Investment plan and economic evaluation ■ Methodology to formulate Transmission and Distribution System Planning.
7. Technical Transfer	■ The Master Plan shall be formulated in collaboration work between the study team and the Tanzanian counterparts.

Source: JICA Study Team

1-4-3 Project Organization

(1) Overall Project Organization

This project will be implemented as a collaborative work between JICA Experts and Tanzanian counterpart team in order to transfer technology through master plan formulation. Figure 1.4-1 shows the project implementation setup.



P/S: Permanent Secretary
M/D: Managing Director

[Source: Prepared using locally obtained data]

Figure 1-4.1 Project Implementation System and Roles

(2) Establishment of Task force Team

Before the commencement of Formulation of Power System Master Plan in Dar es Salaam and Coast Regions, the Team has commenced to confirm the preservation of documents and drawings, operational status and collection for transmission, substation and distribution facilities.

Because the concerned data is extensive, enormous and being not combine managed, the Study Team has established task force team in order for efficient and comprehensive data collection .

The Figure 1.4-2 shows the established task force team.

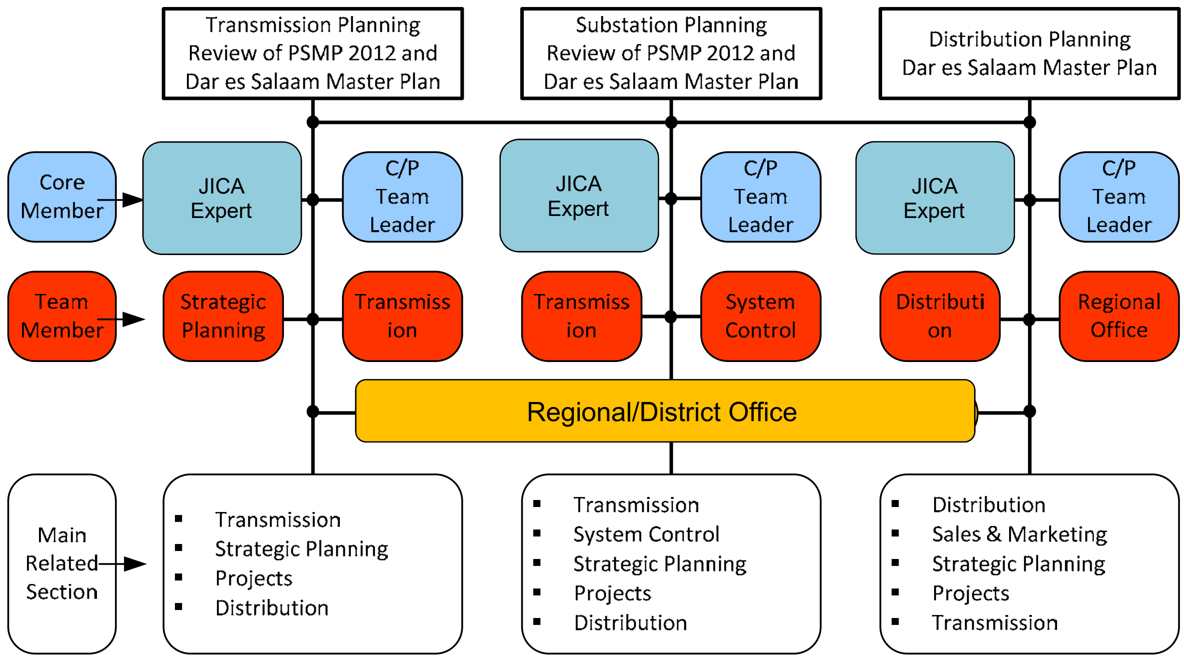


Figure 1-4.2 Configuration of Task force Team

Engineers, who took part in formulating PSMP 2012, have been nominated as the task force team members and engineers who know condition of operation and maintenance of distribution facilities from each regional office are also nominated.

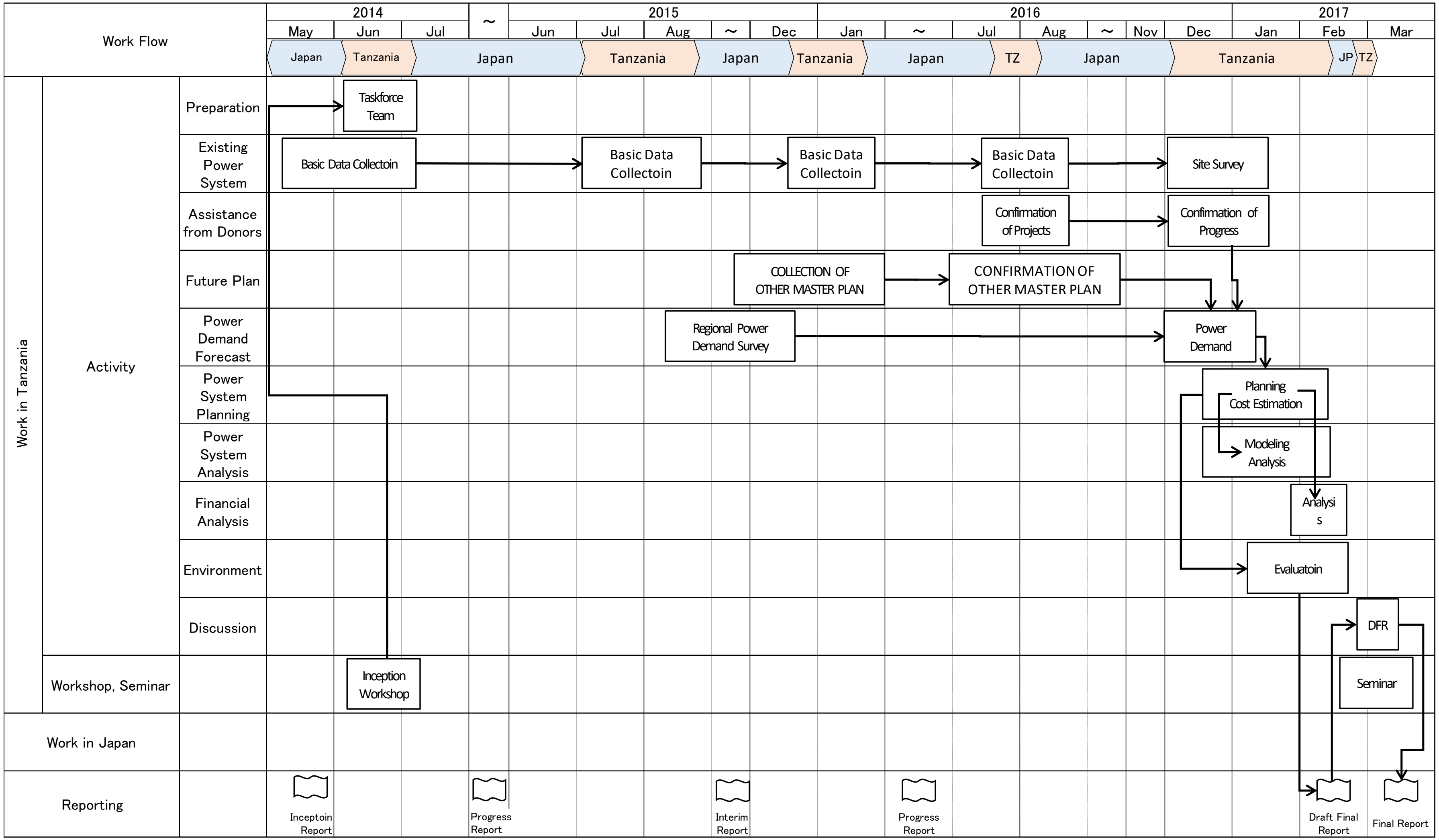
Furthermore, the taskforce team leaders are selected in order to lead the team, to continue the data collection and to communicate with JICA Experts even in their absence on the sites.

Although data collection regarding transmission and substation facilities has been carried out in parallel with data collection of PSMP, the Team has visited each regional office (Ilala, Kinondoni N., Kinondoni S., Temeke and Coast) in order to confirm the present condition of the facilities and operational status and to collect data from the regional offices because there are many primary substation existing in those regions.

Data collection work has been well done so far, however the Team needs to continue the data collection and analysis with close communication among the team to formulate power system master plan in Dar es Salaam and Coastal Regions to be concretely commenced from June 2015.

1-5 Process of the Study

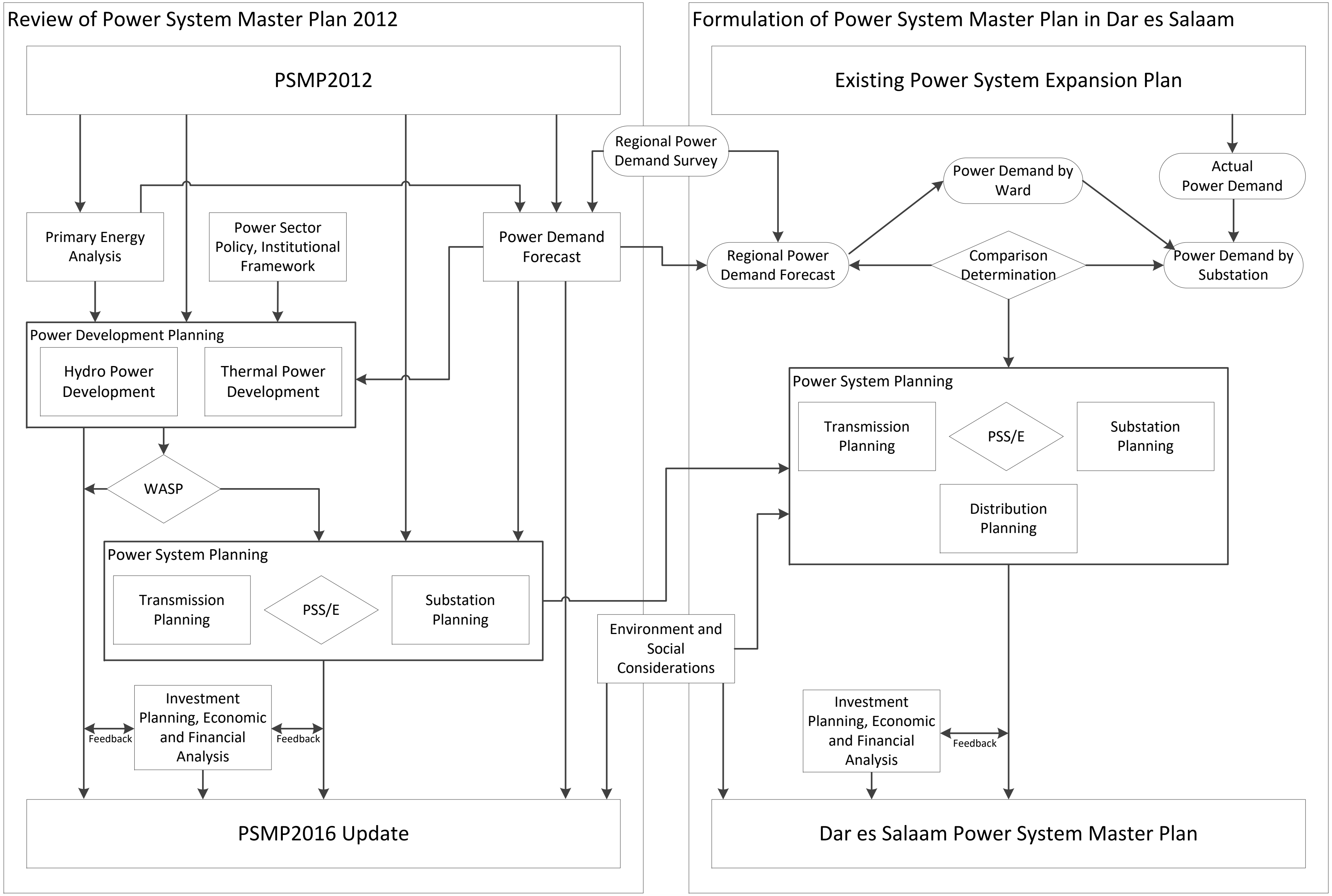
The Study is mainly divided into “Data Collection and Analysis”, “Base Data Compilation”, “Scenario Settings and Formulation of Master Plan” and “Review of Master Plan and Recommendations” stages. The process of the study on such stages is shown in the Figure 1-5.1.



Source: JICA Study Team

Figure 1-5.1 Overall Schedule and Process of the Study

1-6 Flow for Formulation of Dar es salaam and Coastal region Power System Master Plan



Source: JICA Study Team

Figure 1-6.1 Flow for Formulation of Dar es salaam and Coastal region Power System Master Plan

Chapter 2 General Conditions in Dar es Salaam city and its Surroundings

2-1 Socio-economic situation

2-1-1 Overview of the Dar es Salaam city and its surroundings

Dar es Salaam city is located in a coastal zone at latitude 6°42′ south and longitude 39°16′ east, facing the Indian Ocean. A plain stretches for 15-16 kilometers from the coast to the inland area.

(1) Marine port

Dar es Salaam Port is located in the center of Dar es Salaam, which is the largest trade port in Tanzania. That position is an important port as a transshipment port in East Africa region. Dar es Salaam's highly efficient terminal work will be explained by specialized container handling facilities, adoption of privatized administrative control, and so on. Dar es Salaam Port has become a top port harbor south of Sahara in terms of container handling productivity.

(2) Roads

In front of Dar es Salaam Port, a main arterial highway extends to the north and south with two lanes for both inbound and outbound traffic which are paved in all sections. In general, all major roads in Dar es Salaam are asphalt paved, include space along the side for foot traffic, and have a generous width for vehicle traffic. Rainwater gutters are also installed on either one or both sides of the road to provide road water drainage.

In recent years, Dar es Salaam has experienced a dramatic increase in traffic volume, and traffic congestion is common everywhere. Because of this, due consideration must be given to loading of equipment or construction materials.

(3) Water and sewer services

Dar es Salaam is outfitted with water and sewer services. Due to the low water pressure, however, in some cases extra measures are required such as installing the water service tanks on building rooftops.

Street gutters are installed on either one or both sides of city roads. Although these provide rainwater drainage for roads, no sewer pipes have been laid underground and sewer drains have not been maintained. Sewage effluent is discharged from all buildings except for those in the central city. Normally septic tanks are installed on premises and a leaching pit is in place to treat the sanitary sewage using osmosis.

(4) Communication

Every year communication situation of Dar es Salaam is improving such as high-speed 4G data communication and Wi-Fi spots in town and hotel are widely used, and there are no hindrances in communication between different regions. It is also worth noting that communication between TANESCO headquarters and substations is performed via optical fiber cable, UHF, and VHF radio.

2-1-2 Economic situation

In 2013, Tanzania continued to achieve rapid, stable economic growth. The rate of the growth stood at approximately 7 %, which is consistent with Tanzania's past three year average, and it is significantly higher than the rate of growth achieved by neighboring Uganda and Kenya. The economic growth of Tanzania were driven by Information and Communication Technology (ICT), financial services, construction, trade and mining subsectors.

Table 2-1.1 Recent real GDP growth rates of neighboring countries

Countries	2012	2013	2014
Tanzania	6.9 %	7.0 %	7.0 %
Uganda	2.8 %	5.2 %	6.6 %
Kenya	4.6 %	5.0 %	5.1 %

Note: GDP growth rate in 2014 are estimated by World Bank

Source: World Bank country data

The activities within these sectors are largely concentrated in urban areas except mining sub-sector. As they are also relatively capital intensive, creating jobs are limited comparatively. By contrast, the growth rate of the labor intensive agriculture sector, which employs three quarters of the workforce and contributes approximately 25 % of GDP. The lower-than-average growth rate of the agriculture sector explains the relatively slow decline of poverty in rural areas and the accelerated pace of migration from rural to urban areas. Because these two phenomenon will continue to have a significant impact on Tanzania's economic climate.

According to the economic survey to Tanzanian business people by the KPMG /World Bank, Tanzanian business people remain optimistic regarding the overall performance of the economy, with 64 % of survey respondents stating that the economy will be performed better or the same in 2014 than in the previous year. The majority of the survey respondents were also positive regarding the prospects of their own business in 2014. However, only half of these respondents express the belief that economic climate in 2015 would be better than 2014.

2-2 Development Plan

2-2-1 National Development Plan

In terms of long and medium-term economic plans in Tanzania's socio-economic development plan, the country has established the Tanzania Development Vision 2025 (TDV 2025) as well as the Five Year Development Plan (FYDP I) 2016/17-2020/21.

An overview of TDV 2025 and review of its performance to date (1999 to 2010) are described below.

(1) The Outline of TDV 2025

The preparation of TDV 2025 started in 1994 and the Government finally launched the TDV 2025 in 1999. The goals of TDV 2025 are that Tanzania should have gone through an unprecedented economic transformation and development to achieve middle-income status by 2025; characterized by high levels of industrialization, competitiveness, quality livelihood, rule of law; and having an educated society. Specifically, the Tanzania TDV 2025 outlined the country's social, economic and political aspirations for the first quarter of the 21st century; a per capita income will be reached to USD 3,000 (in nominal terms) by 2025. It means that the country becomes the middle-income country. It is designed that TDV 2025 is implemented through a series of five year development plans. Regarding national economic targets, the following items are adopted.

- A diversified and semi-industrialized economy with a substantial industrial sector comparable to typical middle- income countries
- Macroeconomic stability manifested by a low inflation economy and basic macroeconomic balance
- A growth rate 8 % per annual or more
- An adequate level of physical infrastructure needed to cope with the requirements of TDV 2025 in all sectors
- A competitive player in the regional and world markets has to be promoted for national interests and to adjust quickly to regional and global market shifts

(2) Five Year Development Plan

The target period of the first Five Year Development Plan (FYDP I) is 2011/12- 2015/16. Further future medium term plans are prepared as FYDP II (2015/16 -2020/21) and FYDP III (2020/21- 2025/26). These series of plans will chart out the growth path, which is dynamically consistent with the realization of the status of a semi-industrialized country, which is capable of increasing competition in the domestic, regional, and global markets.

The overall goals of FYDP I are to promote the country's resource potentials in order to fast-track the provision of the basic conditions for broad-based growth. The targeted average GDP growth rate for the FYDP I is 8 % per annum, even though it is estimated by 7 % during FYDP I (from 2011/12 to 2013/14), and thereafter consistently maintaining growth rates of at least 10 % per annum from 2014/15 to 2015/16. The targeted growth has been calculated by taking into account Tanzania's growth record over the past fifteen years, and experiences of countries that managed to reach middle-income status in the last 30 years. In order to generate this growth momentum, five elements will be needed.

- Large investments in energy and transport infrastructure
- Strategic investments to expand the cotton textile industry, high value crops, targeting maize and rice cultivation for food self-sufficiency and exports; fertilizer production tapping the large natural gas and phosphate deposits, development of Special Economic Zones (SEZs) to foster manufacturing growth, and increase the number of cement factories as well as the development of coal and steel industries
- Enhancing skills development
- Drastically improving the business environment
- Institutional reforms for an effective implementation, monitoring and evaluation of the Plan

This will also require sustaining the following sectoral transitions:

- Agriculture to increase its average annual growth rate from 4.4 % to 6.0 %,
- Manufacturing from 8 % to 12.1 %,
- Industry from 8.6 % to 9.4 %
- Services from 7.5 % to 7.8 %

2-2-2 City Development Plan

The study team visited Ministry of Lands Housing and Human Settlements Development: MLHHSD to confirm the national and regional development plan by the government of Tanzania. The study team was provided planning study report of Dar es Salaam City Master Plan, the Dimensional Master Plan for Kigamboni New City and other related documents such as land use plan, and confirmed those documents.

Outline of the plan and observation are shown from the next paragraph.

(1) The Dimensional Master Plan for Kigamboni New City

In order to make a modern modeling city to contribute other city development in Tanzania and in Africa, MLHHSD has formulated city development plan to for a satellite city in Kigamboni area.

MLHHSD contracted with LH (Korea Land & Housing Corporation) Consortium for the Master Plan in 2009 and the Final Study Report was submitted to MLHHSD in May, 2010 through 8 planning steps and local activities. The Project life period was eight months.

Source: The Dimensional Master Plan for Kigamboni New City

Figure 2-2.1

Planning of Specialized and Community Zones

1) Goal and Target of the Dimensional Master Plan for Kigamboni New City

Population of Kigamboni as of 2010 is 82,802 and the projected population in 2030 will be about 430,000 by using annual growth rate. According to this, target population of Kigamboni New City is 500,000 and approximately 83,400 households are planned based on a 6 members.

In order to achieve an economic growth as a leading developed nation in east Africa and Africa as a whole, Kigamboni city should complement the function of Dar es Salaam

Therefore Kigamboni will have a role as a center for growth in the five areas, while functioning as the economic capital city in Tanzania. Through this growth, Kigamboni will lead the international development of Africa, and its status will be elevated.

a) International Business
b) Tourism/Leisure
c) Industry
d) Education
e) Residential

2) Concept of the Dimensional Master Plan for Kigamboni New City

In order to fulfill the goals and vision for the development of the Kigamboni new city with full regard to the formation of the urban structure that is integrated with Dar es Salaam and its surrounding region. The concept is based on the following;

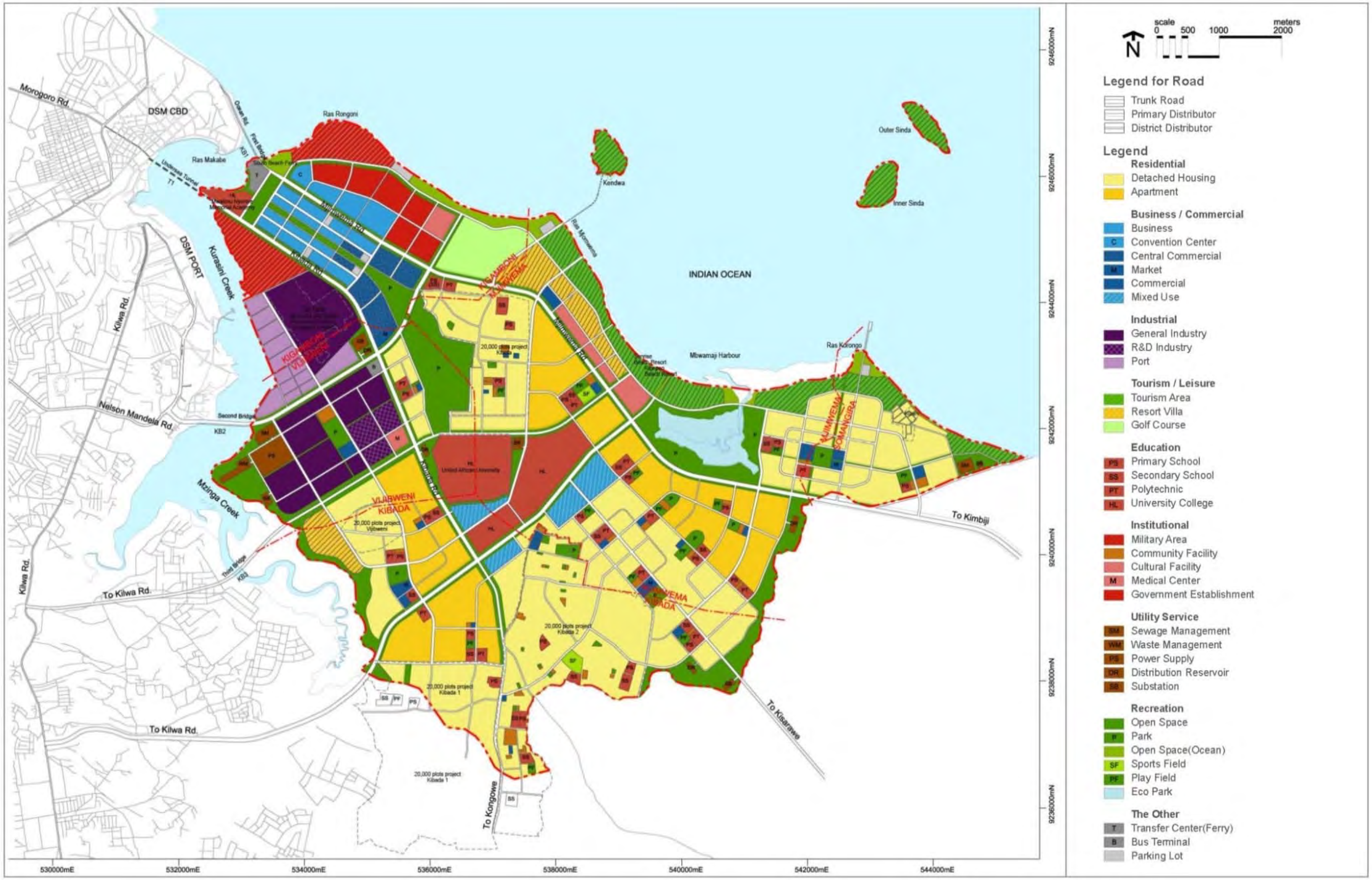
a) The new city of Kigamboni will have its own role to function as a city with self-identity, accommodating 500,000 people by 2030.
b) That existing development status of Kigamboni should be considered in the new plan and that resettlement of people and properties must be done within the planning area.
c) The new city of Kigamboni will achieve sustainable development and continuous economic growth based on the industrial sector of Dar es Salaam, the port and socio-economic activities to be proposed in the plan.
d) The new city of Kigamboni will be developed as an eco-city that will exploit the natural resources available in sustainable manner.
e) The new city of Kigamboni, together with Dar es Salaam, will play a main role as a central city of the eastern part of Tanzania and Africa in terms of transportation and tourism development.
f) The social interaction of Kigamboni residents will be promoted through the city structure and the community infrastructure.

3) Land Use Plan

The proposed comprehensive land use plan (2030) has been derived from the master plan concept, and the land use zoning plan.

In preparing this plan philosophies and aspiration of present Kigamboni community and future generation of Tanzania residents and visitors have been taken into account.

The proposed land use plan is shown in Figure 2-2.2.



Source: The Dimensional Master Plan for Kigamboni New City

Figure 2-2.2 Proposed Land Use Plan (2030)

4) Power Supply Plan

a) Objective

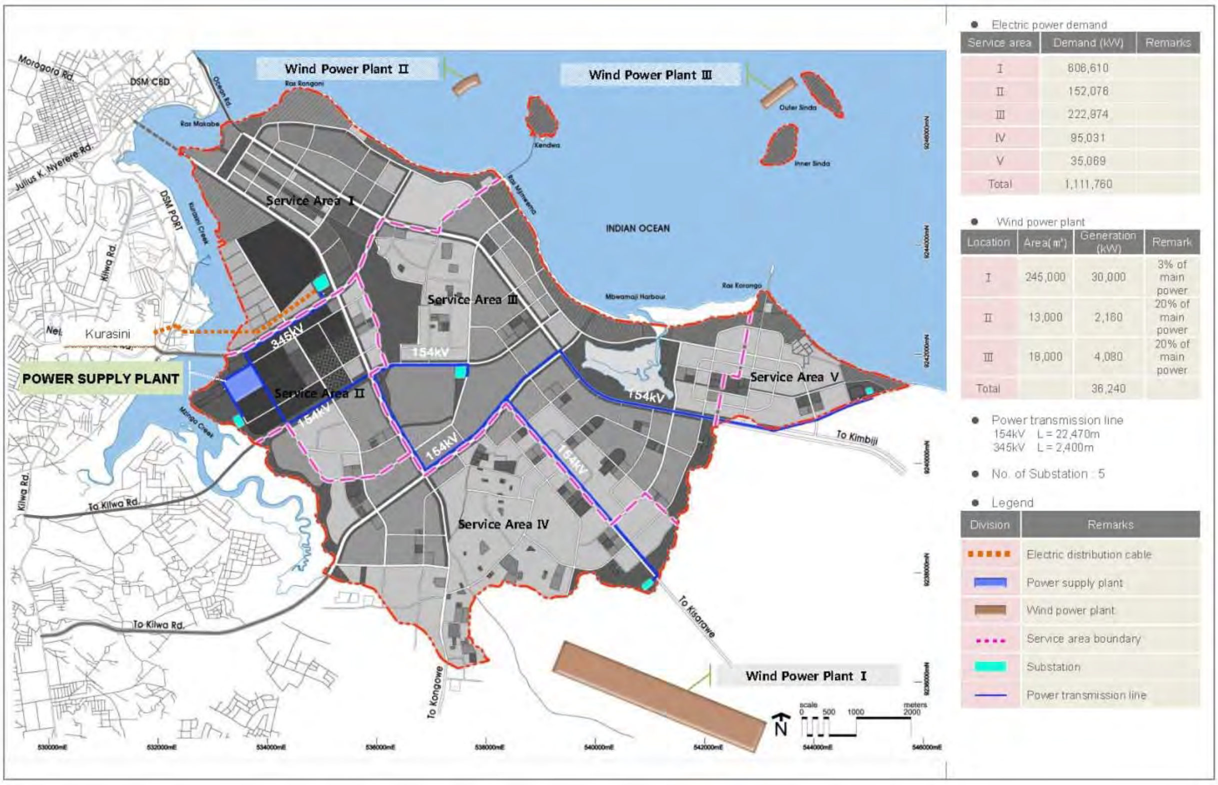
- Stable power production and supply must be accomplished by utilizing natural resources produced in Tanzania.

b) Policy

- The power supply plan is established by forecasting future energy demand of the new city.
- TANESCO will be responsible for supply of energy to the new city. However the standard of distribution in the new city will be underground cables.
- The proposed plan and distribution system is as shown in Figure 2-2.3.

c) Outline of Power Supply Plan

- Existing Kigamboni electrical supply situation and future supply plan after new city is built is surveyed with TANESCO.
- Demand of electric power is calculated according to land use plan.
  Power transmission load：1,235.289MVA Power demand：1,111.760MW
- Power plant(CCGT) is planned for stable electric power supply, although TANESCO had a supply plan.
- Electric power distribution cables are proposed to be installed under the ground and substation should be located in the building basement.



Source: The Dimensional Master Plan for Kigamboni New City

Figure 2-2.3 Power Supply Plan of the new city of Kigamboni

5) Implementation Plan

Implementation program is divided into three phases and the first phase is longer than the other phases because it includes resettlement, compensation for properties and detailed designs.

Table 2-2.1 Implementation Plan of the new city of Kigamboni

Concept	Outline	Strategy	Period
1st Phase	In this phase, commercial, business, and administrative demand that are concentrated to the Dar es Salaam CBD need to be effectively relocated in the new city. The city will be developed to accommodate population of about 53,900 houses and 323,200 people who will be resettlement population and new comers from other areas of Dar es Salaam.	1. Kigamboni Bridge 1 and 2 2. Trunk Road 1 and 2 3. Part of Trunk Road 3 4. Access Road 4 5. Partly operation : Power Supply Plant 6. Distribution Reservoir 1 and 2 7. Sewage Management Plant 1 8. Waste Management Plant	2011~2020
2nd Phase	In this phase, the essential elements will be developed for the independent urban growth of the city. It is expected that the infrastructure services will attract additional influx of population to a tune of approximately 488,800 people and 81,500 houses	1. Kigamboni Bridge 3 2. Trunk Road 3 3. Distribution Reservoir 3 4. Partly operation : Power Supply Plant, Sewage	2021~2025
3rd Phase	Through the completion of urban functions and infrastructure services in the first and the second phase, overall framework of the new city will be completed. Additionally developed residential area in third phase will accommodate 500,000 peoples and 83,400 houses with all associated services, facilities, and amenities that are required for the new city.	1. Trunk Road 4, Tunnel 1 2. Sewage Management Plant 2 3. Power Supply Plant 4. Distributing Reservoir 4 5. Waste Management Plant	2026~2030

Source: The Dimensional Master Plan for Kigamboni New City

6) Observation

The Dimensional Master Plan for Kigamboni New City is to create a new satellite city in Kigamboni by 2030 and of the national development plan led by Ministry of Lands Housing and Human Settlements Development: MLHHSD.

In order to make a large-scale city having similar functioning with Dar es Salaam in limited area, huge power demand of 1,100 MW is expected.

In terms of power supply plan, complete underground distribution line, five new underground substations are proposed. Furthermore, different system voltage from which TANESCO has adapted is also considered. Those power supply plan are not agreed by TANESCO. Therefore it is necessary to confirm from TANESCO if TANESCO’s future plan is reflected into the development plan.

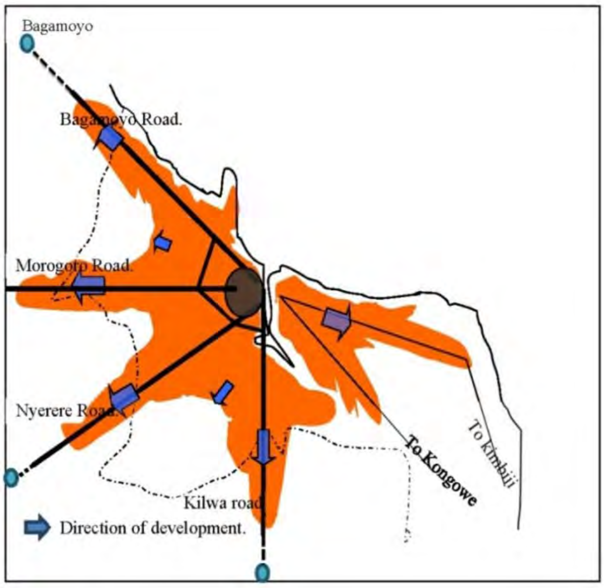
(2) Dar es Salaam City Master Plan 2012-2033

The first planning scheme for the Dar es Salaam City was drawn up in 1891 when Dar es Salaam was declared the capital of the German East Africa. In 1949 Dar es Salaam Municipality had its first Master plan prepared, coinciding with the launch of the first territory wide development programme, which was later replaced by the Arusha Declaration and on the eve of the Second Five Year Plan, a new master plan was prepared in 1968. This was replaced by the 1979 Master plan.

The new Master plan is a product of joint efforts between a consortium of 4 planning and design consultants, the Ministry of Lands, Housing and Human Settlements Development (MLHHSD), the three Municipalities, namely; Ilala, Kinondoni and Temeke, and the City Council (DCC), with important contributions of the major stakeholders.

Tanzania as a country, a member of both the East African Community: EAC and the Southern African Development Community: SADC countries, the new Master Plan endeavors to put in place development guidelines and directions based on three main urban strategies:

a) Conservation of the historical part of the City
b) Re-development and regularization of the informal settlements
c) Comprehensive planning of new areas.



Source: Dar es Salaam City Master Plan

Figure 2-2.4 Development along the main corridor

Source: Dar es Salaam City Master Plan

Figure 2-2.5 New Centralities Strategy

1) Vision and Objectives of Dar es Salaam City Master Plan 2012-2033

This master plan is intended to guide sustainable development of the City of Dar es Salaam into being a desired, livable, and an economic regional gate way in Eastern and Central Africa. The main objective is to guide the creation of a city of the third space that is important for the civil society to establish an important common feeling of a sense of place, and to improve the process of building urban identity and citizenship awareness in the community of the new inhabitants of the town.

Dar es Salaam City is served by four main arterial roads running outward from the City center like spokes of a bicycle wheel, with the City acting as the hub of the wheel. These are Bagamoyo, Morogoro, Nyerere and Kilwa Roads. The government of Tanzania has a priority of this master plan and reviewed the master plan from 2014 though it has not approved yet.

2) Concept of Dar es Salaam City Master Plan 2012-2033

a) Concept of the Plan

The Master plan defines in a structural way the transformation and development scenarios for Dar es Salaam City.

The main goals on which the plan is based are:

- To improve the existing City;
- To define the future City; and
- To set up an organic, balanced urban system, characterized for cohesion and quality.

b) Concept of Land Use Plan

The Master plan identifies axes of development that may offer an alternative to the location of new centrality's of metropolitan scale (with commercial, tertiary and productive activities) that can attract a lot of movement, especially of people, proposing to locate them along an intermediate axis between the existing City Centre and the great urban expansion area.

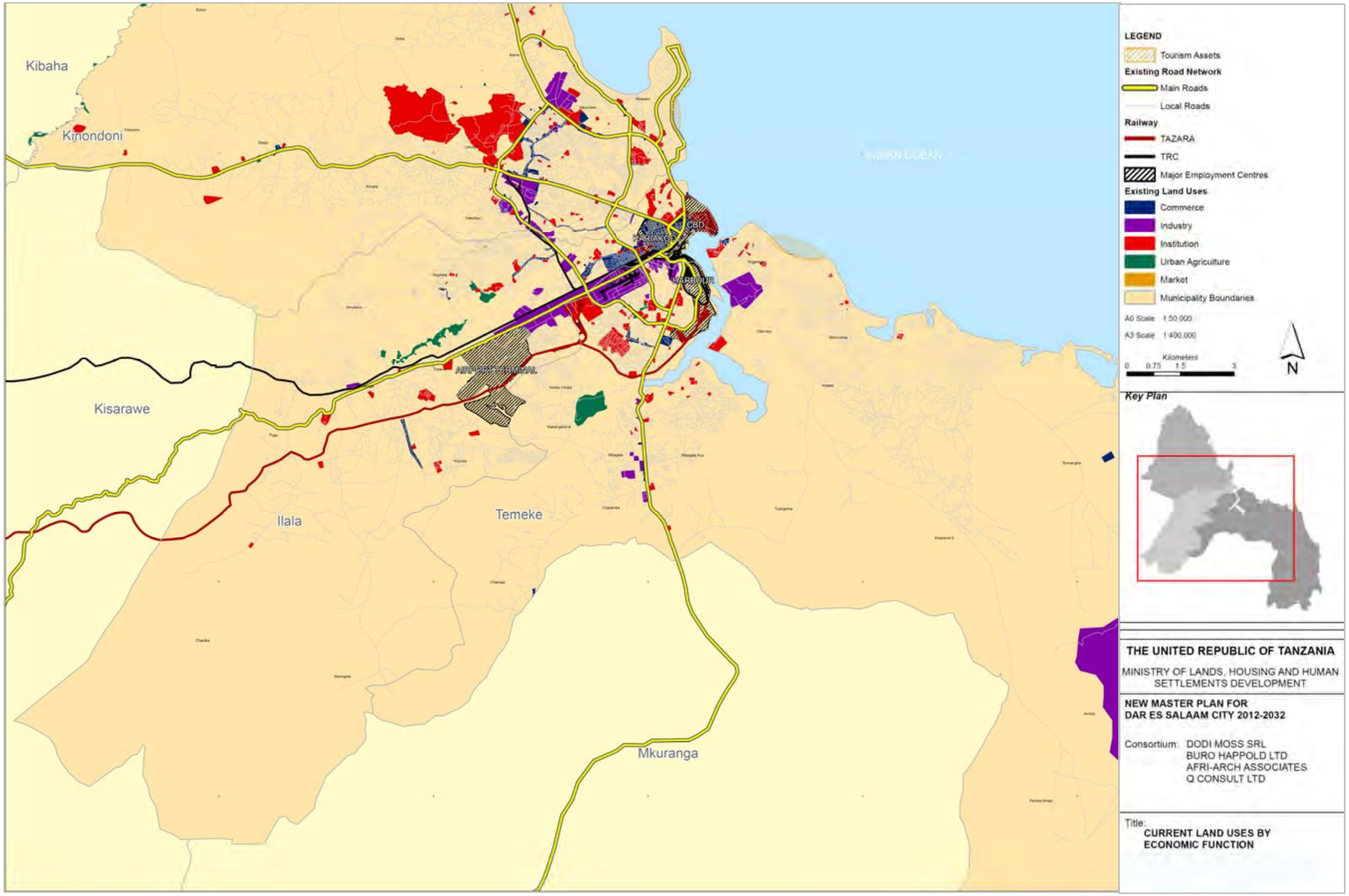
Table 2-2.2 Projections and Scenarios for Dar es Salaam City master Plan

	Existing	50,000 Planning unit	25,000 Planning unit	Projection 2032	Plot size/ facility
Population	3,118,132	3,118,132	3,118,132	8,386,706	
Wards	93	62	125	336	Population and geographical factors
Nursery Schools	435		18 /ward	18/ward	1200-1800 s1q.m
Primary schools	487		9 / ward 1125/ Dar es Salaam	9/ward 3024/Dar es Salaam	1.5-4.5 ha
Secondary schools	425		6/ward 750/Dar es Salaam	6/Ward 2016/Dar es Salaam	2.5-5.0 ha
Dispensaries	469	5km or pop between 7000-10,000	319 units	837 units	
Health centre	32	10km or pop 10,000- 25000	125units	336 units	
District Hospitals	3	District/or pop120,000	26units	70 units	
Hospitals	34				
Referral Hosp	1+	1/pop150,000	20	55	
Markets	67	62	125	336	
Libraries		62	125	336	
Community centres		62	125	336	
Fire Brigade Stations	2		25	68	

Source: Dar es Salaam City Master Plan

3) Land Use Plan

Proposed land use plan is shown at the beginning of the report and the current land uses by economic function is shown in Figure 2-2.6 and the proposed land uses by economic function is shown in Figure 2-2.7.



Source: Dar es Salaam City Master Plan

Figure 2-2.6 Current Land Uses by Economic Function

Source: Dar es Salaam City Master Plan

Figure 2-2.7 Proposed Land Uses by Economic Function

4) New Satellite Centers

The new "satellite urban centers" is a project led by the Ministry of Lands Housing and Human Settlements Development, in collaboration with the Dar es Salaam City Council and the Kinondoni, Ilala, and Temeke Municipalities.

The City is growing at a rate of 4%; statistics consider that the increase in population is over 160,000 people per year.

These areas were defined agricultural areas or open spaces, according to the 1979 Master plan

The MLHHSD in dealing with these challenges prepared “the satellite towns” project. The new urban centers have two main objectives:

- Decentralized the City services, in order to decongest the City centre; and
- Methodological attempt to guide the development of peri urban areas.

The project proposes 5 new urban centers, as follows:

- Bunju and Luguruni, in Kinondoni Municipality;
- Pugu Kajiungeni, in Ilala Municipality;
- Kongowe and Kimbiji in Temeke Municipality; and Kibamba-Luguruni, situated in Kinondoni Municipality is the pilot project. The process started in 2006

5) Power Supply

It is the purpose of the 2030 Master plan to align itself to a common goal as the policy.

a) Vision

“Vision” is to effectively contribute to the growth of the national economy and thereby improve the standard of living for the entire nation in a sustainable and environmentally sound manner.

b) Mission

“Mission” is to create conditions for the provision of safe, reliable, efficient, cost-effective and environmentally appropriate energy services to all sectors on a sustainable basis.

6) Implementation Plan

The Master plan envisages a growth of the city of about 5 million people acknowledges the expansion of the City in a radial direction and proposes a future organization based on new urban centralities and Urban Units. However, current forecasts of the metropolitan area and neighboring cities show an expected development of the city of extreme importance not only in western direction, but also in north / south direction, along the coast.

On the one hand, the strengthening of the Bagamoyo corridor, with the prevision of a new airport, a new port and a new industrial zone of large dimensions, assumes that the area of Bagamoyo will also have a considerable residential development (not yet quantified, but that could be of many hundreds of thousands of people). On the other hand, the area of Kigamboni is already designed to accommodate six hundred thousand inhabitants – this figure may still grow. The forecasts for these two areas are factors whose actual developments and impacts on the provisions of the City Master plan cannot yet be grasped.

Table 2-2.3 Implementation Plan

Concept	Outline	Contents	Period
The First Phase	The first time, the period of 15 years is divided into two phases, one of 5 years and a subsequent period of 10 years. During the first phase, lasting for five years, policies of the Master plan to be initiated to structure the future development of the City and experiment and define the procedures for the implementation of the Plan. At this stage it is expected that, from now on, the normal management activities of the existing City and the urban transformations will be oriented towards the realization of major new projects introduced by the Plan, providing for the start of work on:	1. The redevelopment of the City Centre, in particular through the preparation and implementation of the project for the Waterfront and, continuing the policies already undertaken by the DART project through the re-organisation of the traffic system with the introduction of at least one park and ride facility, and through the implementation of a service structure (for culture and leisure purposes) of metropolitan character; 2. The main road arteries that define and re-organize the existing City, namely the new ring road which, starting from the port will connect all the radial roads up to Bagamoyo Road and the new roads that lead from the Salender Bridge up to Mandela Road; 3. Some interventions of urban densification and redevelopment, to be launched in parts of the informal city, particularly the degraded and lacking urban structures. These areas will be chosen from among those that have been identified in the maps of the Master plan: it is expected that these interventions may affect about 150,000 inhabitants; 4. The realization of basic services (such as education, health, and leisure) within the upgraded residential areas; 5. The accommodation of green areas within the existing city and in particular the rehabilitation and transformation into urban park of the bed of the Msimbazi Creek; 6. The redevelopment of the whole existing system of technology networks, energy and sanitary networks; 7. The first interventions of urban expansion, following a logic of concentration of interventions and opposing the on-going dispersion and growth without quality. It is expected that, by using the reference parameter of the Urban Unit, the creation of an expansion can be initiated corresponding to the settlement of about 900,000 inhabitants, to be located mainly along the axis of Morogoro Road and the axis of Bagamoyo Road; 8. Identification and protection of the territorial and environmental areas to be safeguarded within the boundaries of the future city, in order to ensure their preservation from improper settlements that might arise during the period of implementation of the Plan; and 9. The design of the Territorial Tourism Park.	For 5 years
The Second Phase	The second phase has a period of ten years and will be the one in which to realize:	1. The completion of the major infrastructure of the future metropolitan city, in particular the outer ring road axis; 2. The new production areas; 3. The new urban and metropolitan centralities; and 4. The continuation of the policies of requalification and expansion laid down in the Master plan. At the end of the second phase, the city should have increased by approximately 3.5 / 4 million inhabitants.	For 10 years
The Third Phase	A further five years, will start after making a comprehensive reassessment of the choices of the Master plan, in relation to demographic developments, economic and territorial changes that will have taken place then. This phase will be either the one that will bring to a conclusion of the policies started, or the one that will implement the new policies that, over time, will have become necessary. It will also be the phase of the drafting process of a new Master plan for 2033/2053.		2026~2030

Source: Dar es Salaam City Master Plan

7) Observation

Dar es Salaam City Master Plan 2012-2033 which follows Master Plan in 1979 and led by Ministry of Lands Housing and Human Settlements Development: MLHHSD.

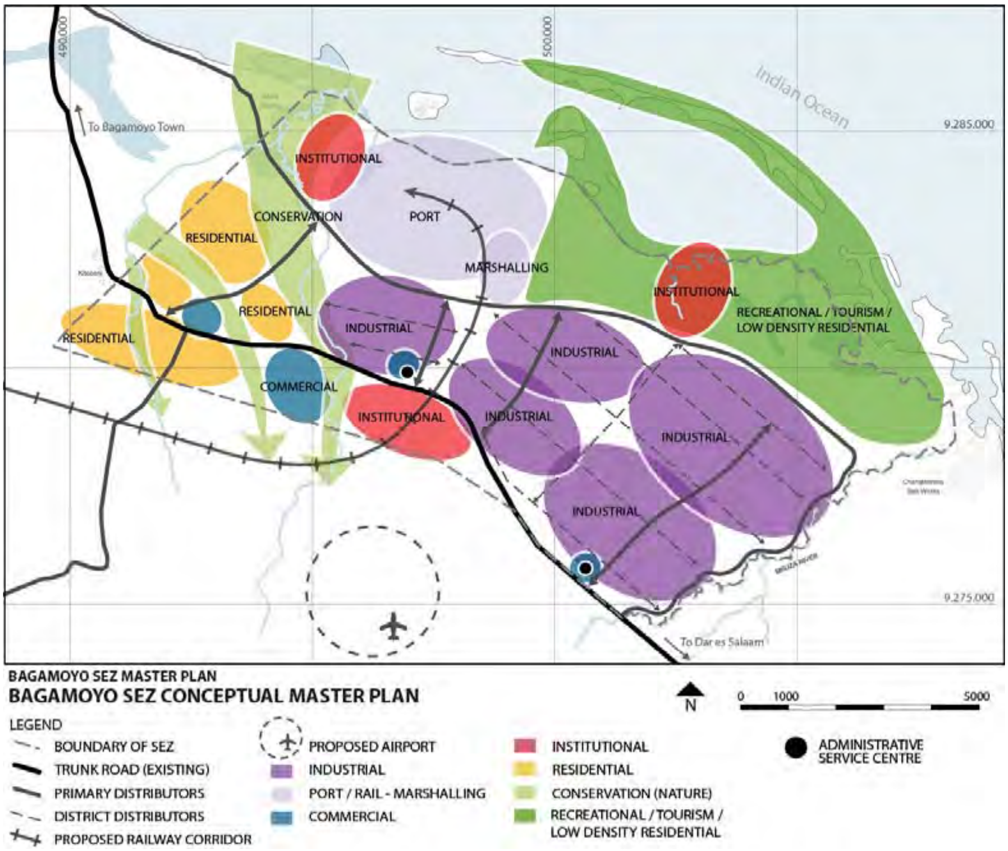
Main Characteristic of the Dar es Salaam City Master Plan 2012-2033 is to decentralize the metropolitan function along with the main corridors in order to improve living standard of the people by providing efficient transport system and other infrastructure. New satellite centers are on-going pilot project by MLHHSD.

Dar es Salaam City Master Plan 2012-2033 is utilized to formulate power system master plan in Dar es Salaam and Coastal Regions in terms of future load distribution, to determine new transmission line route or location of substation and to reflect to power system expansion plan.

(3) Bagamoyo SEZ Master Plan

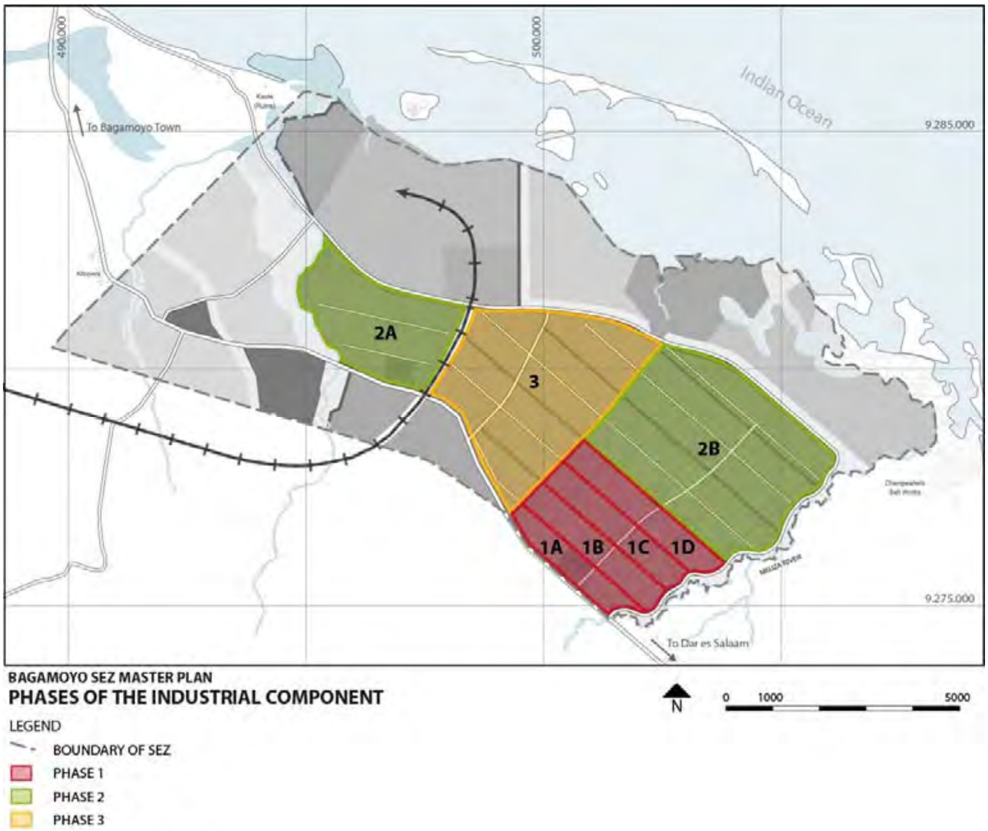
1) Vision and Objectives of Bagamoyo SEZ Master Plan

The intent of this master plan is to create Bagamoyo area the first Special Economic Zone (SEZ) (about 9,800 hectares) of fourteen SEZs that the Tanzanian government plans to develop nationwide in the future. Its main objectives are to establish a new trade port, create high-quality industrial zones that incorporate advanced technology, promote investment and employment both in and outside the country, and by doing so serve as a model case for other SEZs. The increase in population is estimated to be roughly 23,000 people by 2020; 45,000 people from 2021 to2025; and 75,000 people from 2026 to 2030, resulting in a forecast power demand of about 50 MW.



Source: Bagamoyo SEZ Master Plan

Figure 2-2.8 Bagamoyo SEZ Conceptual Master Plan



Source: Bagamoyo SEZ Master Plan

Figure 2-2.9 Phases of the Industrial Component

Chapter 3 Present Condition of Power Supply and Demand

3-1 Electricity Supply Setup

In Tanzania, electricity is supplied by the state-owned Tanzania Electric Supply Company Limited (TANESCO) except that 1) in Zanzibar, Zanzibar Electricity Corporation (ZECO), distributes electricity mainly supplied by TANESCO via submarine cable connecting the island and the mainland, and 2) Rural Energy Agency (REA), a government agency, is promoting various rural electrification programs in the areas not covered by the national grid or TANESCO's independent systems. In 1964, three years after independence, the Government bought two private electricity companies operating in Tanzania. In 1975, two companies were merged to form the current TANESCO with the government as the sole shareholder. Since then, the company has been responsible for electricity supply in the country for half a century.

In the 1990s, the government included TANESCO in the list of parastatal organizations for privatization. After various attempts to vitalize the electricity sector, in June 2014, the Government announced Electricity Supply Industry Reform Strategy and Roadmap 2014-2025.[1] It proposes to unbundle the present integrated single market system and introduce a deregulated electricity market stepwise by 2025 to establish a reliable and efficient electricity supply system.

3-2 Electricity Supply System

TANESCO is a state-owned integrated monopoly for electricity supply in Tanzania and is in principle controlled under the Electricity Act of 2008 and the Energy and Water Utilities Regulatory Authority Act, 2001. It is a public organization under the Ministry of Energy and Minerals (MEM); Board of Directors is appointed by the government, which exercises control through MEM.[2]

MEM is mainly responsible for formulation of energy and electricity policy, and management of TANESCO.

The Energy and Water Utilities Authority (EWURA) created in 2005 by the Energy and Water Utilities Regulatory Act is mandated to oversee and regulate the operations of TANESCO granting following licenses:

a. Electricity Generation License
b. Electricity Transmission Cross Border Trading License
c. Electricity Distribution and Cross Border Trading License
d. Electricity Supply License

Presently, each license is for a term of twenty years commencing from 1st March 2013.

The company has business licenses to all regions granted by the Ministry of Industry and Trade under the Department of Revenue Collection Trade Licenses.

1 Ministry of Energy and Minerals, "Electricity Supply Industry Reform Strategy and Roadmap 2014-2025, June 2014
2 Tanzania Electric Supply Company Limited, "Corporate Business Plan 2014," December 2013

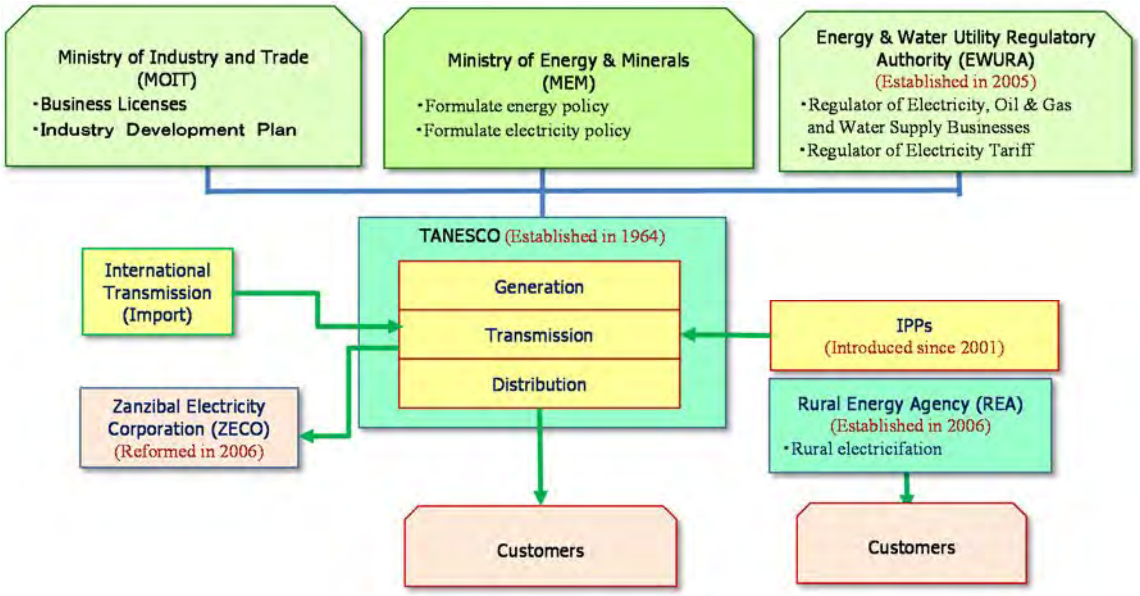


Figure 3-2.1 Structure of Electricity Supply System

After 2000 thermal plants have been built by IPPs and TANESCO, but they could not adequately cover the rapidly growing electricity demand. A severe drought in 2010 incurred serious supply shortage in the power system traditionally dependent on hydropower. To bridge the electricity supply gap in the country, TANESCO was forced to contract with Emergency Power Producers (EPP) in 2011 at expensive rates. Today they amount to more than one third of the country's thermal generation capacity, which have significant impact on TANESCO's financial status. TANESCO needs to be released from this excessive financial burden to cope with various investment needs more flexibly for healthy development of the electricity industry.

3-3 Organization and Functions of Electricity Sub-Sector

3-3-1 Ministry of Energy and Minerals

The organization of the Ministry of Energy and Minerals (MEM) comprises, in addition to the administrative/supportive divisions and units, three divisions and units which are responsible for strategies and policies on energy, gemstones and mineral resources as shown in Figure 3.3-1.

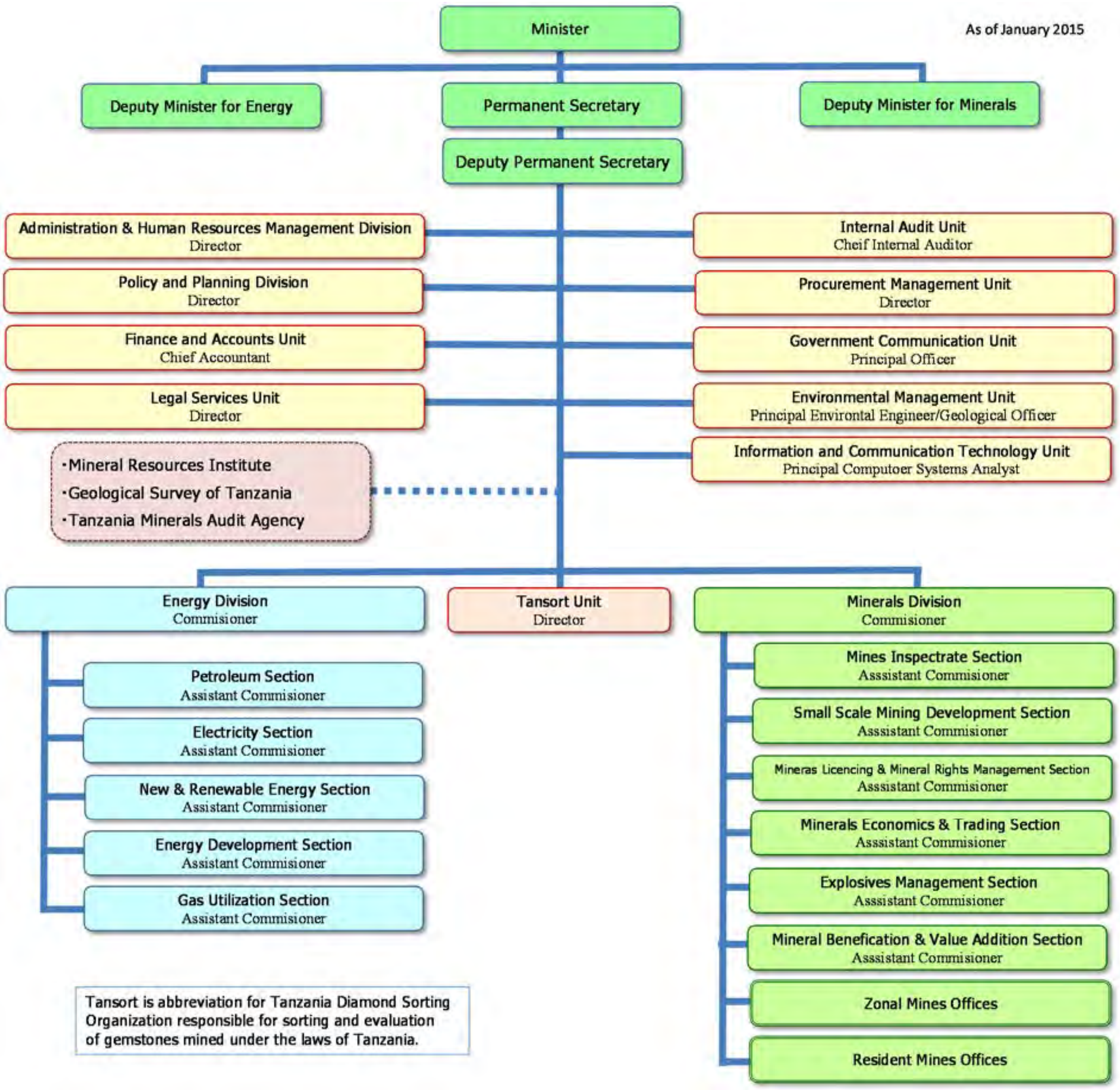


Figure 3.3-1 Organization Chart of the Ministry of Energy and Minerals

In the Energy Division, there are five sections under the Commissioner, namely, Petroleum Section, Electricity Section, New and Renewable Energy Section, Energy Development Section and Natural Gas Utilization Section. Oil and gas upstream activities are covered by Petroleum Section and natural gas downstream activities are developed under Natural Gas Utilization Section. Electricity businesses are controlled by Electricity Section and related policies are developed jointly by Electricity Section and Energy Development Section, while New and Renewable Energy Section is in charge of promoting and developing renewable energies. Coal mining is controlled by the Minerals Division including licensing of mining rights. Tansort Unit is responsible for management of resources yielding gem stones.

There are also affiliate organizations, Mineral Resources Institute, Geological Survey of Tanzania, and Tanzania Minerals Audit Agency, attached to MEM.

3-3-2 TANESCO

The organization of Tanzania Electric Supply Company Limited comprises, in addition to administrative/supporting sectors, four divisions under supervision of Assistant Managing Directors; Generation, Transmission, Investment and Distribution & Customer Services as shown in Figure 3.3-2.

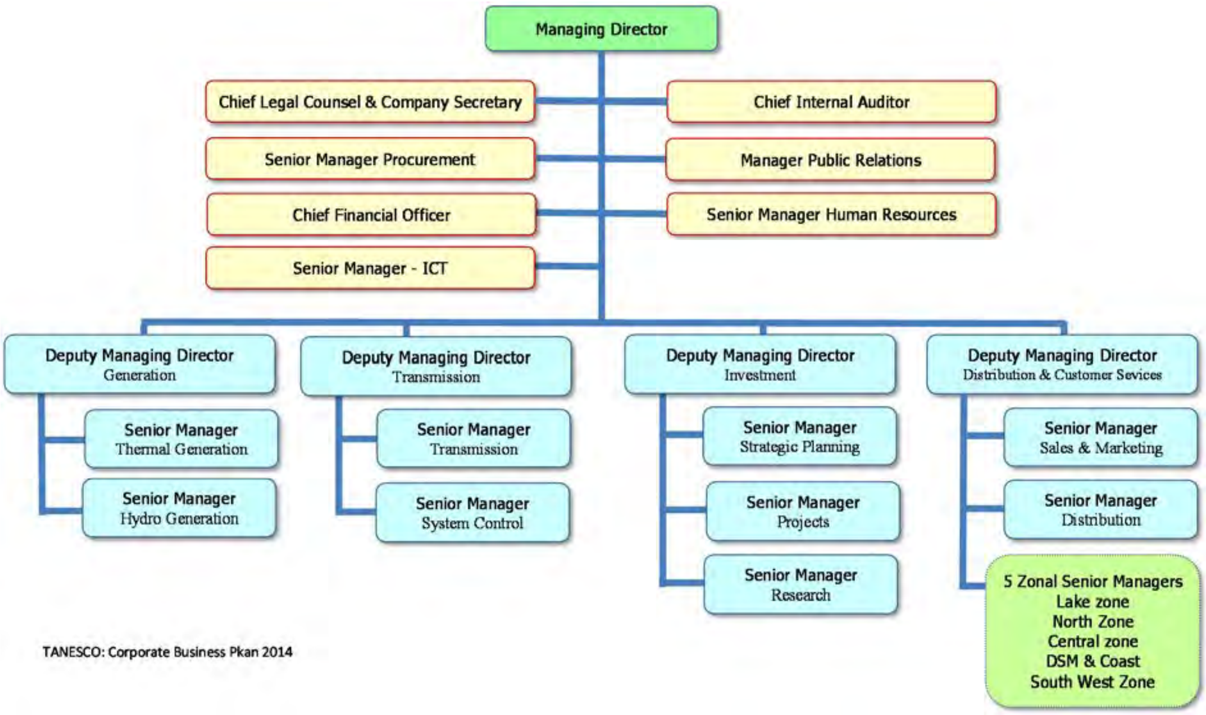


Figure 3.3-2 Organization Chart of TANESCO

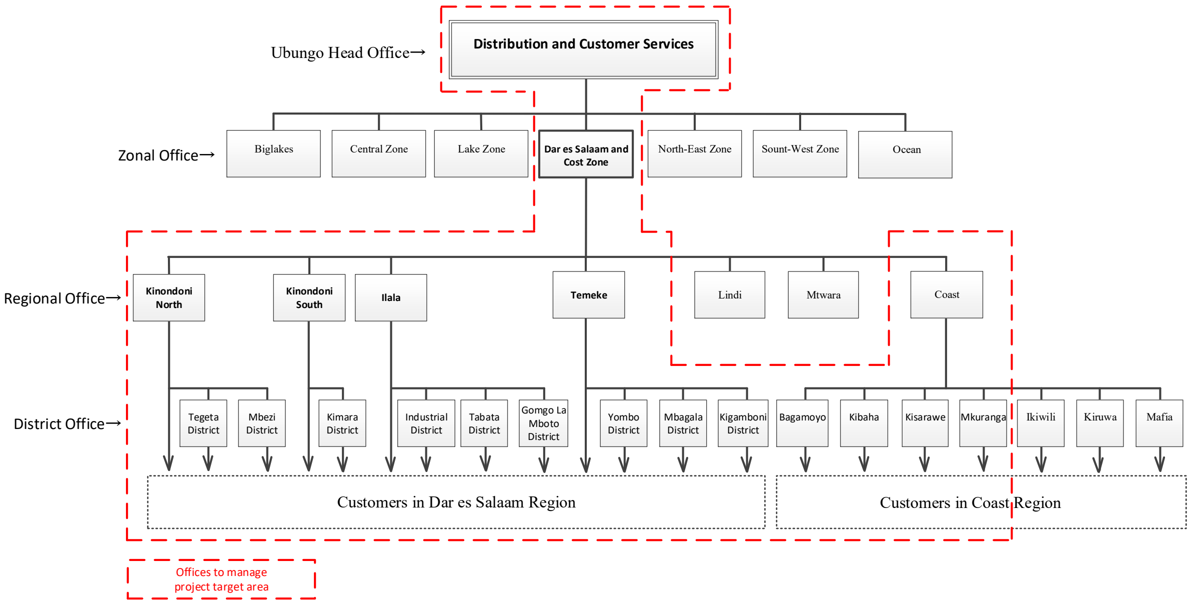
Generation Division is responsible for all power generation functions owned by TANESCO both National Grid connected and off-grid stations.

Transmission Division is responsible for optimal operation and maintenance of the national grid transmission network.

Investment Division is responsible for the three main functions of R & D, strategic planning and main project implementation management.

Distribution and Customer Services Division is responsible for the distribution network system consisting of 33kV and 11kV supply voltage that serves distribution transformers stepping down to 400/230 volts for residential, light commercial and light industrial supply. Commercial and heavy industries are supplied directly at 33kV and 11kV. This master plan involves the zonal offices, regional offices, and district offices under the control of the Distribution and Customer Services headquarters. The organization is as shown in Fig. 3-3.3.

In addition, the Transmission Division deals with implementation plans related to generation and transmission facilities, but implementation plans for distribution facilities are implemented by the Distribution Division. Regarding maintenance works, the Generation Division and Transmission Division are in charge of generation and transmission facilities, but distribution facilities are implemented by the regional office and report to the Distribution Division.



Source: JICA Study Team by the data from TANESCO

Figure 3-3.3 TANESCO Zonal, Regional and District office

3-4 Energy Policy

Economic development strategies and policies in Tanzania have been developed based on the Tanzania Development Vision 2025[3] (TDV 2025) set out in 1995, which envisages Tanzania to become a middle income country with a high level of human development. To this end, the economy should achieve an annual per capita income of at least US$3,000 by 2025 through transformation from a low productivity agricultural economy to a semi-industrialized one. A solid foundation for a competitive and dynamic economy with high productivity should be laid with an adequate level of physical infrastructure. Based on this concept, the ESI Reform Strategy and Roadmap 2014-2025 stipulates that, to achieve the target under the TDV, fast economic growth is needed which must be propelled by adequate, accessible, reliable, affordable and environmentally friendly electricity supply. Among others, the Strategy aims at improving access levels to electricity from 24% as of March 2014 to 30% by 2015, 50% by 2025 and 75% by 2033. To achieve this, huge amount of capital investment is needed. While the government and TANESCO have been the primary financiers in the past, the projected growth exceeds existing resources. Thus, the private capital investment becomes an important option to bridge the financing gap.

Present strategies and policies relating to the electricity industry is summarized in Table 3.4-1. The National Energy Policy was first formulated in 1992, and was revised in 2003. The new updated Energy Policy 2015 among other things aims at promoting affordable energy supplies to support national development goals. The Electricity Act enforced in 2008 sets a platform for re-organization of the ESI, under which the MEM Minister may restructure the ESI to foster competition for increased efficiency, enhanced development of private capital investment and promote regional electricity trading.

[3] Planning Commission, “The Tanzania Development Vision 2025”, 1995

Table 3.4-1 Laws, Strategies and Polices relating to Electricity Industry

Laws	The Electricity Act, 2008
	The Rural Energy Act, 2005
	The Energy and Water Utilities Regulatory Authority Act, 2001
Strategy & Plan	Tanzania Development Vision 2025
	National Strategy for Growth and Reduction of Poverty (Mkukuta II), 2005
	The National Energy Policy, 2003
	The Tanzania Five Year Development Plan 2011/12 - 2015/16
	The Tanzania Five Year Development Plan II 2016/17 - 2020/21 (May 2016)
	Strategic Plan 2011/12 - 2015/16
	The National Natural Gas Policy of Tanzania - 2013
	Electricity Supply Industry Reform Strategy and Roadmap, 2014
	Sustainable Energy for All (December 2015)
	National Energy Policy 2015

As explained above, the ESI Reform Strategy and Roadmap was announced in June 2014. The Strategy recommends gradual unbundling of TANESCO into independent generation, transmission and distribution companies with emphasis of private sector participation in the supply chain except for transmission segment. In the course of implementing the reform, the present Electricity Act and other relevant laws need to be reviewed and amended to facilitate private sector participation in the electricity market, third party access to the transmission grid, liberalization of electricity tariff, etc., step by step according to the market reform program.

3-5 Overview of Energy Supply

3-5-1 Overview of Energy Supply

In the east African region, no significant activities have been observed in fossil energy development until recently. The situation is same for Tanzania, where small amounts of coal, 100,000 tons per year, and natural gas, 33 billion cubic feet (Bcf) or 820,000 tons in oil equivalent (toe), are produced locally and mostly used for power generation. Crude oil is not produced locally. After the Tiper Refinery, a small refinery of 875 kt per year or 18 kbpd located in Dar es Salaam, was shut down in 1999, all petroleum products are imported for domestic supply.

In recent years, however, brighter prospects are emerging on development of coal and natural gas resources as shown in Table 3-5.1 and Figure 3-5.1.

Table 3-5.1 Energy Production/Consumption and Power Generation

		1980	1990	2000	2010	2012	2014
		ktoe	ktoe	ktoe	ktoe	ktoe	ktoe
Coal	Production	1	2	49	0	49	152
Natural Gas	Production	0	0	0	643	812	761
Oil	Import	718	668	765	1,549	2,594	2,659
Biomass	Production	7,237	8,928	12,458	18,232	19,567	21,033
Hydro	Production	59	133	184	232	152	223
Total		8,015	9,733	13,462	20,662	23,181	24,834
Non-Biomass		778	803	998	2,424	3,607	3,795
(Import)		718	668	765	1,549	2,594	2,659
(Import Ratio)		92.3%	83.2%	76.7%	63.9%	71.9%	70.1%
Biomass Ratio		90.3%	91.7%	92.5%	88.2%	84.4%	84.7%
Power Generation	TWh	0.79	1.63	2.47	5.27	5.59	6.22

Source: IEA "World Energy Balances of Non-OECD Countries - 2016"

Note: Natural gas production started to increase in the summer of 2015 when the new pipeline was put in operation.

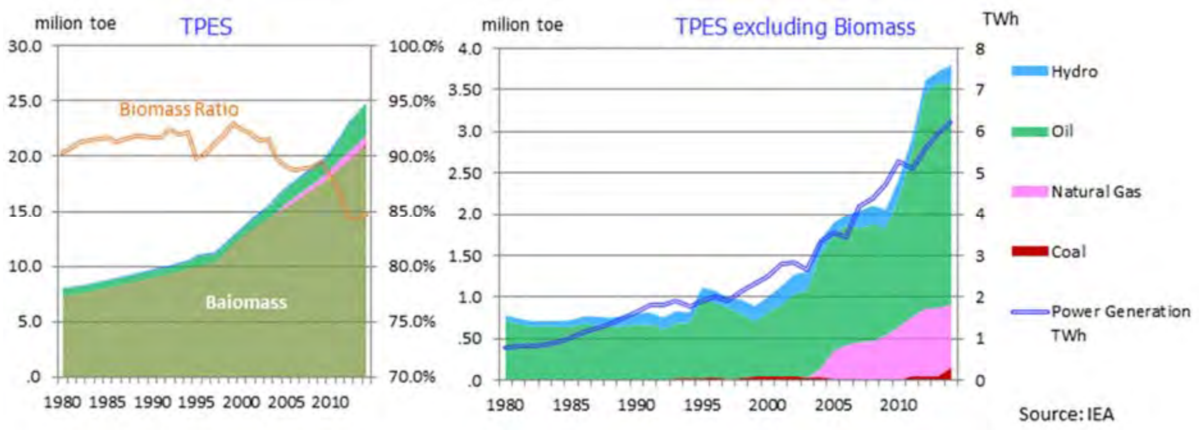


Figure 3-5.1 Energy Production/Consumption and Power Generation

Among others, natural gas has been contributing to the modernization of energy. The Songo gas field located 200km south of Dar es Salaam was discovered in 1974, which extends onshore and shallow offshore of the Songo Song Island. Because of the tiny size, its development had been withheld for decades. Only in 2001, the World Bank decided to support development of the Songo gas field and related gas utilization facilities. In 2004, the gas field and the gas system were completed to supply fuel for power generation and industrial use in the Dar es Salaam district. Following this, the Mnazi Bay gas field, located further south, was also developed and started gas supply in 2007 for a local small power station with a generation capacity of 18MW in Mtwara city.

Then, construction of a new gas pipeline, 36” x 532km from the Mnazi Bay gas field to Dar es Salaam with a transport capacity of 784 MMcfd, was commenced in summer of 2012 and completed in July 2015 to increase the country’s natural gas supply capacity significantly from these onshore and shallow water gas fields. A new branch line from the Songo gas field was also constructed for connection to the new trunk line. In line with this project, the new gas thermal power plants Kinyerezi-1 (150MW) started test operation in July 2015 and commercial operation by fall. In order to fill up the new pipeline, oil companies are conducting well workover and drilling new production wells; the Songo Songo targets to increase production to 190MMcfd, North Kilwa 20 MMcfd and the Mnazi Bay to 210MMcfd. In addition, construction of Kinyerezi I Extension (185 MW) and Kinyerezi-2 (240MW) gas to power plants by the Government and Japanese party were also given a green light.

Table 3-5.2 Gas Reserves in Tanzania

Category	Gas fields	Proven Reserve	Provable Reserve
		P90	P50
		P1	P1+P2
Land/Shallow Water		Tcf	Tcf
	Songo Songo	0.88	2.5
	Mnazi-Bay	0.262	5
	Mkuranga		0.2
	Nyuni	0.045	0.07
	Ruvuma		0.178
	Ruvuma		2.17
	Sub-total		10.118
Deep Water	Block-2		25.4
	Block1,3&4		21.73
	Sub-total		47.13
Total			57.25

Source: TPDC

A small quantity of coal, annual 100,000 tons, used to be produced in far interior regions in southwestern Tanzania near Lake Nyasa (Lake Malawi), and is consumed locally or exported to Malawi. Since 2011 coal production at the Ngaka coal mine in the region has been developing and delivered to nationwide industrial users like cement producers. In 2015, coal production in Tanzania exceeded 250,000 tons and is further increasing. In this region several plans are also underway to develop interior coal mines for mine mouth power generation. In addition, several exploration licenses have been awarded for new ventures following the fast developing projects but they are still in the stage of studying exploration plans. The aggregate power generation capacity in the immediate development plans is 1,200MW, scheduled to start around 2019. However, several hurdles must be cleared before the final investment decision, such as construction of transmission lines extending for 250kms (between Ngaka and Makambako) or even finding financial and technical partners to develop projects. They are yet to announce the Final Investment Decision and some of them may need a longer lead time for finding partners and preparation of infrastructure such as access roads.

3-5-2 Overview of Renewable Energy

In Tanzania, the three top priority choices that emerged to support national development priorities were geothermal power development, renewable energy for rural electrification (RERE), and alternative biomass supply options.

Tanzania is one of the pilot countries of the Scaling-Up Renewable Energy Program (SREP) under the Strategic Climate Fund of Climate Investment Funds (CIF).

The SREP-Tanzania Investment Program will consist of two distinct and complementary investment projects with a combined generation potential of about 147 MW.

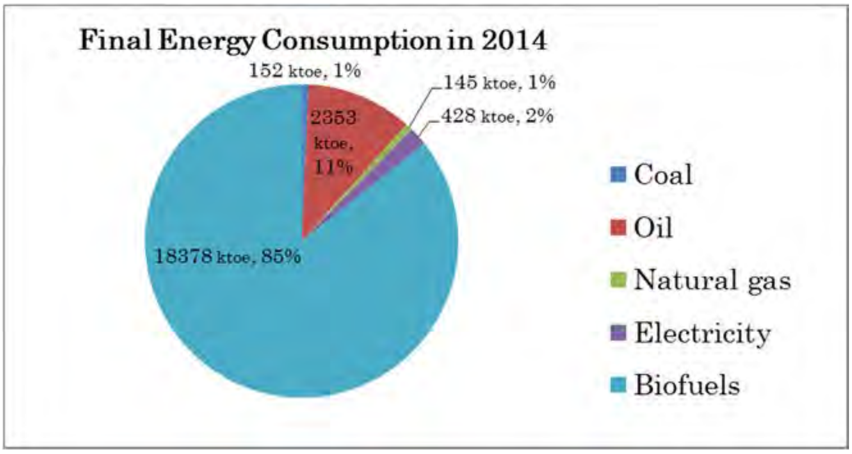
Project 1: Geothermal Power Development Project. The purpose of this project is to support geothermal energy as a low-cost, reliable and important source of energy in Tanzania's electricity supply, with the support of the public sector. Total cost is $ 450 million, of which $ 400 million will be a 100 MW geothermal power plant covered by the PPP

(Public-Private Partnership) contract. The expected project outcome is a PPP project that has successfully developed, constructed, and commissioned the operation and maintenance of about 100 MW of geothermal power supplying about 700 GWh per year to the national grid.

Project 2: Renewable Energy for Rural Electrification (RERE) Project. The purpose of this project is to establish a rural electrification project in an independent and expandable independent system and demonstrate its usefulness by supporting investment by private companies in this project. This project will support the Tanzanian government's plan to increase electrification access from 18.4% to at least 75% by 2035 by rural electrification by renewable energy. The rural electrification agency of Tanzania will be the implementing entity. The project expects to generate a renewable energy potential of 47 MW directly co-funded with SREP resources and directly benefitting about half a million people and to create a pipeline of RERE projects that will eventually help 2.2 million people.

3-5-3 Final Energy Consumption

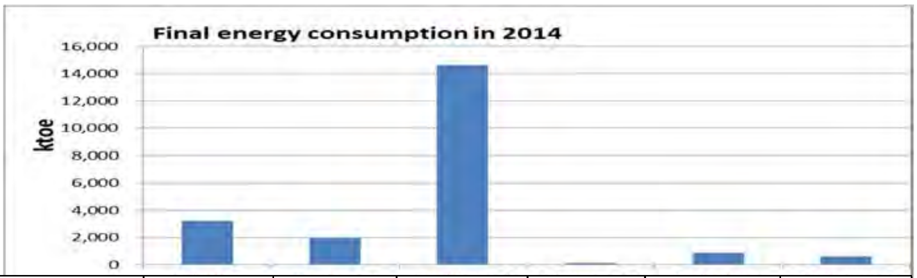
In 2014, biomass represented 85% of total energy consumption. Charcoal made from wood was the single largest source of household energy in urban areas, with about half the annual consumption occurring in Dar es Salaam. Petroleum products comprised 11% of the total energy consumed, whilst electricity accounted for just 2% (Fig. 3-5.2). Other energy sources, including solar, represented a small share.



Source: IEA: Energy Balance for Tanzania (2014)

Figure 3-5.2 Energy Balance for Tanzania (Total Final Consumption)

The residential sector accounts for most of the energy used, the vast majority of which consists of biofuels and agricultural waste; 78% of the biomass used in the residential sector is for household cooking (Fig. 3-5.3).



	Industry	Transport	Residential	Commercial	Agriculture	Non-energy
Total	3,223	1,973	14,632	98	890	597
Electricity	109	0	192	98	15	14
Bio fuel & Waste	2,612	0	14,330	0	854	583
Natural gas	145	0	0	0	0	0
Oil products	205	1,973	110	0	21	0
Coal and peat	152	0	0	0	0	0

Source: IEA: Energy Balance for Tanzania (2014)

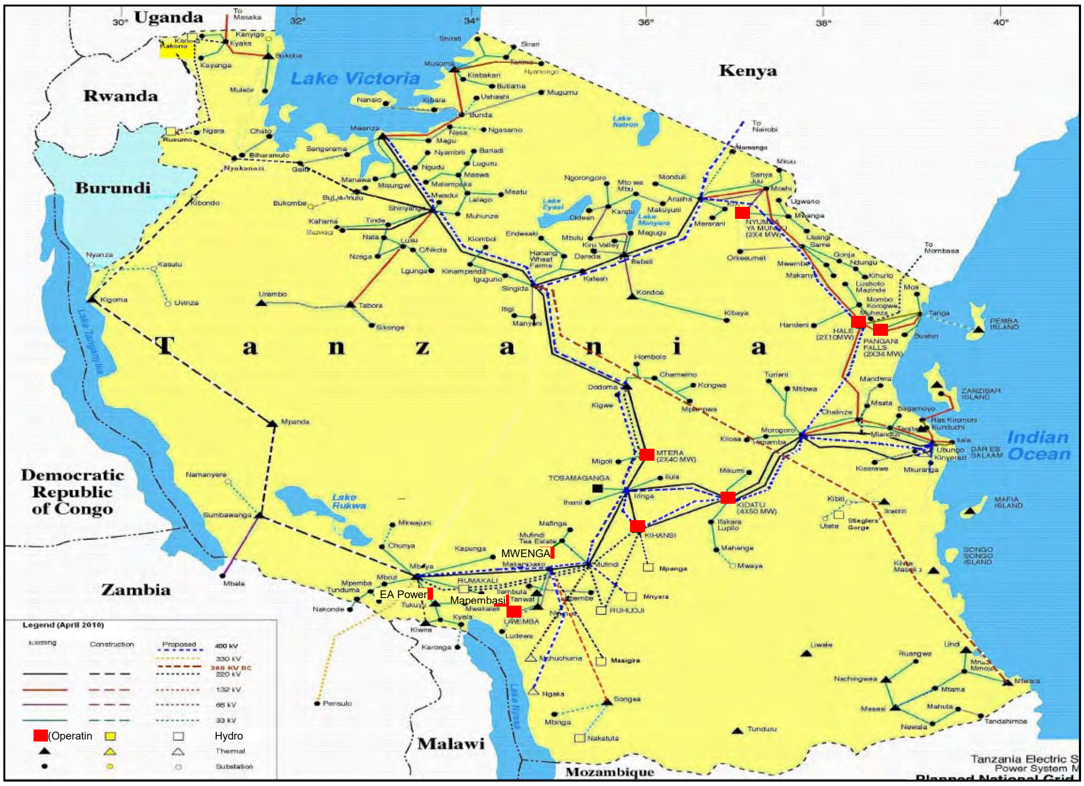
Figure 3-5.3 Energy Balance for Tanzania (TFC for Sectorial Energy Use)

3-6 Present Condition of Power Supply and Demand

3-6-1 Transition of Power Supply and Demand

The Tanzania power transmission network is consisting of 400 kV as the maximum voltage, with 220 kV, 132 kV and 66 kV following.

Three Hydro power plants (HPP) are Kidatu HPP (4 x 51 MW), Mtera HPP (2 x 40 MW) and Kihansi HPP (3 x 60 MW). The 3 HPPs supply the power through 220 kV transmission lines to three direction, i.e. the east direction of Dar es Salaam (DSM) which is the biggest power demand area in the country, the northwest direction of Shinyanga, Singida, etc. in which several mines are located, and the south west direction of Mbeya region which is the biggest city in the south west area of the country. (Refer to Figure 3-6.1)



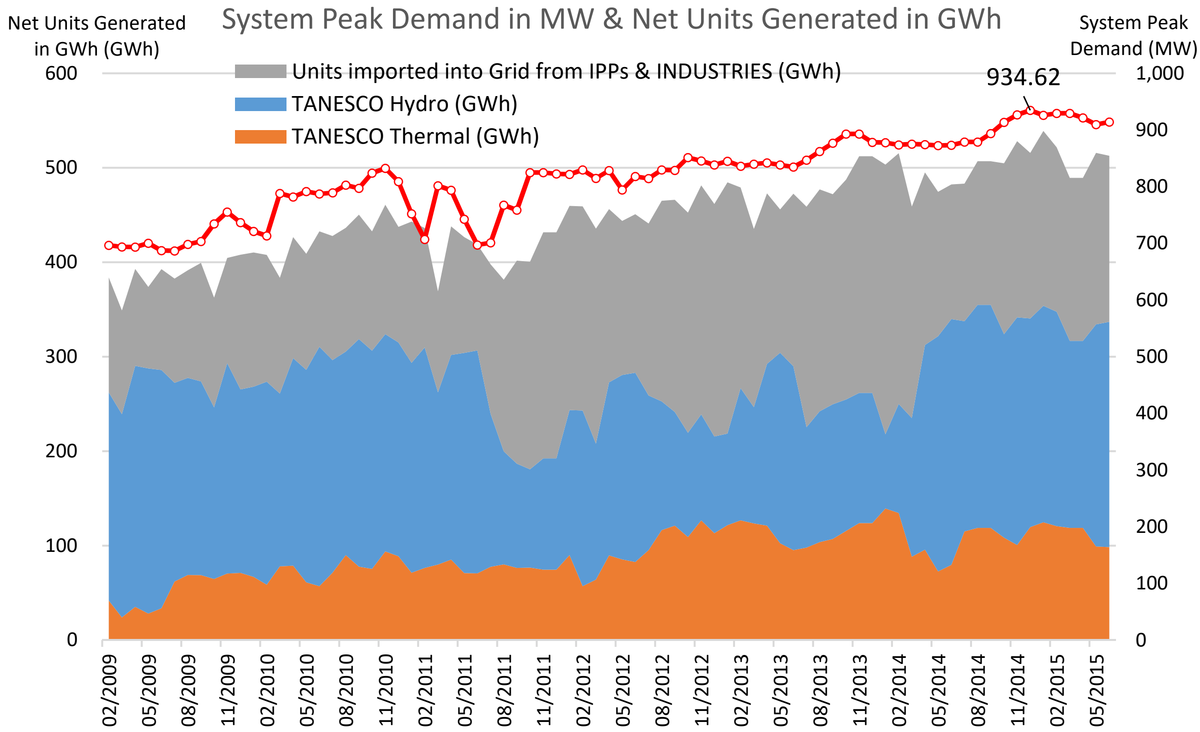
Source: TANESCO, with additions

Figure 3-6.1 Location Map of Operating Hydro Power Plants interconnected to National Grid

Recently, the power by the 3 HPPs supplies mainly to northwest and south west regions, since the power generation by thermal power plants in DSM has been increasing gradually.

Also, other 3 HPPs (Hale 21 MW, Nyumba ya Mungu 8 MW and New Pangani Falls 68 MW) which are connected to national grid system as well. On the other hand, there are 24 Thermal power plants (TPP) in the whole country. Among them, 6 TPPs only are connected to the national grid and other 18 TPPs are operated in their own isolated systems, located mainly in west and south area.

As of today, the following power are imported from; Uganda 20 MW through132 kV line Kagera region, Zambia 10 MVA through 66 kV line (Rukwa region) and Kenya 1 MW through 33 kV line.



Source: TANESCO

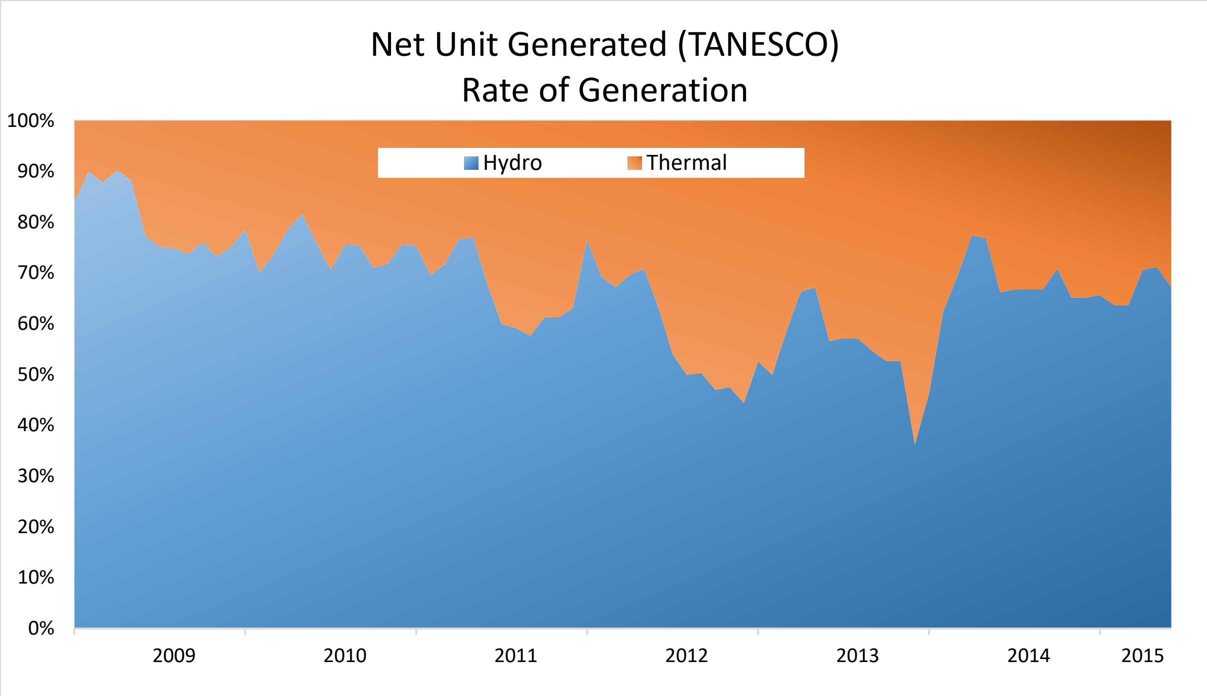
Figure 3-6.2 System peak demand (MW) and Generated power by Unit (GWh)

Figure 3-6.2 shows System peak demand in MW and Net units generated in GWh from January 2009 to June 2015. In November 2009, the peak demand was 755 MW and 935 MW in December 2014. Thus, the average rate of the growth is 4.7% per year.

The procured power from IPP and industries varies in accordance with the power generation by TANESCO's HPP.

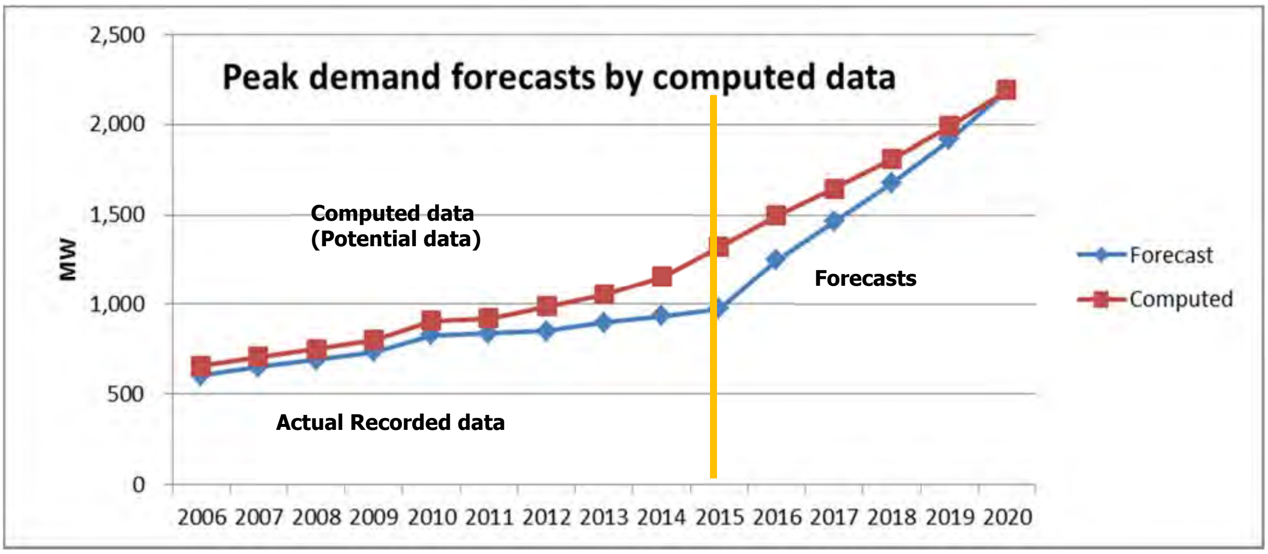
The rate of TANESCO's HPP and TPP in a month from January 2009 to June 2015 is shown in Figure 3-6.3. The peak generation of HPPs in each year is in April. The percentage of HPP is gradually decreased year by year from 2009 to 2013. However, it recovered in 2014.

The relation among potential and statistical forecasting is shown in Figure 3-6.4. Availability capacity of power generation facilities in Tanzania nationwide is approx. 960 MW (as of 2015), but the potential demand as of 2015 as shown in Figure 3-6.4 is approx. 1,300 MW. Thus, the country is in serious supply shortage.



Source: JICA Study Team by the data from TANESCO

Figure 3-6.3 Rate of Power Generation by TANESCO's HPP and TPP



Source: JICA Study Team by the data from TANESCO

Note: As of 2015, the difference between the un-constrained data and the actual data is 22 %

Figure 3-6.4 The relation among potential and statistical forecasting

3-6-2 Power Supply and Demand in Dar es Salaam and Coast regions

Business areas on power supply by TANESCO are shown in Figure 3-6.5.

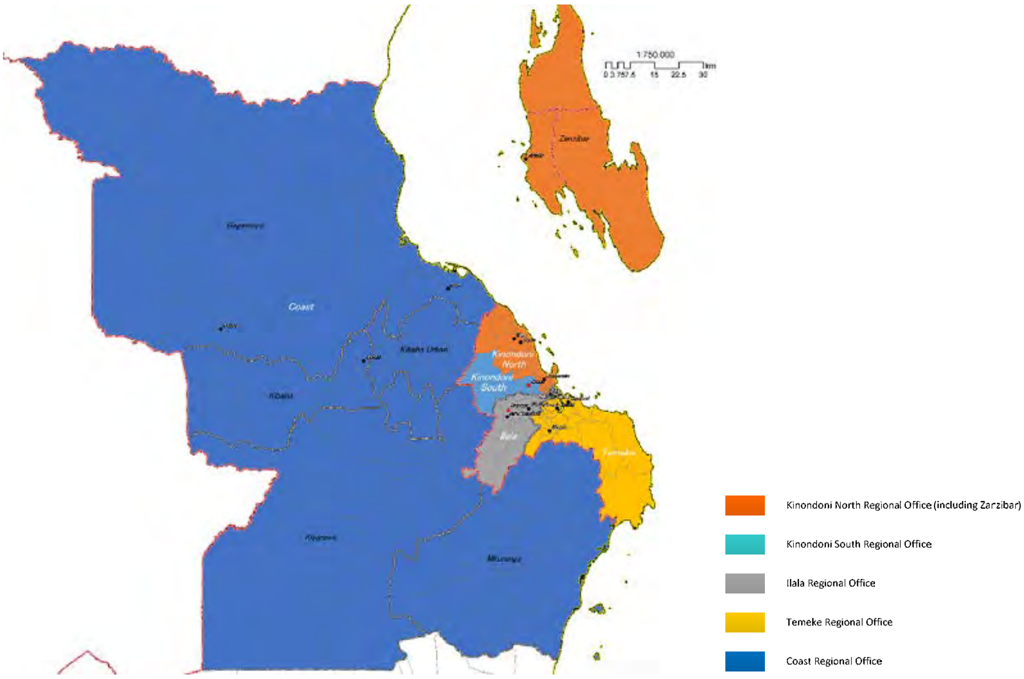
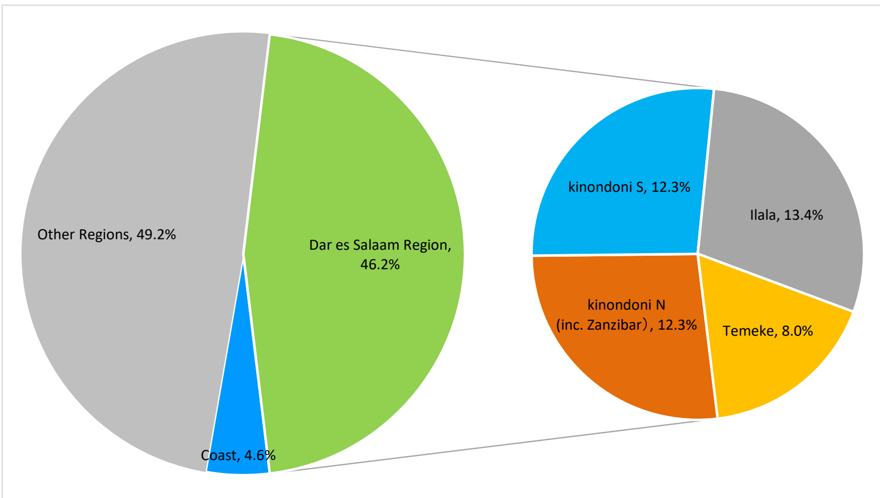


Figure 3-6.5 Business areas on power supply by TANESCO

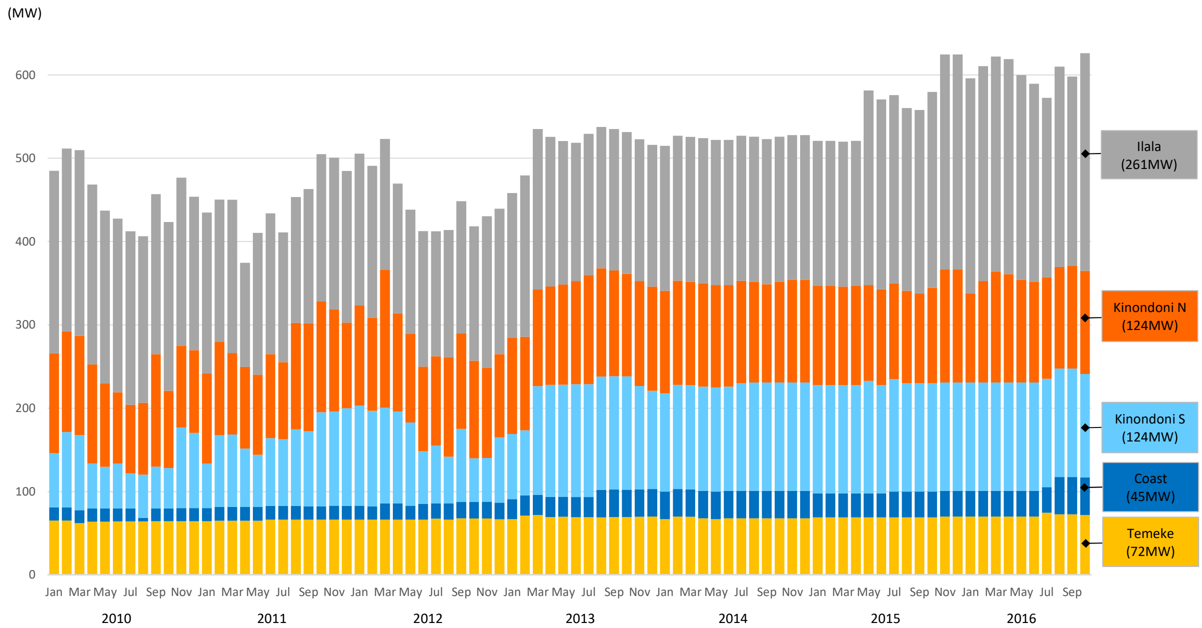
Basically, it follows the administrative division, but for the Kinondini area it operates the electricity business divided into the north and the south, and concerning Zanzibar it is supplying electricity from the Tegeta substation located in the Kinondoni North area, so Kinondoni North Office It has jurisdiction of the total national power demand in October 2016, Dar es Salaam, including Zanzibar, and the Coast region accounted for about one-half of the total. In the Dar es Salaam region, the power supply share of its four regions is as shown in Fig. 3-6.6 below.



Source: JICA Study Team by the data from TANESCO

Figure 3-6.6 Load Share of Dar es Salaam and Coast regions

From January 2010 through October 2016, the maximum power load per month of the four (4) TANESCO regions in the Dar es Salaam region is shown in Fig. 3-6.7 below. Peaks for the Temeke TANESCO region were nearly flat, while in other TANESCO regions, the peaks values were showing growth despite the presence of peaks and valleys.



Source: JICA Study Team by the data from TANESCO

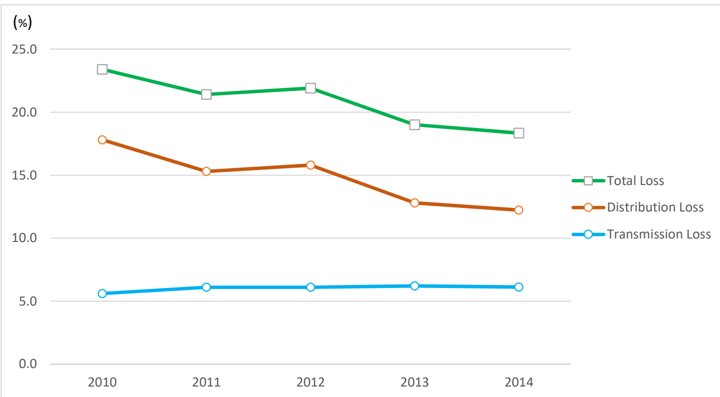
Figure 3-6.7 Transition of Peak Demand in Dar es Salaam and Coast regions

3-6-3 Power Loss

(1) Transmission and Distribution Loss

Fig. 3-6.8 shows transmission and distribution power loss in all of Tanzania from 2010 through 2014.

The trend analysis focuses on power loss reduction, and during the year of 2014 the average transmission and distribution loss was 18.3% (transmission loss: 6.1%, distribution loss: 12.2%).



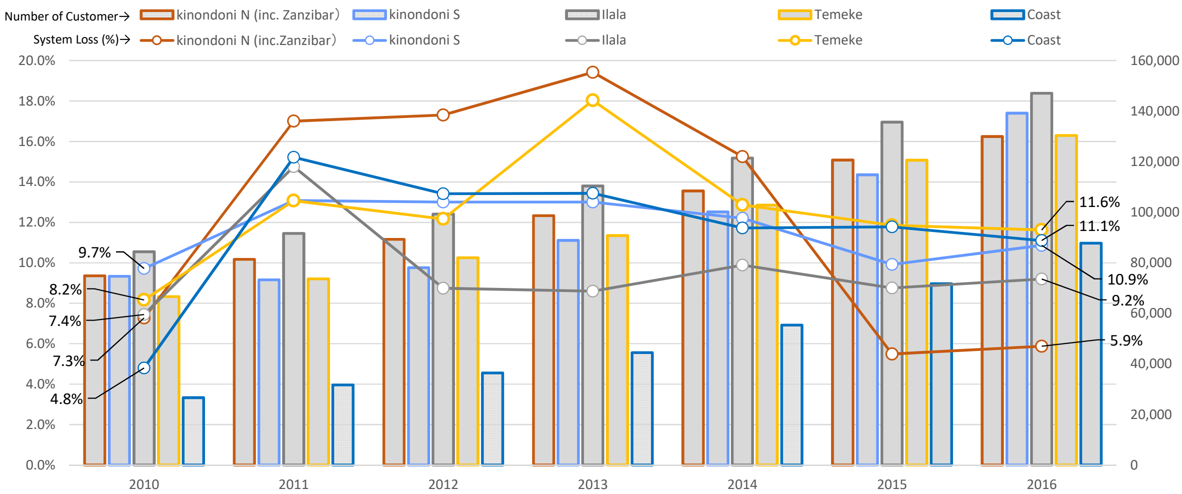
Source: JICA Study Team by the data from TANESCO

Figure 3-6.8 Transmission and Distribution Loss (2010 – 2014)

(2) Present Condition of Distribution Loss in Dar es Salaam and Coast regions

The electric power transmitted to districts where demanded is sold and the fees collected by the Regional Office controlling that district. On the whole, the system loss in transmitting electricity to users in Dar es Salaam and Coast regions is trending toward improvement. Reasons of high loss rate might be operation with small size conductors or longer low voltage lines compare to shorter medium voltage lines.

Average system loss percentages per TANESCO regional office from 2010 to October 2016 are shown in Figure 3-6.9.



Source: JICA Study Team by the data from TANESCO

Figure 3-6.9 Transition of System Loss rate in Dar es Salaam and Coast regions

TANESCO Regional Offices send reports to headquarters on billing rates (BR) for electricity transmitted, and cash collection rates (CCR) for electricity sold. The monthly reports of each Regional Office from 2010 to 2016 are summarized as follows:

BR：Billing Rate

The red line represents TANESCO sales targets and the blue one average annual rate of actual sales results.

In all of Tanzania, the Dar es Salaam region sales percentages are high, and due to reductions in sales losses at the Ilala office a sales rate of more than 90% has been maintained since 2012.

The North and South Regional Offices in Kinondoni have achieved more than a 90% sales rate since 2015, and the Temeke Regional Office and the Coast Regional Office maintain a sales rate very close to 90%. All regional offices in Dar es Salaam and Coast regions have achieved their sales goals.

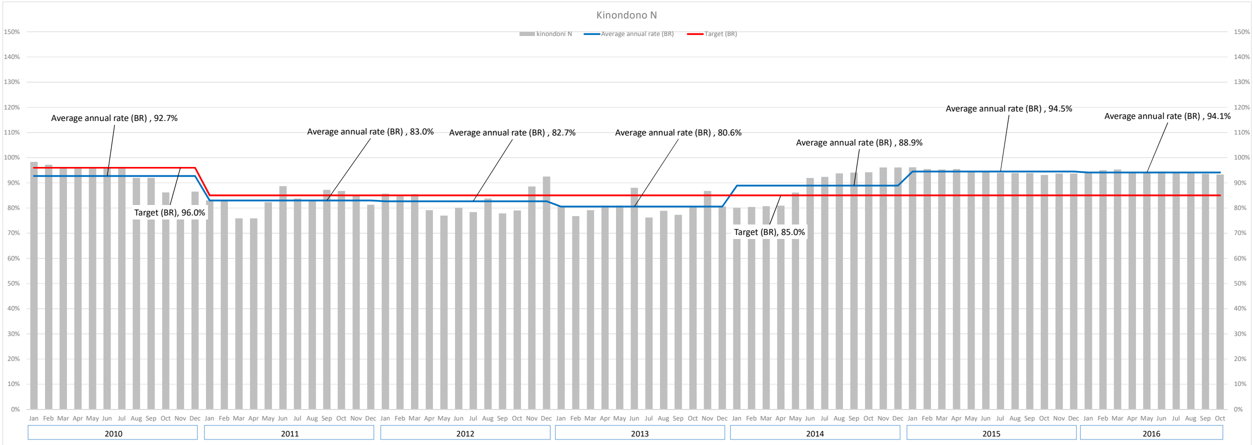


Figure 3-6.10 BR (Kinondoni North Regional Office)

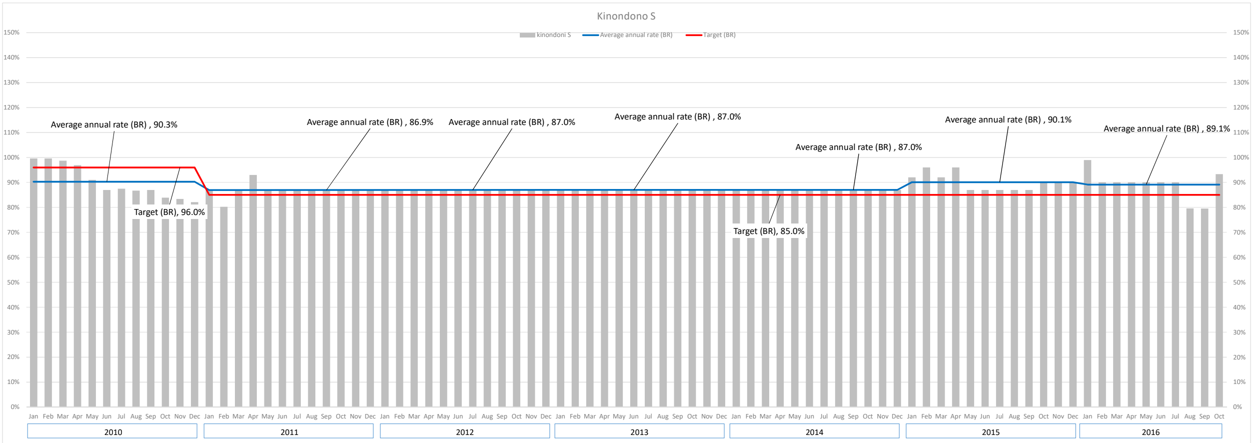


Figure 3-6.11 BR (Kinondoni South Regional Office)

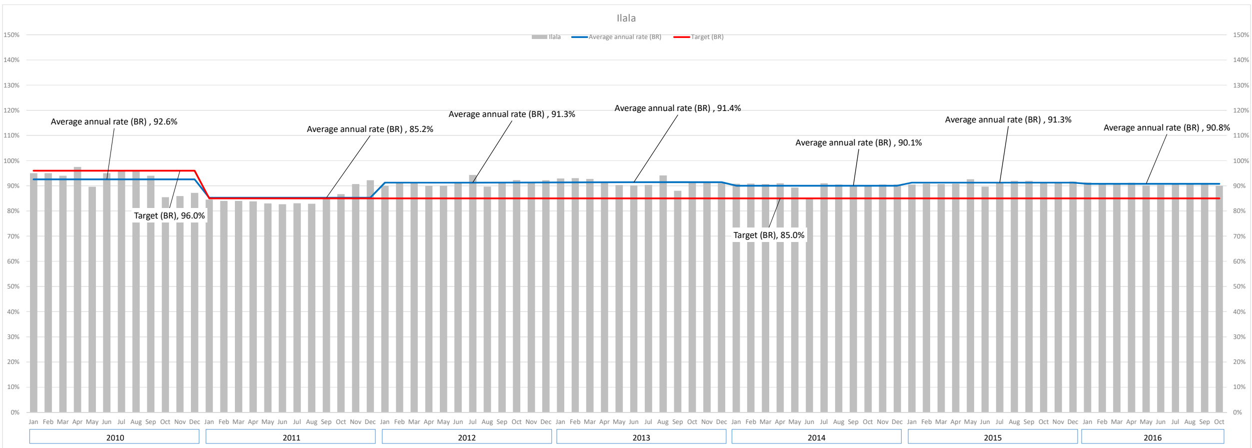


Figure 3-6.12 BR (Ilala Regional Office)

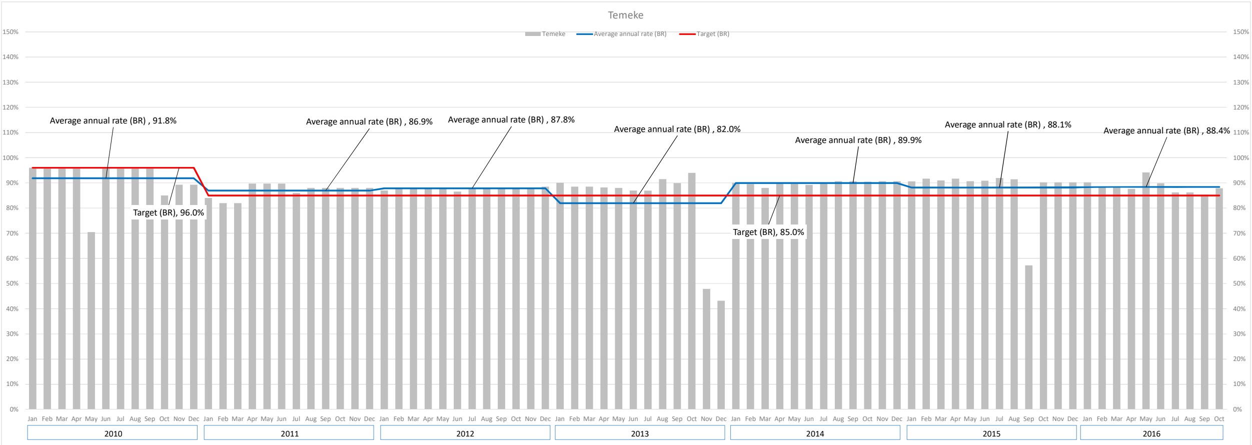


Figure 3-6.13 BR (Temeke Regional Office)

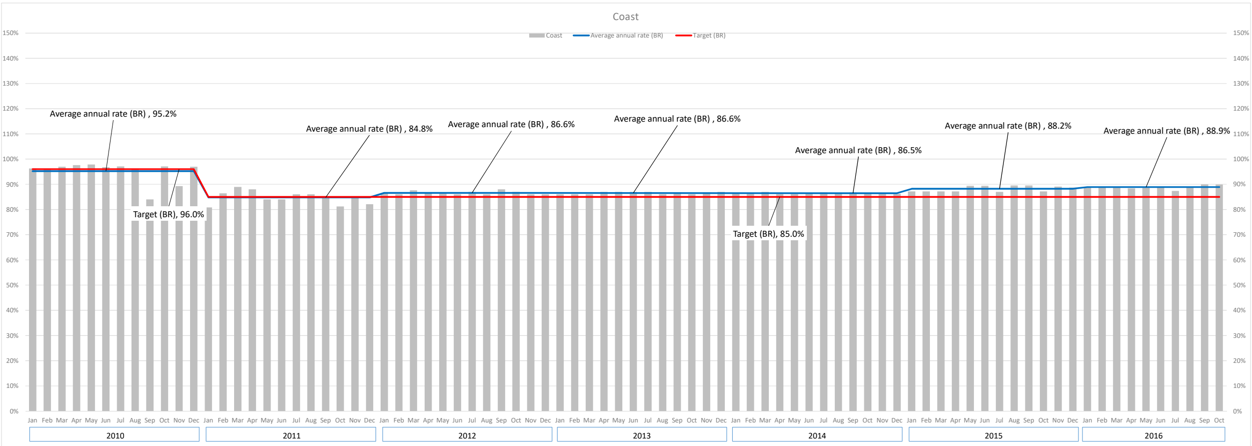


Figure 3-6.14 BR (Coast Regional Office)

CCR：Cash Collection Rate

Fig. 3-6.15 shows the movement in TANESCO customer numbers between 2010 and 2016. As of October 2010, TANESCO customers totaled more than 1.8 million, more than 33.5% of which were in Dar es Salaam and Coast regions. TANESCO billing systems were mostly done with meters read visually, but there were too many mistakes made and a great deal of power stolen, which resulted in low cash collection rates. But after installation of, LUKU meter prepaid system[4] in Dar es Salaam region during the 1990s, it was found the system to be effective and they are now installed country wide. This is thought to have contributed to improvement in the electricity cash collection rate.

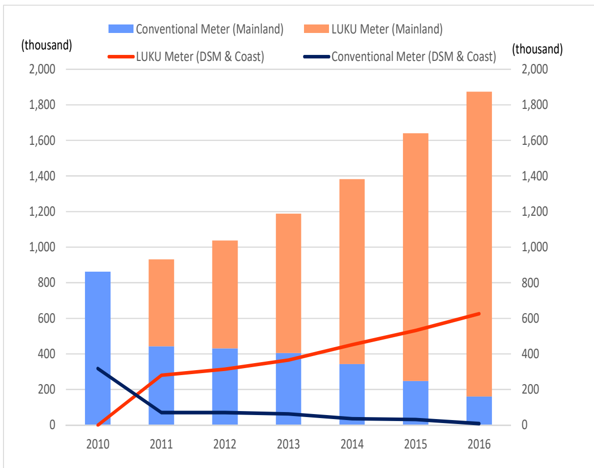


Figure 3.6-15 Number of Customers

[4] LUKU meter: A prepaid system that uses M-PESA LUKU Recharge or TIGO-PESA LUKU Recharge systems in mobile phones to handle payments. No handling fees, no need to go to a payment window, just input your LUKU meter number and pre-payments for can be made, and your electric power turned on.

In the charts below, the red lines indicate TANESCO's cash collection rate target and the green ones the average annual rate of actual cash collection. Within Tanzania, the Dar es Salaam regions cash collection rates are high, and with reductions in sales losses, Ilala Office has maintained sales rates of more than 90% since 2012.

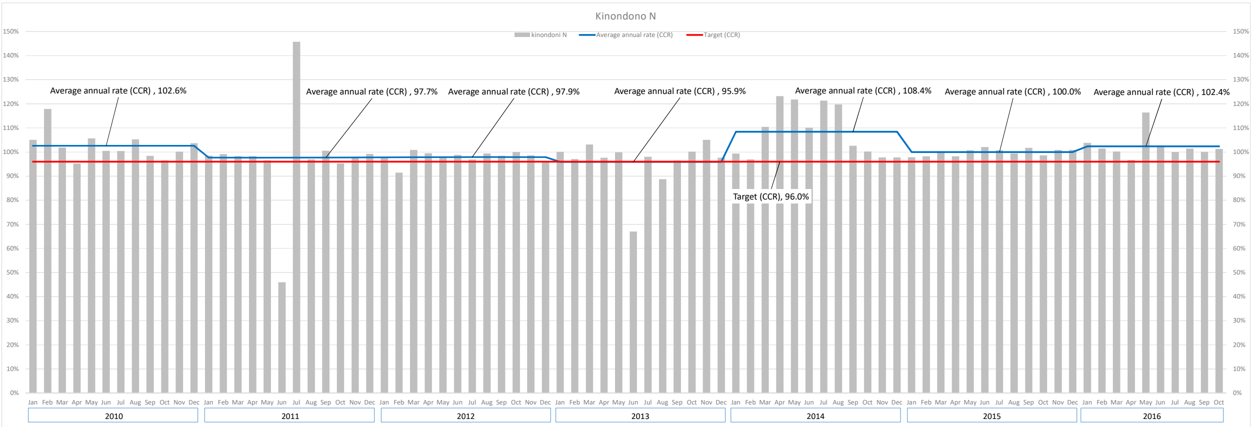


Figure 3-6.16 CCR (Kinondoni North Regional Office)

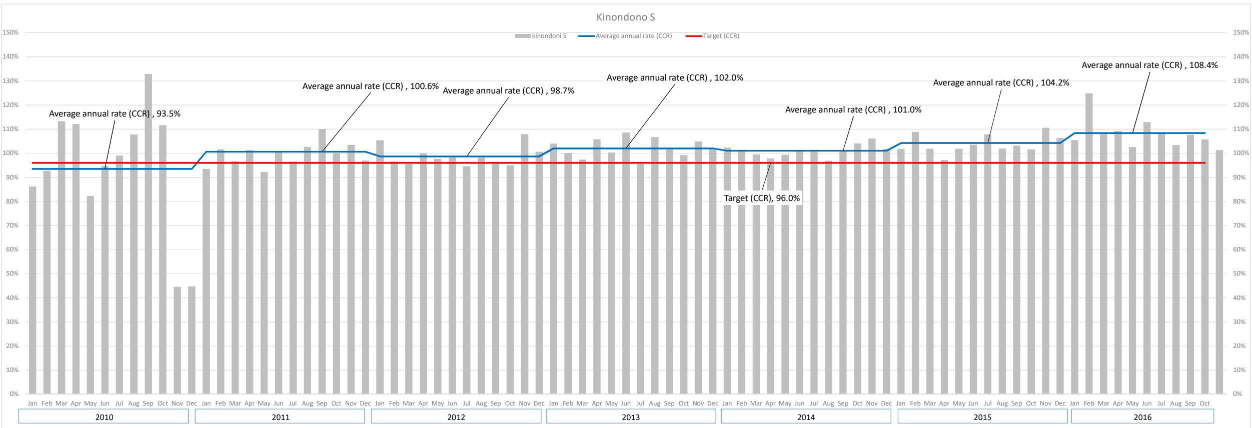


Figure 3-6.17 CCR (Kinondoni South Regional Office)

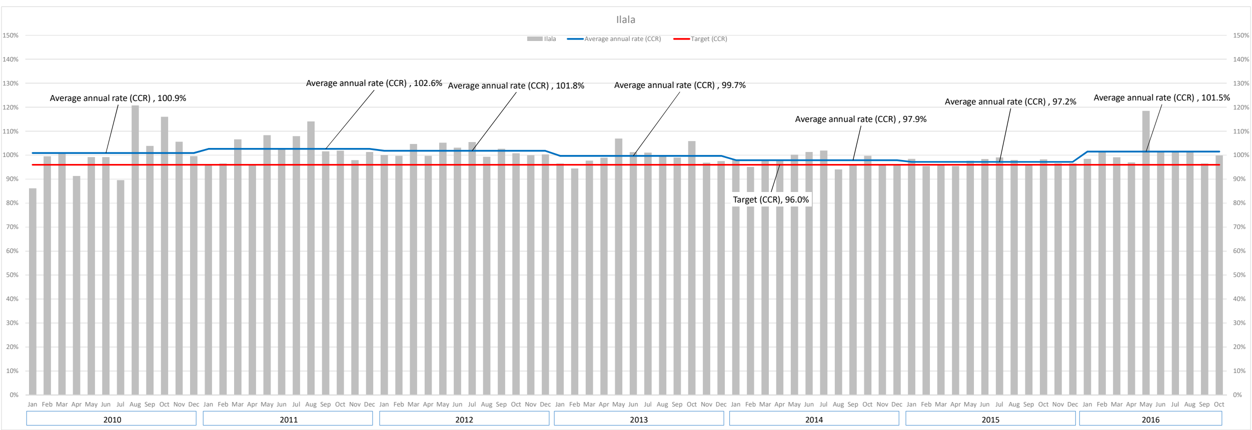


Figure 3-6.18 CCR (Ilala Regional Office)

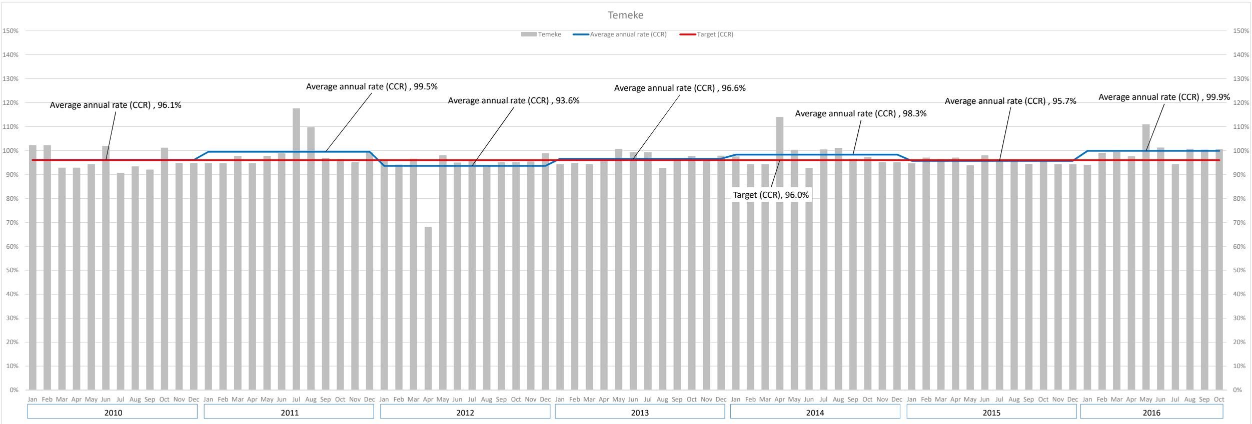


Figure 3-6.19 CCR (Temeke Regional Office)

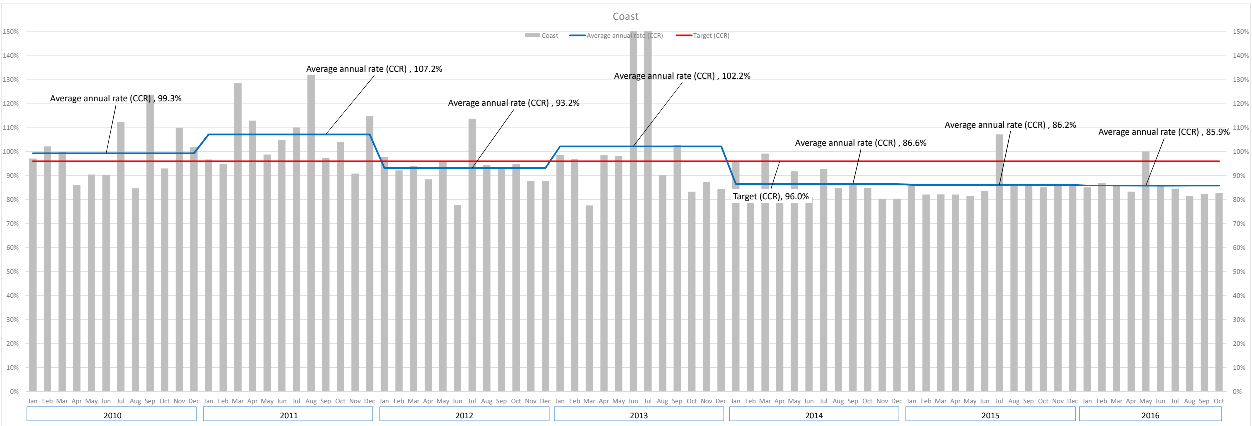


Figure 3-6.20 CCR (Coast Regional Office)

3-6-4 Access to the Electricity

Tanzania Rural Energy Agency (REA) has been in charge of rural electrification projects since 2007.

In December 2011, Turnkey Phase-I, a rural electrification project that included 41 sub-projects, in cooperation with the private sector connected 26,305 new customers in 16 regions in the country. In October 2013, Turnkey Phase-II was launched, which implemented 760 sub-projects for 24 regions and provided access to electricity about 2,500 villages and 1.25 million people.

As of March 2014, 24 percent of the Tanzanian population was connected with electricity supply. The GoT plans to increase connection levels to 30 percent by 2015, 50 percent by 2025 and at least 75 percent by 2033. To achieve these targets, more funds will be required for generation, transmission and distribution systems expansion.

Table 3-6.1 below shows the access to electricity in all regions as of March 2016.

In addition to the rural electrification projects by the REA mentioned above, TANESCOs promotion of new connections has been successful, leading to access for 37.1% of the villages in rural Tanzania, and to 45.1% of the total population obtaining access to electricity.

Moreover, in August 2016, the government of Tanzania announced investments in Turnkey Phase-III, which will bring electricity to another 7,500 villages.

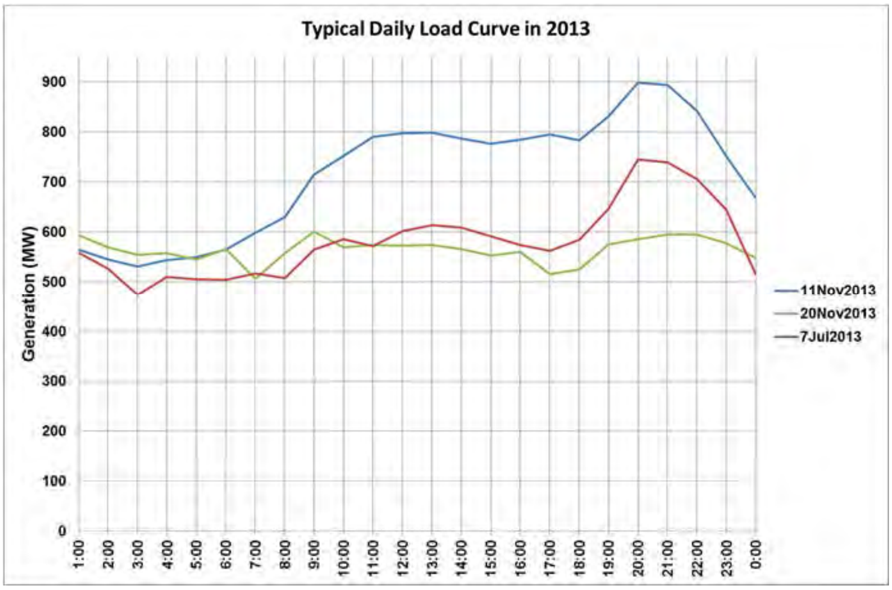
Table 3-6.1 Access to the Electricity in Tanzania (As of March 2016)

SN	Region Name	Total Village as per Census 2012	Connected	Not Connected	% of villages electrified	Benefiting population	Total population	Access
1	Arusha	429	225	204	52.4%	922,839	1,694,310	54.5%
2	Dar es salaam	453	410	43	90.5%	4,268,586	4,364,541	97.8%
3	Dodoma	633	268	365	42.3%	965,455	2,083,588	46.3%
4	Geita	495	62	433	12.5%	273,600	1,739,530	15.7%
5	Iringa	547	266	281	48.6%	376,315	941,238	40.0%
6	Kagera	709	303	406	42.7%	1,071,001	2,458,023	43.6%
7	Katavi	189	22	167	11.6%	59,772	564,604	10.6%
8	Kigoma	324	127	197	39.2%	820,062	2,127,930	38.5%
9	Kilimanjaro	585	470	115	80.3%	1,369,228	1,640,087	83.5%
10	Lindi	600	138	462	23.0%	239,454	864,652	27.7%
11	Manyara	485	211	274	43.5%	568,882	1,425,131	39.9%
12	Mara	572	236	336	41.3%	751,267	1,743,830	43.1%
13	Mbeya	1287	410	877	31.9%	1,126,839	2,707,410	41.6%
14	Morogoro	853	308	545	36.1%	877,904	2,218,492	39.6%
15	Mtwara	867	169	698	19.5%	269,863	1,270,854	21.2%
16	Mwanza	758	307	451	40.5%	1,231,167	2,772,509	44.4%
17	Njombe	422	216	206	51.2%	415,580	702,097	59.2%
18	Pwani (Coast)	547	231	316	42.2%	631,301	1,098,668	57.5%
19	Rukwa	521	79	442	15.2%	144,275	1,004,539	14.4%
20	Ruvuma	588	151	437	25.7%	432,551	1,376,891	31.4%
21	Shinyanga	552	141	411	25.5%	468,609	1,534,808	30.5%
22	Simiyu	487	132	355	27.1%	461,704	1,584,157	29.1%
23	Singida	463	150	313	32.4%	475,801	1,370,637	34.7%
24	Tabora	752	172	580	22.9%	541,887	2,291,623	23.6%
25	Tanga	1091	434	657	39.8%	895,583	2,045,205	43.8%
	Mainland	15209	5638	9571	**37.1%**	19,659,525	43,625,354	**45.1%**

Source: JICA Study Team by the data from TANESCO

3-6-5 Load Characteristics

The daily power load curve of Tanzania is the lights-on type that peaks when lights are turned on at night. This curve is true for both work days and holidays. Figure 3-6.21 shows typical daily power load curves for 2013. The blue line indicates the year's largest peak on November 11 (Mon.). The red line shows the daily power load on July 7 (Sun.). Both show that the daily power load peaked at 8:00 p.m. The green line (daily load curve for November 20 (Wed.)) shows that loads in daytime and nighttime are virtually the same but this is thought to be caused by limitations from the power provider.



Source: TANESCO

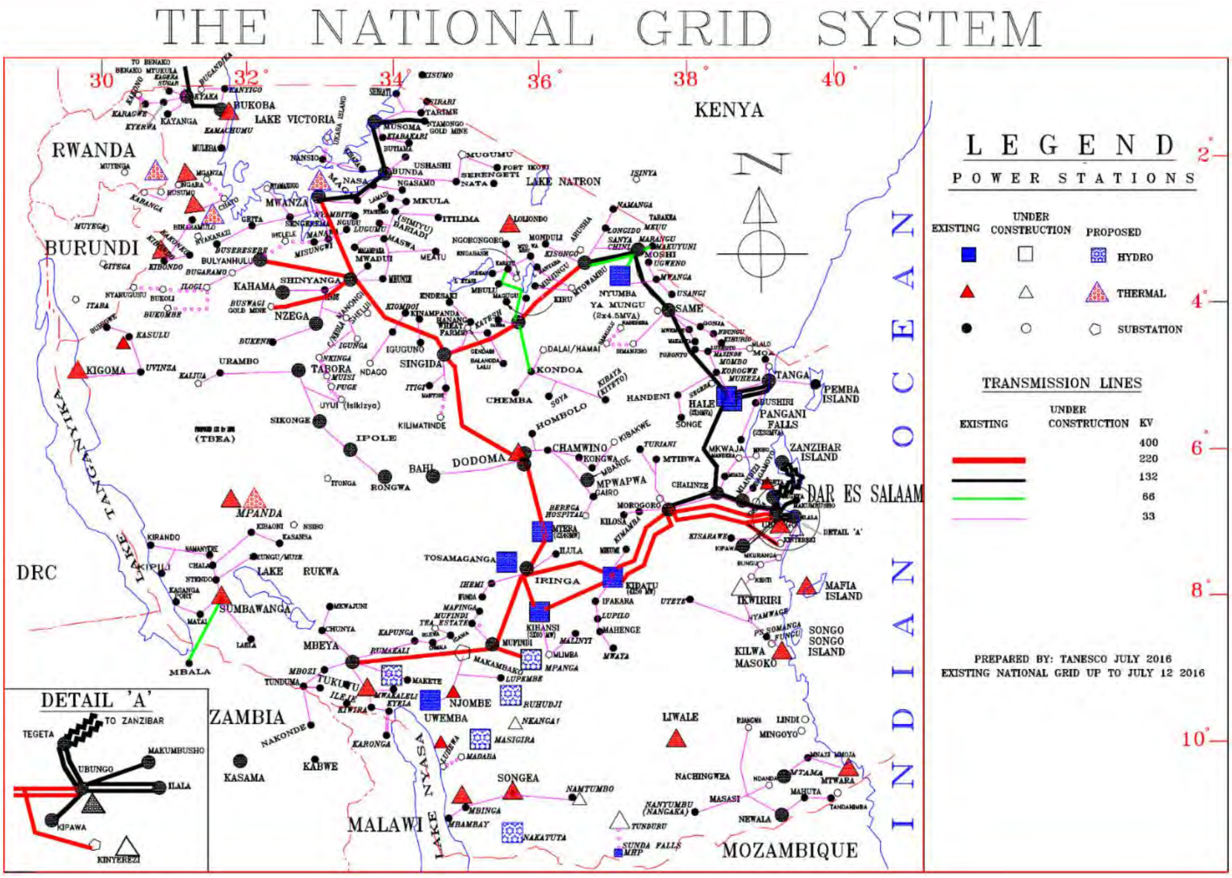
Figure 3.6-21 Typical Daily Load Curve (2013)

3-7 Existing Grid System

3-7-1 Main Grid

Since the transmission lines and substations were constructed in 1960's or 1970's and are operating continuously as shown in Table 3-7.1, most of equipment for power supply in the country are getting obsolete. Further, TANESCO is forced to restrict power supply for chronic overload conditions such as operation with long settling time of protection equipment. Thus, the lack of power supply resulted in the difficulty of social and economic activities.

Figure 3-7.1 shows Existing Grid System of the whole country. For existing grid system of Dar es Salaam and Coast Region, please see Chapter 5, "5-1-1 Transmission Line and Substations (1) Existing Network in Dar es Salaam and Coast Region".



Source: PSMP 2016 update

Figure 3-7.1 Tanzania Grid System

The transmission system is comprised of 647 km of 400 kV, 2,745 km of 220 kV, 1,626 km of 132 kV and 580 km of 66 kV. The isolated centers away from the grid are served by generating units with an aggregate nominal capacity of 81.5 MW. TANESCO imports power from Uganda via 132 kV (approximately 30 MW in the peak time) and from Zambia through 66 kV lines (approximately 10 MW in the peak time).

Simulation of the existing power system under peak load conditions revealed that the following portions of lines are overloaded;

- Iringa – Mtera – Dodoma – Singida 220 kV line
  (In particular, the average of load factor between Mtera and Dodoma in early 2015 was over 106%)

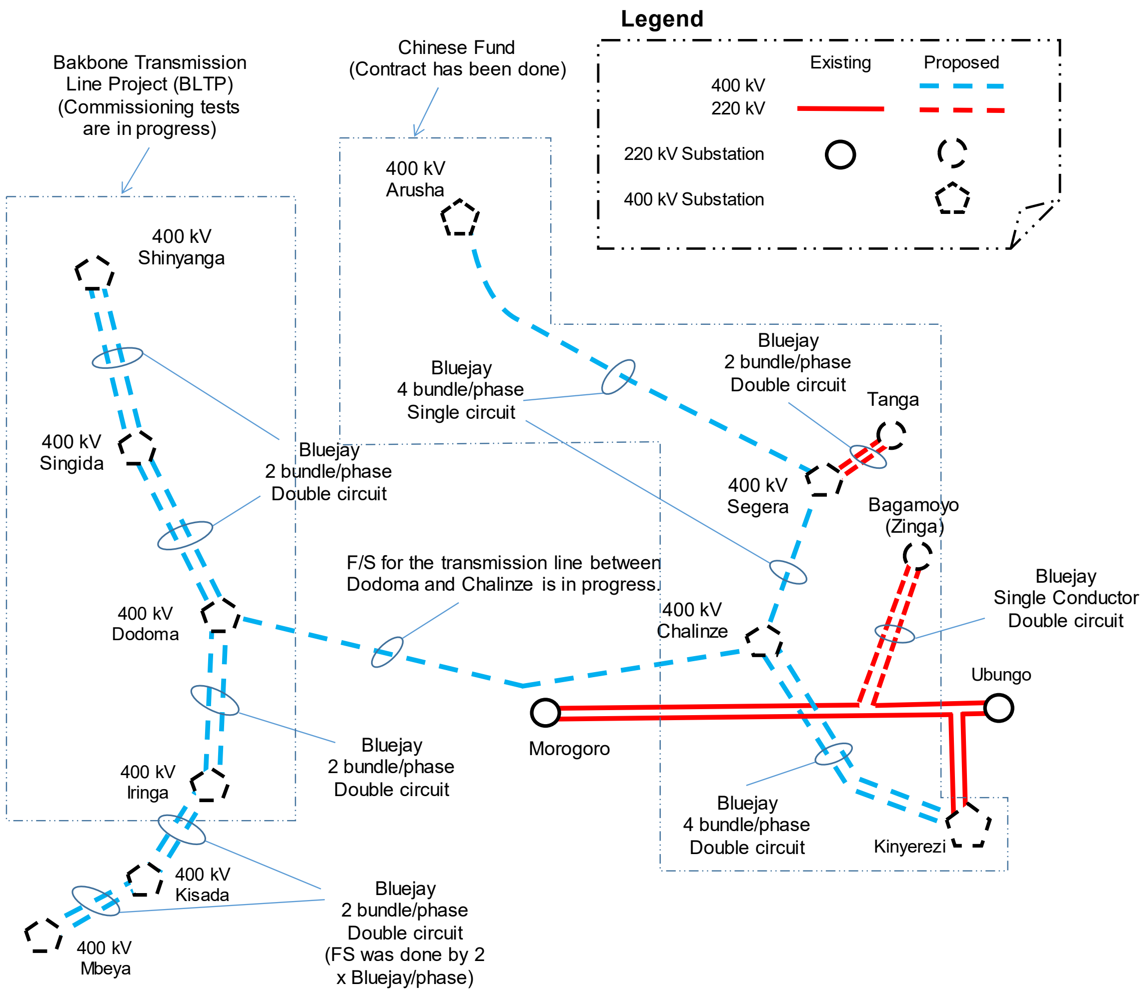
As a result of system analysis by TANESCO together with Norway consultant in October 2014, it was found that the overload was expected on the 132 kV transmission line from Chalinze to Arusha via Hale. (The conductor of the line is Wolf (150 mm^2) with normal rating 74 MVA only.)

This has resulted in the introduction of the following 400/220 kV projects at the moment;-

- 647 km of 400 kV Iringa – Shinyanga backbone project (in final stage of commissioning)
- 441 km of 400 kV Dar es Salaam – Chalinze – Segera – Arusha (committed)

- 64 km of 220 kV Segera – Tanga (committed)

The proposed increase of power generation in Mbeya and Iringa regions (Muchuchuma (coal); 600 MW in 2020, Kiwira (coal); 400 MW in 2020 and others) has caused shortage of the 220 kV line capacity to the areas. Hence, 400 kV lines “Iringa – Kisada (new substation) – Mbeya” (292 km) has been planned for construction. In addition, the feasibility study on the necessity of 400 kV transmission line from Chalinze to Dodoma (336 km) is in progress. Figure 3-7.2 shows 400/220 kV transmission lines and substations planned as of today.



Source: JICA Study Team by TANESCO information

Figure 3-7.2 Planned 400/220 kV transmission lines and Substations as of 2016

The existing transmission line (66 kV to 220 kV) are listed in Table 3-7.1. Note that 400 kV transmission lines are not included, since they are under final commissioning.

Table 3-7.1 Existing Transmission Line System (As of November 2016)

Rated Voltage (kV)	from	to	Route Length (km)	No. of Towers	No. of Circuits	Conductor		Year Commi-ssioned	Current Rating*1 (Amps)	Full Rating (MVA)	Normal Rating*2 (MVA)
						Code Name	Aluminum Sectional Area (mm^2)				
220	Morogoro	Ubungo 1st	172	456	1	Bluejay	564	1975	1,092	416	333
220	Kidatu	Mindu	116	279	1	Bluejay	564	1975	1,092	416	333
220	Mindu	Moro Dev.	12	41	1	Bluejay	564	1982	1,092	416	333
220	Kidatu	Iringa	160	441	1	Bison	350	1985	679	259	207
220	Iringa	Mufindi	130	336	1	Bison	350	1985	679	259	207
220	Iringa	Mtera	107	297	1	Bison	350	1985	679	259	207
220	Mtera	Dodoma	130	303	1	Bison	350	1985	679	259	207
220	Mufindi	Mbeya	220	544	1	Bison	350	1985	679	259	207
220	Dodoma	Singida	210	528	1	Bison	350	1988	679	259	207
220	Singida	Shinyanga	200	532	1	Bison	350	1988	679	259	207
220	Shinyanga	Mwanza	140	336	1	Bison	350	1988	679	259	207
220	Morogoro	Kidatu	130	328	1	Bluejay	564	1993	1,092	416	333
220	Morogoro	Ubungo 2nd	179	477	1	Bluejay	564	1995	1,092	416	333
220	Singida	Babati	150	424	1	Rail	483	1996	993	378	303
220	Babati	Arusha	162	433	1	Rail	483	1996	993	378	303
220	Kihansi	Iringa	95	277	1	Bluejay	564	1998	1,092	416	333
220	Kihansi	Escapmet	2	2	1	Pheasant	644	1998	1,187	452	362
220	Kihansi	Kidatu	180	529	1	Bluejay	564	1999	1,092	416	333
220	Shinyanga	Bulyanhulu	129	277	1	Bison	350	2000	679	259	207
220	Shinyanga	Buzwagi	108	237	1	Bison	350	2000	679	259	207
220	Kinyerezi	Ubungo-Pai	6	23	1	Bluejay	564	2016	1,092	416	333
220	Kinyerezi	Ubungo-Pai	6	23	1	Bluejay	564	2016	1,092	416	333
132	Ubungo	Mlandizi	37	334	1	Wolf	150	1963	406	93	74
132	Mlandizi	Chalinze	60		1	Wolf	150	1963	406	93	74
132	Chalinze	Hale	175	534	1	Wolf	150	1963	406	93	74
132	Chalinze	Morogoro	82	288	1	Wolf	150	1967	406	93	74
132	Hale	Tanga	60	389	1	Wolf	150	1971	406	93	74
132	Hale	Same	173	561	1	Wolf	150	1975	406	93	74
132	Same	Kiyungi	102	291	1	Wolf	150	1975	406	93	74
132	Ubungo	Tegeta	19	64	1	Wolf	150	1980	406	93	74
132	Tegeta	Zanzibar	38	-	1	XLPE Cu	95	1980	286	65	52
132	Kiyungi	Arusha (Njiro)	70	208	1	Wolf	150	1983	406	93	74
132	Mwanza	Musoma	210	628	1	Wolf	150	1989	406	93	74
132	Shinyanga	Tabora	203	587	1	Wolf	150	1989	406	93	74
132	Musoma	Nyamongo	90	238	1	Wolf	150	1989	406	93	74
132	Mtukula (Uganda)	Kyaka	30	85	1	Tiger	130	1992	361	83	66
132	Kyaka	Kibeta/Bukoba	54	157	1	Tiger	130	1992	361	83	66
132	Hale	Tanga	60	200	1	Hawk	241	1994	659	151	121
132	Pangani Falls	Hale	9	33	2	Hawk	241	1995	659	301	241
132	Ubungo	FZ III (Kipawa)	9	16	1	Wolf	150	2000	406	93	74
132	Ubungo	Makumbusho	7	37	1	Hawk	241	2010	659	151	121
132	Ubungo (II)	Tegeta	19	64	1	Wolf	150	2012	406	93	74
132	Ras Kilomoni	Zanzibar II	38	-	1	XLPE Cu	400	2013	640	146	117
132	Ubungo	Ilala	8	25	2	TACSR240	240	1999/2016	962	440	352
132	Kinyerezi	FZ II	4	16	1	Wolf	150	2016	406	93	74
132	Kiyungi	Njiro	70	300	1	Wolf	150	2016	406	93	74
66	Kiyungi	Arusha	78	625	1	Rabbit	50	1967	197	23	18
66	Nyumba Ya Mungu	Kiyungi	53	463	1	Rabbit	50	1968	197	23	18
66	Babati	Kondoa	85	251	1	Wolf	150	1999	406	46	37
66	Babati	Mbulu	85	192	1	Wolf	150	1999	406	46	37
66	Mbulu	Karatu	65	172	1	Wolf	150	1999	406	46	37
66	Mbala (Zambia)	Sumbawanga	120	569	1	Wolf	150	2001	406	46	37
66	Bunda	Kibara	60	300	1	Rabbit	50	2007	197	23	18
66	Kiyungi	Makuyuni	34	172	1	Wolf	150	2012	406	46	37

Note: *1 Source; SURAL catalogue
*2; Normal Rating
＝Full Rating x 80%

Voltage	Total Length Above Table	No. of Lines Above Table	Remarks
220kV	2,745	22	
132kV	1,626	24	(2 x submarine cables included)
66kV	580	8	
Total:	4,950	54	

Source: PSMP 2016 update

The main features of ACSR conductor and XLPE cable on each voltage are shown in Table 3-7.2.

Table 3-7.2 ACSR conductor and XLPE cable properties on each voltage

Voltage	Conductors	Code	Cross Section (mm^2)	Number of Conductor	*Capacity (MVA)	Remarks
220 kV	ACSR	Bluejay	565	1	333	
				2	666	Planned
				4	1,232	Planned
		Bison	350	1	207	
		Pheasant	644	1	362	
		Rail	483	1	303	
132 kV	ACSR	Wolf	150	1	74	
		Hawk	241	1	121	
		Tiger	130	1	66	
	XLPE	—	300/400	-	143	Submarine cable
		—	95	-	52	
66 kV	ACSR	Wolf	150	1	37	
		Rabbit	50	1	18	

Source: JICA Study Team

*Capacity is 80% of the full rating of the conductor. (TANESCO standard)

As shown in Table 3-7.2, ACSR Hawk sectional size adopted on 132kV transmission lines is 240mm^2, which was fair enough when the lines were built. However, it is rather small transmission capacity at the moment in these days. Although on 220kV transmission lines, only single conductor is so far adopted, in the future plan a multiple conductor will be deployed such as Twin, Quadruple bundle phase conductor.

There are 49 substations with 66 kV to 220 kV in the national network as of 2015, as shown in Figure 3-7.1. The existing transformers in substations are summarized in Table 3-7.3. (Note; Details of transformers per substations are indicated in Attachment S-4.)

Table 3-7.3 Summary of Transformers in Substations

Primary Voltage (kV)	Secondary Voltage (kV)	Tertiary Voltage (kV)	Unit Capacity (MVA)	Units	Total Capacity (MVA)	Remarks
220	132	33	45	1	45	
			60	6	360	
			90	1	90	
			150	2	300	
		—	60	2	120	
	66	—	30	2	60	Babati
	33	33	35	2	70	Tertiary winding : Shunt reactors
	33	—	10	1	10	
			15	2	30	
			20	2	40	
			22.5	2	45	
			22.5	2	45	For Shunt reactors
			30	5	150	
	11	—	45	2	90	3 x 15 MVA single phase transformer
		—	60	4	240	For 51 MW Generators
		—	71	3	213	For generators

Primary Voltage (kV)	Secondary Voltage (kV)	Tertiary Voltage (kV)	Unit Capacity (MVA)	Units	Total Capacity (MVA)	Remarks
	6.6	—	15	1	15	Bulyanhulu
Total of 220 kV Transformers				30	1,923	
132	66	33	15	1	15	
	66	—	15	1	15	
		—	20	1	20	
	33	11	120	2	240	For generators
	33	—	5	2	10	
			10	9	90	
			15	7	105	
			20	6	120	
			30	2	60	
			45	3	135	
			50	2	100	
			60	4	240	
			90	3	270	
	11	—	40	2	80	
			56	3	168	For generators
			60	2	120	
			65	4	260	For generators
	6.6	—	45	1	45	
Total of 132 kV Transformers				55	2,093	
66	33	11	8.4	5	50.4	
	33	—	5	5	25	
			10	2	20	
	11	—	5	2	10	
Total of 66 kV Transformers				14	105.4	
33	33	—	20	2	40	Voltage regulating transformer
	11	—	5	1	5	For generators
			12.5	2	25	
Total of 33 kV Transformers				5	70	
11	11	—	2	2	4	For phase shifting
Total Number and Capacity				**106**	**4,195.4**	

Source: Study team based on TANESCO data

Reactive power compensators in the network are shown in Table 3-7.4 (Static Var Compensators, 3-7.5 (Shunt Reactors) and 3-7.6 (Capacitor Banks).

Table 3-7.4 List of Static Var Compensators in Substations

Name of S/S	ID No.	Voltage (kV)	Capacity (Mvar)	Remarks
Shinyanga	SVC1	220	-35 to +30	
Singida	SVC1	220	-35 to +30	

Source: Study team based on TANESCO data

Table 3-7.5 List of Shunt Reactors in Substations

Name of S/S	ID No.	Voltage (kV)	Capacity (Mvar)	Remarks
Bulyanhulu	R1	220	15	
Buzwagi	R1	220	15	
Dodoma	R1	220	60	There are two (2) x R2 reactors (different capacities).
	R2		60	
	R2		20	
	R3	33	10	
	R4		10	
Iringa	R1	220	60	
	R1	33	10	
	R2		10	
Kihansi Hydro	R1	220	20	
Mufindi	R1	11	35	
Mbeya	R1	220	10	
Mwanza	R1	33	10	
	R2		10	
Njiro	R1	220	20	
Nyamongo	R1	132	5	
Shinyanga	R1	220	60	
	R2		60	
	R3	33	10	
	R4		10	
Singida	R1	220	20	
	R2		20	
	R1		60	
	R2		60	
	R3	33	10	
	R4		10	

Source: Study team based on TANESCO data

Table 3-7.6 List of Capacitor Banks in Substations

Name of S/S	ID No.	Voltage (kV)	Capacity (Mvar)	Remarks
Buzwagi	CB1	33	5	
	CB2		5	
	CB3		5	
	CB4		5	
Dodoma	FSC1	220	91	Fixed Series Compensator
Ilala	CB1	33	18.3	
	CB2		18.3	
	SC11	11	5	SC11 to 13 will be installed by Japan's Grant Aid project in 2016.
	SC12		5	
	SC13		5	
Kiyungi	C1	33	2.5	
	C2		2.5	
	C3		5	
	C4		5	
	C5		5	
Njiro	C1	33	10	
	C2		10	
	C3		10	
	C4		10	
Nyamongo	C1	33	5	
Tanga	C1	33	10	
	C2		10	
Ubungo	CB1	33	18.3	Connected to Auto-transformer tertially.
	CB2		18.3	Ditto

Source: Study team based on TANESCO data

3-7-2 Assistance from donors related to Power System

In recent years, aid to Tanzania for expansion and reinforcement of the power system has been mostly received from Japan, the World Bank, the African Development Bank, and Finland. The following summarizes the power system projects currently under way.

(1) Japan

Under Japan's aid policy of "promoting economic and social development towards sustainable economic growth and poverty reduction", the electric power sector is classified as a high priority area among other infrastructure development projects where Japan's technological assistance can be fully utilized. During such projects, Japan's aid efforts will also aim to control emissions of greenhouse gases and develop sustainable use of resources, etc., which also protect the environment. At the same time, Japan aims to assist in attaining effective use of the infrastructure and independent management through personnel training and development. With these goals in mind, assistance projects as listed in Table 3-7.7 are currently in progress.

Table 3-7.7 Japanese Assistance in recent years

Project name	Scheme	Period
Capacity Development of Efficient Distribution and Transmission systems	Technical cooperation project	2009 Aug. – 2016 Mar.
Iringa-Shinyanga Trunk Transmission Line Reinforcement Project	Loan project	2010 Dec. – 2014 Jun.
Reinforcement of Power Distribution in Dar es Salaam (Detailed Design)	Grant aid project	2015 Mar. – on-going
Group training in Japan	Training on subject-basis	As appropriate

Table 3-7.8 summarizes the ODA Project for Reinforcement of Power Transmission and Distribution in Dar es Salaam, which was under way as of October 2016.

Table 3-7.8 Project Component (Japan)

Priority	Substation	Component
1	Ilala substation (132/33/11kV) (Reinforcement)	• Reinforcement of Ilala substation Including two sets of 60 MVA Transformer (132/33 kV) • Reinforcement of existing 132kV transmission line (approximately 7.5km: from Ubungo substation to Ilala substation)
2	Msasani substation (33/11kV) (Expansion)	• Expansion of Msasani substation Including a set of 15 MVA Transformer (33/11kV) • Construction of 33kV distribution line (approximately 7.6 km: from Makumbusho substation to Msasani substation)
3	Muhimbili substation (33/11kV) (New construction)	• Construction of Muhimbili substation Including a set of 15 MVA Transformer (33/11kV) • Construction of 33kV distribution line (approximately 2.0km: from NCC (New City Center) substation to Muhimbili substation)
4	Jangwani Beach substation (33/11kV) (New construction)	• Construction of Jangwani Beach substation Including a set of 15 MVA Transformer (33/11kV) • Construction of 33kV distribution line (approximately 6.5 km: from Tegeta substation to Jangwani Beach substation)
5	Mwananyamala substation (33/11kV) (New construction)	• Construction of Mwananyamala substation Including a set of 15 MVA Transformer (33/11kV) • Construction of 33kV distribution line (approximately 1.1 km: from Makumbusho substation to Mwananyamala substation)

Source: JICA Study Team by the data from TANESCO

(2) World Bank (WB)

In addition to its loan project for trunk power distribution systems, the WB also carries out the Tanzania Energy Development and Access Expansion Project (TEDAP), which aims to improve access to electricity. Under the US$91 million TEDAP, high-voltage transmission lines and primary substations are improved and constructed in the major cities of the Dar es Salaam region, Kilimanjaro region, Arusha region, etc. as Transmission component. The distribution component consists of reinforcement and construction of medium-voltage distribution lines plus primary and secondary substations in the said major cities. The transmission component was scheduled for completion in December 2014 and the distribution component in February 2015, but construction has been delayed and therefore, both components will be completed in 2017.

Table 3-7.9 Project Component (TEDAP)

<table>
<tr><td rowspan="5">A: Transmission Project</td><td>NO.</td><td>Project Title</td><td>Component</td></tr>
<tr><td>Lot 1:</td><td>Substations in Dar es Salaam</td><td>- Extension of Ubungo S/S
- Extension of FZIIIS/S
- 1×50MVA TR at FZII
- 1×50MVA TR at Mbagala
- 1×50MVA TR at Kurasini</td></tr>
<tr><td>Lot 2:</td><td>Transmission Lines in Dar es Salaam</td><td>- Ubungo-Kurasini 13.0km
- Kurasini-Mbagala 15.1km
- Mbagala-FZII 16,2km
- FZII- FZIII 7.4km</td></tr>
<tr><td>Lot 3b:</td><td>Substation Kilimanjaro International Airport (KIA)</td><td>- 2×20MVA Transformers</td></tr>
<tr><td>Lot 3c:
Lot 4 :</td><td>Rehab. Kiyungi Substation and new 132kV Transmission Line</td><td>- New MV Indoor Switchgear 70km Kiyungi-Njiro T/Line</td></tr>
<tr><td rowspan="5">B Distribution Project</td><td>NO.</td><td>Project Name</td><td>Component</td></tr>
<tr><td>Lot 1:</td><td>6 New Substations in Dar es Salaam</td><td>- 2×15MVA TR City Center
- 1×15MVA TR FZI
- 1×15MVA TR FZII
- 1×15MVA TR Mburahati
- 2×15MVA TR Mikocheni
- 2×15MVA TR Oysterbay</td></tr>
<tr><td>Lot 2:</td><td>Rehabilitation of 5 Substations in Dar es Salaam</td><td>- 1×15MVA TR Chang'ombe
- 1×15MVA TR Kariakoo
- 2×15MVA TR Kurasini
- ×15MVA TR Mbagala
- ×15MVA TR Ubungo</td></tr>
<tr><td>Lot 3:</td><td>Installation of 8 Substations in Arusha & Kilimanjaro</td><td>- 1×15MVA TR Boma Mbuzi
- 1×15MVA TR Mt. Meru
- 1×15MVA TR Kiltex
- 1×15MVA TR Njiro B
- 1×15MVA TR Sakina
- 1×15MVA TR Themi
- 1×15MVA TR Trade School
- 2×15MVA TR Unga Ltd</td></tr>
<tr><td>Lot 4:</td><td>Distribution Lines in Dar es Salaam, Arusha & Kilimanjaro</td><td>- 33kV OHL ×83km in DSM
- 33/0.4kV TR×39 in DSM
- 11/0.4kV TR×11 in DSM
- 33kV OHL ×62km in Arusha
- 11kV OHL ×81km in Arusha
- 33/0.4kV TR×24 in Arusha
- 11/0.4kV TR×23 in Arusha
- 33kV OHL ×25km in Moshi</td></tr>
</table>

Source: JICA Study Team by the data from TANESCO

(3) African Development Bank (AfDB)

Other than the loan projects for trunk power distribution systems conducted by the AfDB in financial cooperation with Japan, the UA 75 million Electricity V Project is also is completed This was involved in rehabilitation and construction of substations in major cities and outlying districts, constructing distribution line systems, etc., replacing transformers (made in Japan) and repair of other related equipment in the Ilala substation, which is the main primary substation in the Dar es Salaam region.

Table 3-7.10 Project Component (AfDB)

	Project Title	Project Scope
AfDB	Iringa-Shinyanga Transmission Line (Backbone transmission investment project)	- Construction of 400kV Backbone Transmission Line between Iringa and Shinyanga
	Electricity V Improvement of power supply and expansion of the area in Dar es Salaam, Arusha, Mtwara regions.	- Construction of Distribution Line - Rehabilitation of 4 substations - Assistance to formulate Distribution Master Plan in 8 regions - Study for SCADA (Supervisory Control and Data Acquisition) - TANESCO Revaluation of asset value

Source: JICA Study Team by the data from TANESCO

(4) Finland

In addition to construction of primary substation in central Dar es Salaam, the scope of Finland's project includes the construction high-voltage distribution lines, repairing secondary transformer stations, building a distribution control center, and installing telecommunications terminals in existing substations.

Table 3-7.11 Project Component (Finland)

	Project Title	Project Scope
Government of Finland	Improving the Electric Power Supply Reliability in the City of Dar es Salaam	- Distribution SCADA system (for the control of the 33kV distribution network in Dar es Salaam). - One new 132/33kV substation (City Center) with two (2) 132/33kV – 35/50 (ONAN/ONAF) MVA power transformers. - Extension of Ilala 132kV substation (feeder bay plus gantries) - 132kV underground cable connecting Ilala and new City Centre substations. - Reinforcement of Sokoine and Kariakoo 33/11kV substations. - 33kV underground cable network for connecting Sokoine, Kariakoo and Railway station substations to form a ring.

Source: JICA Study Team by the data from Hifab

(5) Millennium Challenge Corporation (MCC)

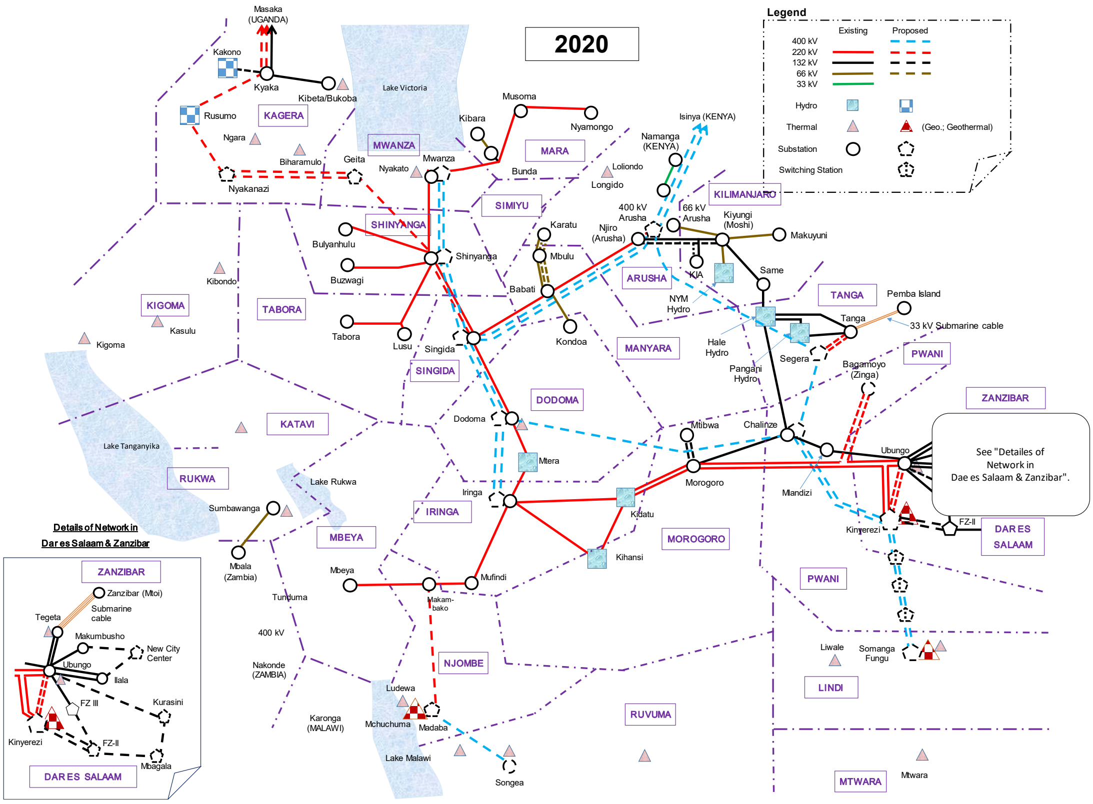
To improve power conditions on the island of Zanzibar, a US$63 million project was implemented for laying a high-voltage submarine cable, constructing high-voltage distribution lines and substations etc., which was completed in 2013. Distribution of electricity on the island of Zanzibar is done by Zanzibar Electricity Corporation (ZECO), but most of the electricity is supplied by TANESCO through Tegeta substation from the mainland.Development Plan of Transmission Lines and Substations.

3-8 Development Plan of Transmission Lines and Substations

3-8-1 National Grid Development Plan

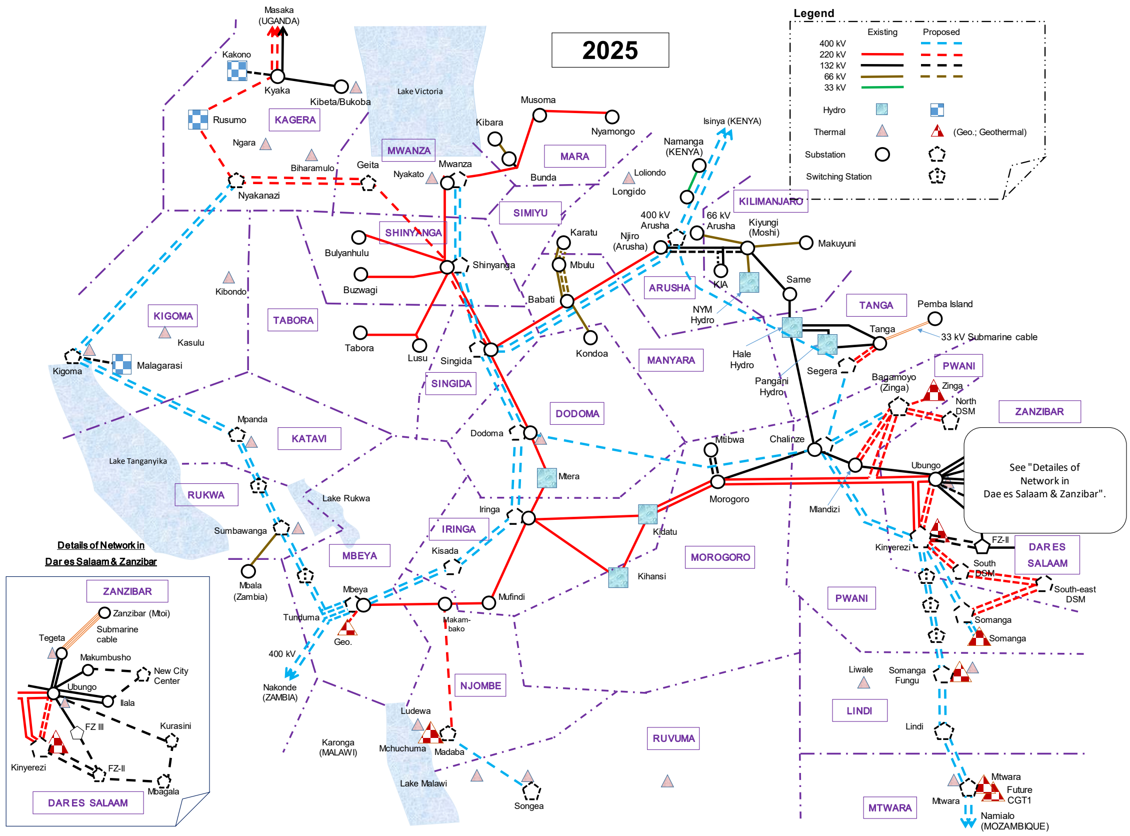
TANESCO has released "POWER SYSTEM MASTER PLAN 2016 UPDATE" in December 2016.

The development plan from 2020 to 2040 (per 5 years) are shown in Figure 3-8.1 (1) to (5) below.



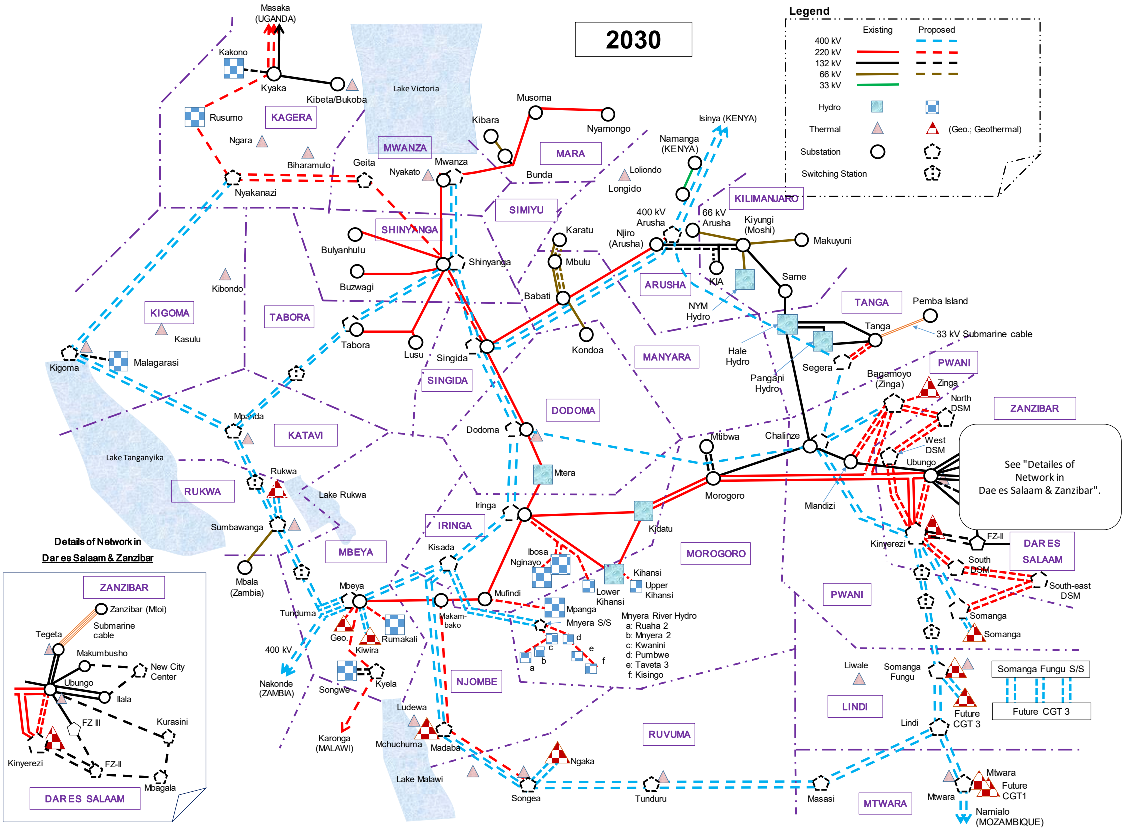
Source: PSMP 2016 update

Figure 3-8.1 (1) Generation and Transmission Plan – Year 2020



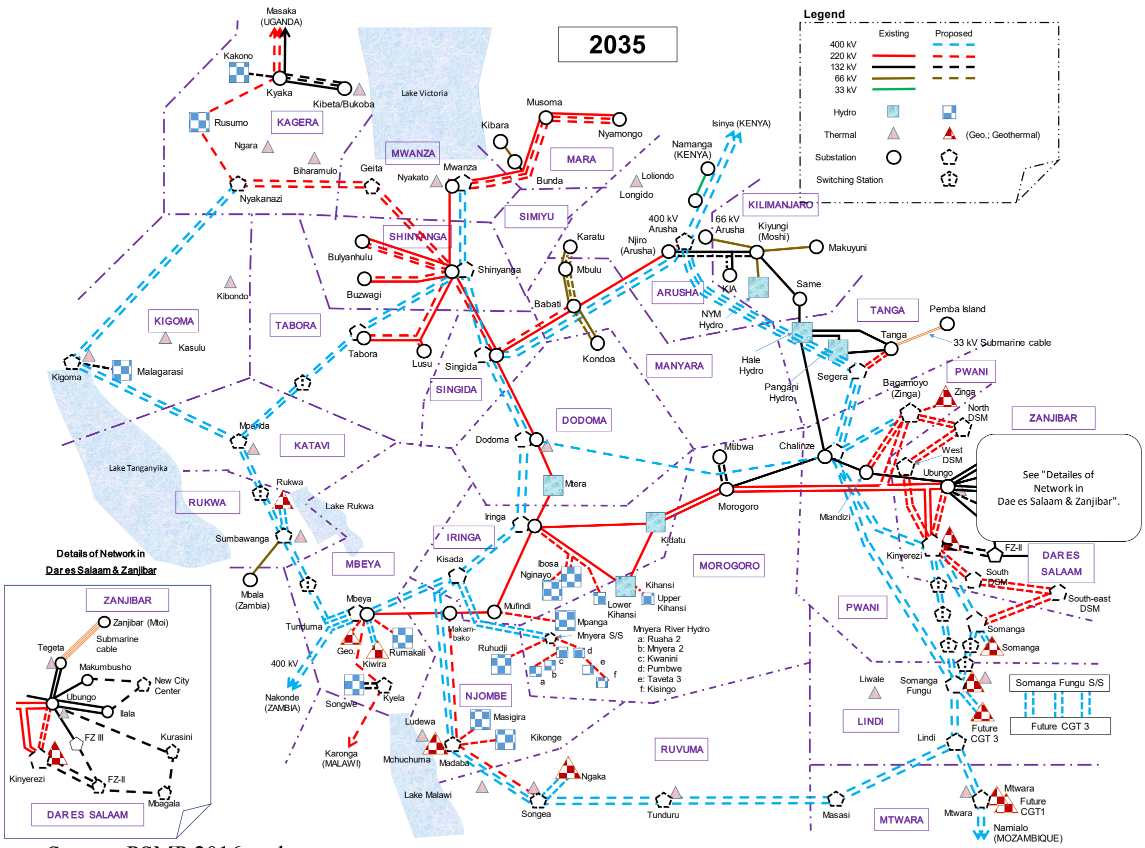
Source: PSMP 2016 update

Figure 3-8.1 (2) Generation and Transmission Plan in 2025



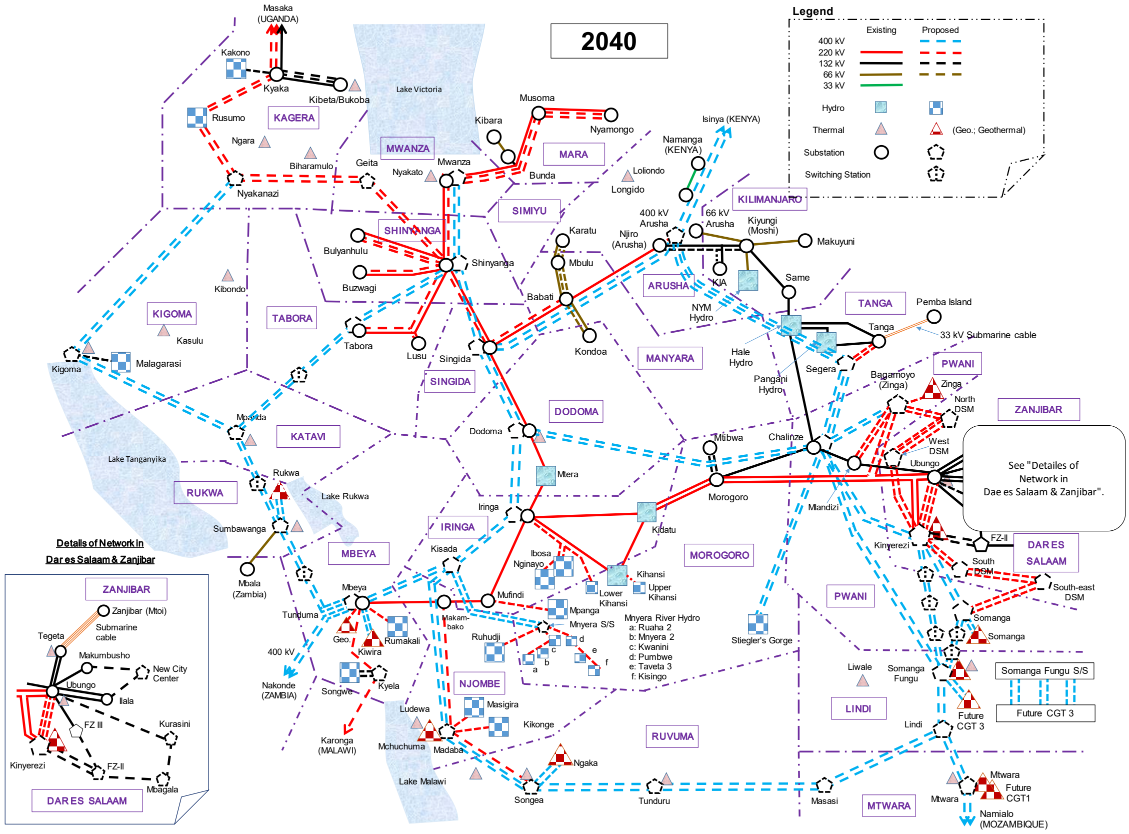
Source: PSMP 2016 update

Figure 3-8.1 (3)　Generation and Transmission Plan in 2030



Source: PSMP 2016 update

Figure 3-8.1 (4)　Generation and Transmission Plan in 2035



Source: PSMP 2016 update

Figure 3-8.1 (5) Generation and Transmission Plan in 2040

The Western, Northern and Lake Zones need new transmission capacity to secure a satisfactory supply, the South-West and Dar es Salaam areas also need transmission capacity to evacuate excess generated power to other load centers. The details of Dar es Salaam and Coast area master plan are explained in Chapter 5.

Transmission capacity to other countries is an integrated and important part of a main grid that facilitates new renewable power generation and ensures security of supply domestically. The countries project portfolio for interconnectors comprising of six projects as follows.

- Kenya

The fund has been committed and the bidding completed. The new 400 kV interconnector to Kenya is currently undergoing implementation phase. The connection point in the Grid is Arusha. Approximately 200 MW will be imported.

- Zambia

Tanzania is going to export approximately 400 MW to Zambia and the feasibility study of the transmission lines has been completed. Tanzania is planning a connection to Zambia at 400 kV which is currently under evaluation of influence to the grid by power export to outside countries. The connection point in the Grid is Mbeya.

- Uganda

Uganda and Tanzania are planning for the 220 kV Masaka (Uganda) - Kyaka (Tanzania) interconnector, and Tanzania will import the power approximately 100 MW. Two countries are going to sign for MOU of the construction of the interconnector.

- Mozambique

Both countries have noticed there is power shortage in northern area of Mozambique. Tanzania is planning a new connection to Mozambique with a voltage of 400 kV; Inter-Utility Memorandum of Understanding for the Construction of the Tanzania-Mozambique Interconnector and for Trade in Power and Telecoms (IUMOU) was signed between EDM (Electricidade de Mozambique) and TANESCO in 2015.

- Rwanda and Burundi

Tanzania, Rwanda and Burundi are planning an 80 MW hydro power plant project at Rusumo border, the project will enable the National grids of the three countries (26 MW each) to be interconnected through 220 kV transmission line.

- Malawi

A total of 360 MW hydro power plant project at Songwe border is planned, the project will enable the National grids of the two countries to be interconnected through 220kV transmission line. As of today, there is no more information about it.

3-8-2 Future Plan

(1) Transmission System

PSMP 2016 Update recommends the following additions of transmission system which satisfy transmission planning criteria. Table 3-8.1 to Table 3-8.5 show the Transmission system additions in every 5 years up to 2040.

Table 3-8.1 Transmission System Additions from 2016 to 2020

Rated Voltage (kV)	from	to	Remarks	Route Length (km)	No. of Circuit	Conductor			Year to be Com-missioned	Current Rating*1 (Amps)	Full Rating (MVA)	Normal Rating*2 (MVA)	Grounds
						Code Name	No. of Cond. per Phase	Aluminum Sectional Area (mm2)					
400	Dodoma	Singida	Backbone Project	210	2	Bluejay	2	564	2016	1,092	3,026	2,421	Under construction and will be completed in 2016
400	Iringa	Dodoma	Backbone Project	237	2	Bluejay	2	564	2016	1,092	3,026	2,421	Under construction and will be completed in 2016
400	Singida	Shinyanga	Backbone Project	200	2	Bluejay	2	564	2016	1,092	3,026	2,421	Under construction and will be completed in 2016
220	Kinyerezi	Ubungo-Pai	Jacobson	8	1	Bluejay	2	564	2016	1,092	832	666	Completed
220	Ubungo-Pai	Kinyerezi	Jacobson	8	1	Bluejay	2	564	2016	1,092	832	666	Completed
132	Kinyerezi	FZ-II		5	1	Wolf	1	150	2016	406	93	74	Almost completed. To extend about 50m to connect to FZ II substation.
132	Morogoro	Mtibwa	MCC, F/S completed	88	1	Hawk	1	242	2016	659	151	121	Bidding completed in 2015 and Construction will be completed in 2016. The second line is required in 2020.
220	Wind Project	Singida		10	1	Bluejay	2	564	2017	1,092	832	666	Operation will be started at 50 MW in 2017, at 75 MW in 2018, at 75 & 100 MW in 2020 and at 50 MW in 2021
400	Kin-Som SwS1	Kin-Som SwS2		53	2	Bluejay	8	564	2018	1,092	12,105	9,684	To adjust Somanga Fungu PS start operation in 2018
400	Kin-Som SwS2	Kin-Som SwS3		53	2	Bluejay	8	564	2018	1,092	12,105	9,684	To adjust Somanga Fungu PS start operation in 2019
400	Kin-Som SwS3	Somanga Fungu P/S	210 MW	53	2	Bluejay	8	564	2018	1,092	12,105	9,684	To adjust Somanga Fungu PS start operation in 2019
400	Kinyerezi	Kin-Som SwS1		53	2	Bluejay	8	564	2018	1,092	12,105	9,684	To adjust Somanga Fungu PS start operation in 2019
400	Kisada	Iringa		106	2	Bluejay	8	564	2018	1,092	12,105	9,684	To adjust Muchuchuma coal fired PS start operation in 2018
400	Kisada	Madaba		243	2	Bluejay	8	564	2018	1,092	12,105	9,684	To adjust Muchuchuma coal fired PS start operation in 2018
400	Muchuchuma P/S	Madaba	Total 1,800 MW	15	2	Bluejay	4	564	2018	1,092	6,052	4,842	To adjust Muchuchuma coal fired PS start operation in 2018. Total generation capacity will be 1,800 MW in 2037.
220	Geita	Nyakanazi		130	2	Bluejay	2	564	2018	1,092	1,664	1,332	To adjust Rusmo hydro PS start operation in 2018. Since the second line is required in 2025, even single circuit line can be applied but double circuit line shall be constructed in 2018.
220	Madaba	Songea		171	1	Bluejay	2	564	2018	1,092	832	666	Under construction and will be completed in 2018
220	Makambako	Madaba		162	1	Bluejay	2	564	2018	1,092	832	666	Under construction and will be completed in 2018
220	Nyakanazi	Rusumo Falls P/S	30 MW	97	1	Bluejay	4	564	2018	1,092	1,664	1,332	To adjust Rusmo hydro PS start operation in 2018. The second line is required in 2035.
220	Rusumo Falls P/S	Kyaka	30 MW	150	1	Bluejay	4	564	2018	1,092	1,664	1,332	To adjust Rusmo hydro PS start operation in 2018. The second line is required in 2035.
220	Shinyanga	Geita		240	2	Bluejay	4	564	2018	1,092	3,329	2,663	To adjust Rusmo hydro PS start operation in 2018. JICA Team recommended route instead of Geita-Bulyanhulu line. Since the second line is required in 2025, even single circuit line can be applied but double circuit line shall be constructed in 2018.
400	Arusha	Singida		317	2	Bluejay	2	564	2019	1,092	3,026	2,421	Under procurement stage
400	Arusha	Isinya (Kenya)	up to Kenya border	114	2	Flint	3	375	2019	790	3,284	2,627	Under procurement stage
400	Lindi	Somanga Fungu		216	2	Bluejay	8	564	2019	1,092	12,105	9,684	To adjust Mtwara PS start operation in 2019
400	Mtwara P/S	Lindi	400 MW	74	2	Bluejay	4	564	2019	1,092	6,052	4,842	To adjust Mtwara PS start operation in 2019
220	Arusha	Njiro (Arusha existing)		5	2	Bluejay	4	564	2019	1,092	3,329	2,663	To interconnect new 400 kV Arusha SS from the existing SS when the new 400 kV SS starts operation in 2019
220	Iringa	Lower Kihansi P/S (Hydro)	(36+52+120) MW	120	1	Bluejay	2	564	2019	1,092	832	666	To adjust Lower Kihansi hydro PS in 2019. When Ibosa hydro PS comes online in 2026, this line shall be cut off to interconnect Ibosa PS with pai configuration.
220	Solar I	Dodoma	50 MW	10	1	Bluejay	1	242	2019	1,092	416	333	To adjust Solar I PS start operation in 2019. 220 kV line is adopted because Dodoma SS has only 220/33 kV switchgear configuration.
132	Wind Project	Makambako	100 MW	10	1	Hawk	1	242	2019	659	151	121	To meet Wind PS start operation in 2019. 132 kV line is adopted because Makambako SS has 132kV switchgear system.
400	Chalinze	Segera		175	1	Bluejay	4	564	2020	1,092	3,026	2,421	Bidding completed. The second & third lines are required in 2020 & 2035 respectively.
400	Chalinze	Dodoma		336	1	Bluejay	2	564	2020	1,092	1,513	1,210	Feasibility study is underway. This line is required in 2020 by the system analysis to secure N-1 reliability.
400	Chalinze	Segera		175	1	Bluejay	4	564	2020	1,092	3,026	2,421	To add single circuit line in 2020 to meet increasing demand. Further additional line is required in 2035.
400	Kigoma	Mpanda		290	2	Bluejay	8	564	2020	1,092	12,105	9,684	To export electricity to Uganda in 2020. The western 400 kV double circuit roop lines are configured.
400	Kinyerezi	Chalinze		138	2	Bluejay	4	564	2020	1,092	6,052	4,842	Bidding completed.
400	Kisada	Mbeya		186	2	Bluejay	8	564	2020	1,092	12,105	9,684	The western 400 kV double circuit roop lines are configured.
400	Kiwira P/S	Mbeya	400MW in 2020	110	2	Bluejay	8	564	2020	1,092	12,105	9,684	To adjust Kiwira coal fired PS start operation in 2020. Total generation capacity will be 1,000 MW in 2028.
400	Mbea	Nakonde(Zambia)	up to Zambia border	93	2	Bluejay	2	564	2020	1,092	3,026	2,421	To export electricity to Zambia in 2020
400	Mbe－Sum SwS	Sumbawanga		150	2	Bluejay	8	564	2020	1,092	12,105	9,684	To export electricity to Uganda in 2020, the western 400 kV double circuit roop lines are configured. Since the switching station (SwS) is required to install capacitors from 2035 to 2040 to meet increasing demand, SwS is planned to construct in 2020 togerther with lines.
400	Mbeya	Mbe－Sum SwS		150	2	Bluejay	8	564	2020	1,092	12,105	9,684	To export electricity to Uganda in 2020, the western 400 kV double circuit roop lines are configured. Since the switching station (SwS) is required to install capacitors from 2035 to 2040 to meet increasing demand, SwS is planned to conostruct in 2020 togerther with lines.
400	Mpanda	Mpa-Sum SwS		119	2	Bluejay	8	564	2020	1,092	12,105	9,684	To export electricity to Uganda in 2020. The western 400 kV double circuit roop lines are configured.
400	Mpa-Sum SwS	Sumbawanga		119	2	Bluejay	8	564	2020	1,092	12,105	9,684	To export electricity to Uganda in 2020. The western 400 kV double circuit roop lines are configured.
400	Mtwara	Namialo(Mozambique)	up to Mozambique border	51	2	Bluejay	2	564	2020	1,092	3,026	2,421	To export electricity to Mozambique in 2020. The line to Namialo SS in Mozanbique will be appox. 500 km in total.
400	Nyakanazi	Kigoma		317	2	Bluejay	8	564	2020	1,092	12,105	9,684	To export electricity to Uganda in 2020. The western 400 kV double circuit roop lines are configured.
400	Segera	Arusha		366	1	Bluejay	4	564	2020	1,092	3,026	2,421	Bidding completed. The second & third lines are reequired in 2035 & 2040 respectively.
400	Somanga Fungu P/S	Somanga P/S(PPP)	300MW	20	2	Bluejay	2	564	2020	1,092	3,026	2,421	To adjust Somanga PS (PPP) start operation in 2020
220	Bagamoyo (Zinga)	Kibaha-Pai		45	1	Bluejay	1	564	2020	1,092	416	333	This is one of the Chinese project of Kinyerezi-Chalinze line etc. The completion year is predicted as same as Kinyerezi-Chalinze line.
220	Bunda	Musona		60	1	Bluejay	4	564	2020	1,092	1,664	1,332	To replace with upgraded 220 kV line from existing 132 kV in 2020 to meet increasing demand. The second line is required in 2035.
220	Kibaha-Pai	Bagamoyo (Zinga)		45	1	Bluejay	1	564	2020	1,092	416	333	This is one of the Chinese project of Kinyerezi-Chalinze line etc. The completion year is predicted as same as Kinyerezi-Chalinze line.
220	Kinyerezi	Ubungo		12	2	Bluejay	1	564	2020	1,092	832	666	JICA Team recommended line, to meet increasing DSM demand in 2020.
220	Kishapu Solar	Shinyanga	150 MW	10	1	Bluejay	1	382	2020	1,092	416	333	To adjust Kishapu Solar PS start operation in 2020
220	Kyaka	Masaka(Uganda)	up to Uganda border	30	1	Bluejay	2	564	2020	1,092	832	666	To export electricity to Uganda in 2020
220	Kyela	Karonga(Malawi)	up to Malawi border	20	1	Bluejay	2	564	2020	1,092	832	666	To export electricity to Malawi in 2020
220	Lusu	Tabora		139	1	Bluejay	2	564	2020	1,092	832	666	To replace with upgraded 220 kV line from existing 132 kV in 2020 to meet increasing demand.
220	Mbeya	Kyela		106	1	Bluejay	2	564	2020	1,092	832	666	To export electricity to Malawi in 2020
220	Musona	Nyamongo		90	1	Bluejay	4	564	2020	1,092	1,664	1,332	To replace with upgraded 220 kV line from existing 132 kV in 2020 to meet increasing demand. The second line is required in 2035.
220	Mwanza	Bunda		150	1	Bluejay	4	564	2020	1,092	1,664	1,332	To replace with upgraded 220 kV line from existing 132 kV in 2020 to meet increasing demand. The second line is required in 2035.
220	Segera	Tanga		76	2	Bluejay	2	564	2020	1,092	1,664	1,332	Bidding completed
220	Shinyanga	Lusu		64	1	Bluejay	1	564	2020	1,092	416	333	To replace with upgraded 220 kV line from existing 132 kV in 2020 to meet increasing demand.
132	Kinyerezi	FZ-II		5	2	Hawk	2	242	2020	659	603	482	JICA Team recommended additional double circuit line, to meet increasing DSM demand in 2020.
132	Morogoro	Mtibwa		88	1	Hawk	1	242	2020	659	151	121	To add single circuit line in 2020 to meet increasing demand as a countermeasure against voltage drop.
66	Babati	Mbulu		85	2	Wolf	2	150	2020	406	186	149	To add double circuit line in 2020 to meet increasing demand.

Note: *1 Source：SURAL catalogue
*2；Normal Rating＝Full Rating x 80%

Source: PSMP 2016 update

Table 3-8.2 Transmission System Additions from 2021 to 2025

Rated Voltage (kV)	from	to	Remarks	Route Length (km)	No. of Circuit	Conductor Code Name	Conductor No. of Cond. per Phase	Conductor Aluminum Sectional Area (mm2)	Year to be Com-missioned	Current Rating*1 (Amps)	Full Rating (MVA)	Normal Rating*2 (MVA)	Grounds
400	Kinyerezi	Mkuranga P/S	300 MW	70	2	Bluejay	8	564	2022	1,092	12,105	9,684	To adjust Mkuranga PS start operation in 2022
400	Madaba	Songea		171	2	Bluejay	2	564	2023	1,092	3,026	2,421	To adjust Ngaka coal fired PS start operation in 2023
400	Masasi	Lindi		141	2	Bluejay	4	564	2023	1,092	6,052	4,842	To adjust Ngaka coal fired PS start operation in 2023. To secure steady state stability of Ngaka generator in the grid when the no connection of line between Songea and Madaba. Interconnection SS is changed to Lindi from Mtwara by JICA Team in consideration of line distance.
400	Ngaka P/S	Songea	600MW in 2023	37	2	Bluejay	4	564	2023	1,092	6,052	4,842	To adjust Ngaka coal fired PS start operation in 2023. Total generation capacity will be 1,950 MW in 2040.
400	Songea	Tunduru		230	2	Bluejay	4	564	2023	1,092	6,052	4,842	To adjust Ngaka coal fired PS start operation in 2023. To secure steady state stability of Ngaka generator in the grid when the no connection of line between Songea and Madaba.
400	Tunduru	Masasi		194	2	Bluejay	4	564	2023	1,092	6,052	4,842	To adjust Ngaka coal fired PS start operation in 2023. To secure steady state stability of Ngaka generator in the grid when the no connection of line between Songea and Madaba.
400	Sumbawanga	Rukwa P/S	300MW in 2024	46	2	Bluejay	8	564	2024	1,092	12,105	9,684	To adjust Rukwa coal fired PS start operation in 2024. Total generation capacity will be 1,200 MW in 2038.
132	Malagarasi P/S(Stage III)	Kigoma	44.7 MW	74	1	Hawk	1	242	2024	659	151	121	To adjust Malagarasi hydro PS start operation in 2024
400	Chalinze	Bagamoyo		102	2	Bluejay	8	564	2025	1,092	12,105	9,684	JICA Team recommended additional double circuit line, to meet increasing DSM demand in 2025.
400	Shinyanga	Mwanza		140	2	Bluejay	8	564	2025	1,092	12,105	9,684	To construct new 400 kV double circuit line in 2025 to meet increasing Nwanza & Mara area demand.
220	Bagamoyo	North DSM		40	2	Bluejay	4	564	2025	1,092	3,329	2,663	JICA Team recommended additional double circuit line, to meet increasing DSM demand in 2025. To secure the capacity of West DSM SS in addition for emergency.
220	Geothermal 1	Mbeya	(2 x 50 MW) ×2	35	1	Bluejay	1	564	2025	1,092	416	333	To adjust Geothermal 1PS start operation in 2025, and to include the capacity of Geothermal 2 PS starting operation in 2026.
220	Kinyerezi	South DSM		25	2	Bluejay	4	564	2025	1,092	3,329	2,663	JICA Team recommended additional double circuit line, to meet increasing DSM demand in 2025. To secure the capacity of South-east DSM SS in addition for emergency.
220	Mkuranga	South-east DSM		50	2	Bluejay	4	564	2025	1,092	3,329	2,663	JICA Team recommended additional double circuit line, to meet increasing DSM demand in 2025. To secure the capacity of South DSM SS in addition for emergency.
220	South DSM	South-east DSM		30	2	Bluejay	2	564	2025	1,092	1,664	1,332	JICA Team recommended additional double circuit line, to meet increasing DSM demand in 2025. To adjust South & South-east DSMs start operation in 2025
132	Kyaka	Kibeta/Bukoba		54	1	Hawk	2	242	2025	659	301	241	To add single circuit line in 2025 to meet increasing demand. The additional line is required in 2035.
66	Mbulu	Karatu		65	2	Wolf	2	150	2025	406	186	149	To add double circuit line in 2025 to meet increasing demand.

Note: *1 Source: SURAL catalogue
*2; Normal Rating＝Full Rating x 80%

Source: JICA Study Team

Table 3-8.3 Transmission System Additions from 2026 to 2030

Rated Voltage (kV)	from	to	Remarks	Route Length (km)	No. of Circuit	Conductor Code Name	Conductor No. of Cond. per Phase	Conductor Aluminum Sectional Area (mm2)	Year to be Com-missioned	Current Rating*1 (Amps)	Full Rating (MVA)	Normal Rating*2 (MVA)	Grounds
220	Geothermal 1	Geothermal 2	2 x 50 MW	20	1	Bluejay	1	564	2026	1,092	416	333	To adjust Geothermal 2 PS start operation in 2026
220	Ibosa P/S (Hydro)	Iringa-L. Kihansi T branch	(36+52+120) MW	20	2	Bluejay	2	564	2026	1,092	1,664	1,332	To adjust start operation of Ibosa & Nginayo hydro PSs. The existing line from Iringa SS to Lower Kihansi hydto PS shall be cut off and be re-configured to interconect between Iringa SS & Ibosa PS and between Ibosa PS & Lower Kihansi PS.
220	Ibosa P/S (Hydro)	Nginayo P/S (Hydro)	52MW	10	1	Bluejay	1	564	2026	1,092	416	333	To adjust Nginayo hydro PS start operation in 2026
220	Zinga P/S	Bagamoyo	200 MW	15	1	Bluejay	2	564	2027	1,092	832	666	To adjust Zinga PS start operation in 2027
132	Kakono P/S (Hydro)	Kyaka	87 MW	39	1	Hawk	1	242	2027	659	151	121	To adjust Kakono hydro PS start operation in 2027
400	Mnyera S/S (new)	Kisada	(668.2+358) MW	180	2	Bluejay	4	564	2028	1,092	6,052	4,842	Mnyera SS and its related transmission line shall be constructed to adjust Ruaha2 hydro PS start operation in 2028. 400 kV double circuit line is adopted instead of 220 kV to avoid excessive voltage drop caused by heavy power flow.
220	Ruaha 2 P/S (Hydro)	Mnyera S/S (new)	(60.3+137.4+143.9) MW	33	1	Bluejay	2	564	2028	1,092	832	666	To adjust Ruaha 2 hydro PS start operation in 2028
132	Songwe B S/S	Kyela	(79.5 + 88.1) MW	7	2	Hawk	1	242	2028	659	301	241	To adjust Songwe Manolo hydro PS start operation in 2028
132	Songwe Manolo P/S (Hydro)	Songwe B S/S	88.1 MW	17	1	Hawk	1	242	2028	659	151	121	To adjust Songwe Manolo hydro PS start operation in 2028
220	Kwanini P/S (Hydro)	Mnyera S/S-Ruaha2 T/L	T-branch	10	1	Bluejay	2	564	2029	1,092	832	666	To adjust Kwanini hydro PS start operation in 2029
220	Mnyera 2 P/S (Hydro)	Mnyera S/S-Ruaha2 T/L	T-branch	10	1	Bluejay	2	564	2029	1,092	832	666	To adjust Mnyera 2 hydro PS start operation in 2029
400	Shinyanga	Tabora		200	2	Bluejay	8	564	2030	1,092	12,105	9,684	JICA Team recommended double cirduit line in 2030. Additional bypass line to secure reliability with 400 kV Backbone and Western roop lines.
400	Somanga Fungu S/S	Future CGT3-1	4x470 MW	20	2	Bluejay	4	564	2030	1,092	6,052	4,842	To adjust Future CGT3-1 PS first unit start operation in 2030
400	Tab-Mpa SwS	Mpanda		150	2	Bluejay	8	564	2030	1,092	12,105	9,684	JICA Team recommended double cirduit line in 2030. Additional bypass line to secure reliability with 400 kV Backbone and Western roop lines.
400	Tabora	Tab-Mpa SwS		150	2	Bluejay	8	564	2030	1,092	12,105	9,684	JICA Team recommended double cirduit line in 2030. Additional bypass line to secure reliability with 400 kV Backbone and Western roop lines.
220	Bagamoyo	Mlandizi		40	2	Bluejay	1	564	2030	1,092	832	666	JICA Team ecommended double circuit line in 2030 to meet increasing demand in Pwani area.
220	Kinyerezi	West DSM		20	2	Bluejay	4	564	2030	1,092	3,329	2,663	JICA Team recommended additional double circuit line, to meet increasing DSM demand in 2030. To secure the capacity of North DSM SS in addition for emergency. The additional single line is required in 2040.
220	Mnyera S/S (new)	Taveta 3 P/S (Hydro)	(119.8+83.9+122.9) MW	26	1	Bluejay	2	564	2030	1,092	832	666	To adjust start operation of Pumbwe & Taveta 3 hydro PSs in 2030.
220	Pumbwe P/S (Hydro)	Mnyera S/S-Taveta3 T/L	T-branch	10	1	Bluejay	2	564	2030	1,092	832	666	To adjust start operation of Pumbwe & Taveta 3 hydro PSs in 2030.
220	West DSM	North DSM		20	2	Bluejay	2	564	2030	1,092	1,664	1,332	JICA Team recommended additional double circuit line, to meet increasing DSM demand in 2030. To adjust West DSM SS start operation.
132	Njiro (Arusha existing)	Kiyungi	T-branch to KIA	77	2	Hawk	4	242	2030	659	1,205	964	To replace with double circuite line with bigger standardized conductors in 2030 from the existing line (207 MVA, operation started in 1983) to meet increasing demand. To include T-branch connection to KIA. Since the four conductors line is required in 2040, even single conductor can be applied in 2030 but four conductors line shall be constructed in 2030.

Note: *1 Source: SURAL catalogue
*2; Normal Rating＝Full Rating x 80%

Source: JICA Study Team

Table 3-8.4 Transmission System Additions from 2031 to 2035

Rated Voltage (kV)	from	to	Remarks	Route Length (km)	No. of Circuit	Conductor Code Name	Conductor No. of Cond. per Phase	Conductor Aluminum Sectional Area (mm2)	Year to be Com-missioned	Current Rating*1 (Amps)	Full Rating (MVA)	Normal Rating*2 (MVA)	Grounds
400	Mkuranga	Mku-Som SwS1		61	2	Bluejay	8	564	2031	1,092	12,105	9,684	To secure sufficient capacity to carry generated power to DSM when Future CGT3-1 PS first unit start operation in 2031.
400	Mku-Som SwS1	Mku-Som SwS2		61	2	Bluejay	8	564	2031	1,092	12,105	9,684	To secure sufficient capacity to carry generated power to DSM when Future CGT3-1 PS first unit start operation in 2031.
400	Mku-Som SwS2	Somanga Fungu S/S		61	2	Bluejay	8	564	2031	1,092	12,105	9,684	To secure sufficient capacity to carry generated power to DSM when Future CGT3-1 PS first unit start operation in 2031.
220	Mufindi	Mpanga P/S (Hydro)	160 MW	65	1	Bluejay	2	564	2031	1,092	832	666	To adjust Mpanga hydro PS start operation in 2031
220	Taveta 3 P/S (Hydro)	Kisingo P/S (Hydro)	119.8MW	15	1	Bluejay	2	564	2031	1,092	832	666	To adjust Kisingo hydro PS start operation in 2031
220	Masigira P/S (Hydro)	Madaba	118 MW	73	1	Bluejay	2	564	2032	1,092	832	666	To adjust Masigira hydro PS start operation in 2032
400	Somanga Fungu S/S	Future CGT3-2	6x470 MW	20	2	Bluejay	4	564	2033	1,092	6,052	4,842	To adjust Future CGT3-2 PS start operation in 2033
220	Mbeya	Rumakali P/S (Hydro)	222MW	104	1	Bluejay	2	564	2033	1,092	832	666	To adjust Rumakali hydro PS start operation in 2033
220	Mnyera S/S (new)	Ruhudji P/S (Hydro)	358 MW	88	1	Bluejay	2	564	2033	1,092	832	666	To adjust Ruhudji hydro PS start operation in 2033
220	Kihansi P/S (Hydro)	Upper Kihansi P/S (Hydro)	47MW	10	1	Bluejay	1	564	2034	1,092	416	333	To adjust Upper Kihansi hydro PS start operation in 2034
220	Kikonge P/S (Hydro)	Madaba	300 MW	49	1	Bluejay	2	564	2034	1,092	832	666	To adjust Kikonge hydro PS start operation in 2034
132	Songwe A S/S	Songwe B S/S		40	1	Hawk	1	242	2034	659	151	121	To adjust Songwe Sofre hydro PS start operation in 2034
132	Songwe Sofre P/S (Hydro)	Songwe A S/S	79.5 MW	16	1	Hawk	1	242	2034	659	151	121	To adjust Songwe Sofre hydro PS start operation in 2034
400	Chalinze	Segera		175	1	Bluejay	4	564	2035	1,092	3,026	2,421	To add third line in 2035 to meet increasing demand.
400	Segera	Arusha		366	2	Bluejay	4	564	2035	1,092	6,052	4,842	To add single circuit line in 2035 to meet increasing demand. Since additional one circuit line is requred in 2040, even single line can be applied but double circuit line shall be constructed in 2035.
400	Somanga Fungu S/S	Chalinze		284	2	Bluejay	8	564	2035	1,092	12,105	9,684	To secure sufficient capacity to carry generated power to DSM and to strengthen grid reliability in 2035.
400	Stiegler's Gorge	Chalinze	2 x 1,048 MW	195	2	Bluejay	8	564	2035	1,092	12,105	9,684	To adjust S. Gorge hydro PS start operation in 2035
220	Bulyanhulu	Shinyanga		130	2	Bluejay	4	564	2035	1,092	3,329	2,663	To add double circuit line in 2035 to meet increasing demand.
220	Bunda	Musona		60	1	Bluejay	4	564	2035	1,092	1,664	1,332	To add single line in 2035 to meet increasing demand.
220	Kyaka	Masaka(Uganda)	up to Uganda border	30	1	Bluejay	2	564	2035	1,092	832	666	The second line to Uganda for export is required in 2035 to avoid exceesive voltage drop.
220	Musona	Nyamongo		90	1	Bluejay	4	564	2035	1,092	1,664	1,332	To add single line in 2035 to meet increasing demand.
220	Mwanza	Bunda		150	1	Bluejay	4	564	2035	1,092	1,664	1,332	To add single line in 2035 to meet increasing demand.
220	Nyakanazi	Rusumo Falls P/S		97	1	Bluejay	4	564	2035	1,092	1,664	1,332	To add single line in 2035 to meet increasing demand.
220	Rusumo Falls P/S	Kyaka		150	1	Bluejay	4	564	2035	1,092	1,664	1,332	To add single line in 2035 to meet increasing demand.
220	Shinyanga	Buswagi		108	2	Bluejay	4	564	2035	1,092	3,329	2,663	To replace with double circuit line with bigger standardized conductors in 2035 from the existing line (207 MVA, operation started in 2000) to meet increasing demand. Since the second line is required in 2040, even single circuite line can be applied but double circuit line shall be constructed in 2035.
132	Kyaka	Kibeta/Bukoba		54	1	Hawk	2	242	2035	659	301	241	To replace with single circuit line with bigger standardized conductors in 2035 from the existing line (66 MVA, operation started in 1992) to meet increasing demand.
66	Babati	Kondoa		85	2	Wolf	2	150	2035	406	186	149	To replace with double circuit line with bigger standardized conductors in 2035 from the existing line (37 MVA, operation started in 1999) to meet increasing demand. Since the second line is required in 2040, even single circuit line can be applied but double circuit line shall be constructed in 2035.

Note: *1 Source: SURAL catalogue
*2: Normal Rating＝Full Rating x 80%

Source: JICA Study Team

Table 3-8.5 Transmission System Additions from 2036 to 2040

Rated Voltage (kV)	from	to	Remarks	Route Length (km)	No. of Circuit	Conductor Code Name	Conductor No. of Cond. per Phase	Conductor Aluminum Sectional Area (mm2)	Year to be Com-missioned	Current Rating*1 (Amps)	Full Rating (MVA)	Normal Rating*2 (MVA)	Grounds
400	Mtwara	Future CGT1 P/S	330MW	50	2	Bluejay	2	564	2036	1,092	3,026	2,421	To adjust Future CGT1 PS first unit 110 MW start operation in 2036. Total generation capacity will be 330 MW in 2039.
400	Somanga Fungu	Future CGT3-3	5x470 MW	20	2	Bluejay	4	564	2038	1,092	6,052	4,842	To adjust Future CGT3-3 PS first unit start operation in 2038.
220	Kinyerezi	West DSM		20	1	Bluejay	4	564	2040	1,092	1,664	1,332	To add single circuit line in 2040 to meet increasing demand.
220	Shinyanga	Mwanza		140	2	Bluejay	1	564	2040	1,092	832	666	To replace with double circuit line with bigger standardized conductor in 2040 from the existing line (207 MVA, operation started in 1988) to meet increasing demand.
220	Singida	Babati		150	2	Bluejay	1	564	2040	1,092	832	666	To replace with double circuit line with bigger standardized conductor in 2040 from the existing line (303 MVA, operation started in 1996) to meet increasing demand.
220	Singida	Shinyanga		200	2	Bluejay	1	564	2040	1,092	832	666	To replace with double circuit line with bigger standardized conductor in 2040 from the existing line (207 MVA, operation started in 1988) to meet increasing demand.
132	Chalinze	Morogoro		82	2	Hawk	1	242	2040	659	301	241	To replace with double circuit line with bigger standardized conductor in 2040 from the existing line (74 MVA, operation started in 1967) to meet increasing demand.

Note: *1 Source: SURAL catalogue
*2: Normal Rating＝Full Rating x 80%

Source: JICA Study Team

(2) Substations

The substations should be constructed in consistence with the plan of Transmission system additions. Lists of substation additions from 2016 to 2040 are shown in Table 3-8.6 below.

Table 3-8.6 Substation Additions from 2016 to 2040

Name of Substations	Switchgear Bus Config.: **1-1/2**; One & Half, **DB**; Double Bus, **SB**; Single Bus													Transformer (in MVA)			Reactor	STAT-COM
	400 kV					220 kV				132 kV				Voltage (kV)	Q'ty	Total MVA		
	Bus Config.	1-1/2 Bay	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC					
Arusha	1-1/2	8	7	9		DB	4	5	1					400/220	5	1,500	475	420
Arusha (Njiro)						SB	0	7	0	SB	0	7	0	220/132	7	1,400		
Bagamoyo (Zinga)	DB		2	3	1	DB	7	4	1					400/220	2	1,000	60	110
														220/33	2	180		
Bulyanhulu						DB	2	0	0									
Bunda						DB	4	3	1	SB	0	2	0	220/132	2	200	0	140
Buzwagi						DB	2											
Chalinze	1-1/2	10	12	7		DB	0	7	1	DB	0	4	1	400/220	2	300	640	580
														220/133	3	270		
Dodoma	DB		6	7	1		1	2	0					400/220	2	500	350	525
Geita						DB	4		1									
Geothermal A						SB	2	1	1									
Iringa	DB		4	5	1		1	2	0					400/220	2	500	200	205
Kigoma	DB		4	6	1	DB	0	3	1					400/220	2	250	475	285
														220/132	1	55		
Kin-Som SwS-1	DB		4	4	1												60	385
Kin-Som SwS-2	DB		4	2	1												60	160
Kin-Som SwS-3	DB		4	4	1												60	495
Kinyerezi	1-1/2	11	9	11		DB	12	10	0					400/220	7	3,500	140	255
														220/132	3	450		
Kisada	1-1/2	6	8	3													460	340
Kyaka						DB	4	3	1	SB	3	3	0	220/132	3	300		
Kyela						DB	1	2	1	SB	2	1	0	220/132	1	200		
Lindi	DB		6	3	1	DB	0	2	1					400/220	2	250	240	50
Lusu						DB	2	4	1	SB	0	4	0	220/132	4	400		
Madaba	DB		6	3	1	DB	4	2	1					400/220	2	500	230	50
Makambako						SB	1	0	0	SB	1	0	0					
Masasi	DB		4	3	1	DB	0	2	1					400/220	2	250	170	50
Mbeya	DB		8	7	1	DB	4	3	1					400/220	4	2,000	530	340
Mbe-Sum SwS	DB		4	2	1													100
Mkuranga	DB		5	8	1	DB	2	4	1					400/220	4	2,000	80	435
Mku-Som SwS-1	DB		4	2	1												80	140
Mku-Som SwS-2	DB		4	4	1												80	380
Mlandizi	DB					DB	2	3	1	SB	0	3	0	220/132	3	300		
Mnyera	DB		2	4	1	DB	3	3	1					400/220	3	1,500	90	50
Morogoro						DB	0	3	0	DB	2	3	0	220/132	3	450		
Mpanda	DB		6	5	1	DB	0	2	1					400/220	2	250	340	680
Mpa-Sum SwS	DB		4	4	1												140	400
Mpa-Tab SwS	DB		4	2	1												180	180
Mtibwa										SB	2	0	0					
Mtwara	DB		7	4	1	DB	0	5	1	SB	0	3	0	400/220	2	325	80	80
														220/132	3	300		
Mufindi						SB	1	0	0									
Musoma						DB	4	3	1	SB	0	3	0	220/132	3	300		
Mwanza	DB		2	5	1	DB	3	6	1	SB	0	3	0	400/220	3	1,500	90	75
														220/132	3	600		
Nyakanazi	DB		2	9	1	DB	4	5	1					400/220	4	1,000	360	405
Nyamongo						DB	4	4	1	SB	0	4	0	220/132	4	400	0	0
Segera	1-1/2	7	6	7		DB	2	4	1					400/220	4	800	420	265
Shinyanga	DB		6	8	1	DB	15	7	0	SB	0	3	0	400/220	4	2,630	320	485
														220/132	3	600		
Singida	DB		6	4	1	DB	5	4	0	SB	0	2	0	400/220	2	500	340	190
														220/132	2	200		
Somanga Fungu	1-1/2	11	18	4		DB	0	2	1					400/220	2	250	380	140
Songea	DB		6	3	1	DB	1	2	1					400/220	2	250	220	50
Songwe A S/S										SB	3	1	0					
Songwe B S/S										SB	1	1	0					
Sumbawanga	DB		6	5	1	DB	0	2	1					400/220	2	250	200	260
Tanga	DB		8	14	2	DB	6	18	1	SB	0	12	0	220/132	4	380		
Tunduru	DB		4	3	1	DB	0	2	1					400/220	2	250	220	50
		53	192	174	29		107	141	30		14	59	1		129	31,340	7,990	9,145
	Bus Config.	1-1/2 Bay	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Voltage (kV)	Q'ty	Total MVA	Reactor	STAT-COM
	400 kV					220 kV				132 kV								
	Switchgear Bus Config.: 1-1/2; One & Half, DB; Double Bus, SB; Single Bus													Transformer (in MVA)				

Source: Study team based on PSMP 2016 update

3-9 Structural reform in the power sector and legislative trends

3-9-1 Structural reform in Tanzania

The World Bank report (”Program Document on a Proposed Development Policy Credit in the Amount SDR 65.2 Million to the United Republic of Tanzania for a Second Power and Gas Sector Development Policy Operation,” Feb. 2014) describes the following recent electricity supply industry reform movement.

- In 2007, the Government developed a Power Sector Reform Strategy, which presented a vision for the power sector in Tanzania over the medium to long-term. The reform strategy envisages the evolution of the sector from the current market structure, in which TANESCO is a single-buyer/single-seller of electricity, to eventually a more liberalized and more competitive wholesale market structure in which the producers would be able to sell directly (or through a pool or voluntary electricity exchange) to the distribution companies and large consumers. The strategy was followed by the adoption of a comprehensive Electricity Act in 2008, which takes into account many international best practices for power sector reforms as tailored to the Tanzanian environment.
- The Government realizes that it needs to increase private investments through public and private partnerships (PPPs) in this critical segment of the sector. The MEM adopted a revised PPP strategy in 2013. It adopted a policy in 2013 that future new power plants – beyond those committed ones- will be competitively tendered.
- The implementation of the Government’s policy has started with building capacity for PPP management including development of IPP/PPP projects through a competitive, transparent process.
- The Government has adopted the final report from the NKRA (National Key Result Areas) Lab on energy under the BRN (Big Results Now) initiative and started implementation of the recommendation. The progress in implementing the Lab recommendations including drafting a time-bound Roadmap on the medium- and long-term structure of the power and gas sectors is monitored. It is expected that the Roadmap will cover such topics as TANESCO’s restructuring, private sector participation, matching of objectives and targets to the updated PSMP, and expected state of the power sector in 2015, 2020, and 2035. The Roadmap will be published by the Government by June 2014 and implemented over a period of time.

The MEM’s “Electricity Supply Industry Reform Strategy and Roadmap 2014 -2025,” [5] which was published in June 30, 2014, indicates the following contents. The reform strategy is gradual unbundling of generation, transmission and distribution.

- The reform roadmap consists of immediate term (Jul. 2014 – Jun. 2015), short term (Jul. 2015 – Jun. 2018), medium term (Jul. 2018 – Jun. 2021) and long term (Jul. 2021 – Jun. 2025).

[5] http://www.gst.go.tz/images/TANZANIA%20ELECTRICITY%20SUPPLY%20INDUSTRY%20REFORM%20 STRATEGY%20&%20ROADMAP.pdf#search='Tanzania+ESI+Roadmap')

- The immediate term actions include Task Force establishment, capacity building program preparation, development of standard template power purchase agreement (PPA) models, designation of grid control center as Independent System Operator (ISO), business process review and TANESCO's assets and liabilities valuation and development of grid code to guide transmission and distribution companies operations.
- The short term actions include unbundling generation from transmission and distribution, designation of independent market operator and decision making decentralization (procurement, budget implementation and business plan management.
- The medium term actions include unbundling distribution from transmission, zonal office performance assessment and setting up a mechanism and rules for the operation of a retail market.
- The long term actions include unbundling distribution into several zonal companies, establishment of ESI service standards, investment in human capital and trading system, introduction of retail competition, preparation of generation and distribution companies for listing, reduction of losses from 15% to 12% and connectivity increase from 36% to 50%.
- The roadmap is submitted to the Cabinet and published within June 2014.

Thus, TANESCO shall be unbundled completely in the long term. Therefore, before that it is urgently necessary to make TANESCO an independent sustainable power company, namely, with profitability (no loss) and sound financial situation.

3-9-2 Structural Reform of TANESCO

The MEM and AfDB stated the proposals for TANESCO's future business plan and the reform of the electric sectors in the following reports.

(1) The MEM's "Electricity Supply Industry Reform Strategy and Roadmap 2014 -2025," which was published in June 30, 2014, some of the proposals indicate the followings.

- The reform strategy envisages the evolution of the sector from the current market structure. The reform strategy is gradual unbundling of generation, transmission and distribution.
- The reform roadmap consists of immediate term (Jul. 2014 – Jun. 2015), short term (Jul. 2015 – Jun. 2018), medium term (Jul. 2018 – Jun. 2021) and long term (Jul. 2021 – Jun. 2025).
- The immediate term actions include Task Force establishment, capacity building program preparation, development of standard template power purchase agreement (PPA) models, designation of grid control center as Independent System Operator (ISO), business process review and TANESCO's assets and liabilities valuation and development of grid code to guide transmission and distribution companies operations.
- The short term actions include unbundling generation from transmission and distribution, designation of independent market operator and decision making decentralization (procurement, budget implementation and business plan management.

- The medium term actions include unbundling distribution from transmission, zonal office performance assessment and setting up a mechanism and rules for the operation of a retail market.
- The long term actions include unbundling distribution into several zonal companies, establishment of ESI service standards, investment in human capital and trading system, introduction of retail competition, preparation of generation and distribution companies for listing, reduction of losses from 15% to 12% and connectivity increase from 36% to 50%

(2) The major donor to the government of Tanzania, AfDB, stated the followings about TANESCO in the report [Investment Plan for Tanzania, April 2013].

- First, the authorities aim at shifting the energy mix away from the expensive emergency oil- based power supply to more efficient and lower cost generation with a view to reduce the cost of electricity supply and to mitigate the risks of major shocks to the power system, such as droughts or oil price increases. The focus is presently on gas, coal and renewable energy in the near term, with coal and large hydro in the longer term.
- The second set of measures emphasizes the need to restructure sector institutions and strengthen investment planning, procurement and contracts management. This would include leveraging private investment through IPPs, procured through solicited and competitive bidding processes, and increasing market competition in power generation.

As stated the above reports, TANESCO aims to run the business with the private investments and the market competition and it is possible to be separated in the generation, transmission and distribution entitles in future. Even though the TANESCO has the role of the public utility, it is essential to earn the adequate profits for the running the business in future without the government support. Therefore, it is necessary to earn 1) Sales profit, 2) Operational profit without the government contribution, 3) Profit before tax after deducting the financing expense and 4) Clearing the accumulated loss.

Chapter 4 Power Demand Forecast

4-1 Precondition and method of power demand forecast

4-1-1 Precondition

Based on the econometric model, the PSMP 2016 update formulated a national power demand forecast and regional power demand forecast to achieve government goals. The power demand forecast of the Dar es Salaam and Coast Regions is based on the regional demand forecast results of the PSMP 2016 update, which estimates the power demand by ward until 2030, close to electricity consumers.

Therefore, the same main preconditions for the power demand forecast, such as population, GDP, foreign exchange rates, inflation rate, crude oil price, as established in the PSMP 2016 update, are used for this project.

4-1-2 Method of power demand forecast

The PSMP 2016 update used a forecasting method based on the "regional power demand forecast", where the country's overall power demand forecast is allocated by region and then reviews are made on the regional demand survey results.

Concerning the power demand forecast of the Dar es Salaam and Coast Regions, the method of "forecast for power demand by substation" was selected. After calculating the power demand by ward based on the City Development Plan and the regional demand survey results, load distribution and future load forecast, which were estimated from the site survey of existing substations and power load performance, were added.

The power demand forecast by substation also takes into account the expected future load of the substations supplying electricity to Dar es Salaam and the Coast Region, and their load sharing with substations to be expanded or newly constructed under regional characteristics. Power demand forecasts of PSMP 2016 update.

4-2 Power demand forecasts of PSMP 2016 update

4-2-1 Power demand forecasts in country wide of PSMP 2016 update

The power demands from 2015 to 2040 of PSMP2016 update are as the following table.

Table 4-2.1 Country Wide Power Demand

	Demand items	Unit	2015	2020	2025	2030	2035	2040
Peak demand Base case	Domestic demand	MW	974	2,190	3,659	5,872	9,351	14,332
	Additional demand	MW	71	1,041	1,041	1,041	1,041	1,041
	Export	MW	0	685	677	677	677	677
	Total	MW	1,045	3,916	5,377	7,590	11,069	16,050
	Demand items	Unit	2015/20	2020/25	2025/30	2030/35	2035/40	2015/40
Growth rate	Domestic demand	%	17.6	10.8	9.9	9.8	8.9	11.4
	Additional demand	%	71.1	0.0	0.0	0.0	0.0	11.3
	Export	%	0.0	-0.2	0.0	0.0	0.0	0.0
	Total	%	30.2	6.5	7.1	7.8	7.7	11.5

Note: 'Peak demand + Additional demand + export' is calculated in line with power development policy of Tanzania. The additional demand includes grid shift demand from auto producers and backup demand for stabilizing power supply of big users. And export is power border trading with neighboring countries.

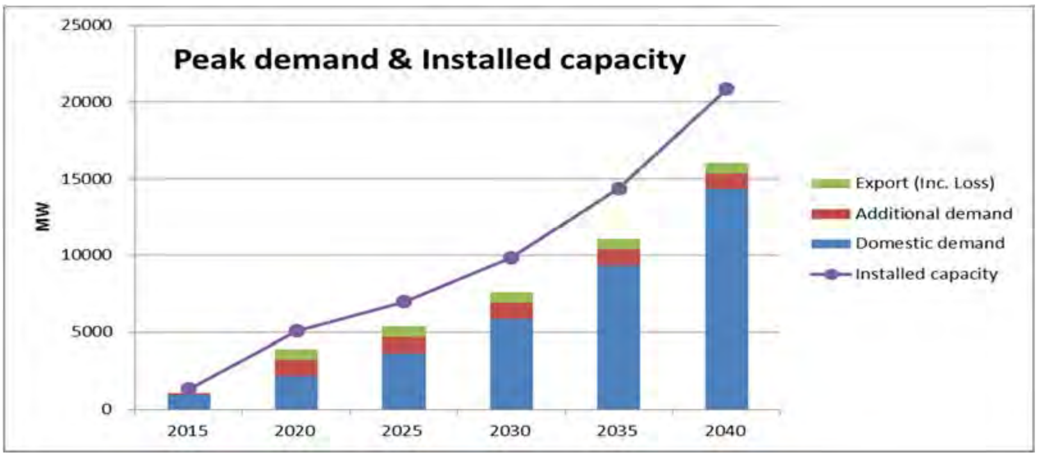


Figure 4-2.1 Country Wide Power Demand

4-2-2 Basic Policy for Power Demand Forecast

(1) Method of Power Demand Forecast by Region

"Regional Power Demand Forecast" will be calculated by distributing the region wide power demand. The distribution logics are as follows;

- The power demand is calculated region by region
- The power demands in a region are consisted of Residential demand, Commercial demand and Industry demand.
- The residential power demand is calculated by the following procedures. As key explanation variables, there are regional population, regional electrification rate and regional actual power consumption in the past.
- The calculation procedures for regional industrial power demand are as the following table. As key explanation variable, there are regional GDP, regional big projects with large power consumption and the future trends of the existing large scale power consumers.
- In the regional large scale project category, there are the big projects more than some level of power consumption like construction and rehabilitation of regional industrial parks, airports, harbors and so on. The power consumptions are added to the regions to use it.

(2) Prediction of Regional Population Growth

For making the regional population in future, it is required to calculate elasticity between regional population growth rate and country population growth rate using censuses in 2002 and 2012. Regarding the regions with the elasticity more than elasticity 1.0, the elasticity is decreased gradually to close to the value of 1.0. The forecasted results of the regional population are as follows:

Table 4-2.2 Regional Population Prediction

Unit: 1,000 persons

	2015	2020	2025	2030	2035	2040
Coast	1,181	1,312	1,441	1,566	1,685	1,790
Dar es Salaam	5,269	6,913	8,649	10,346	11,940	13,387
Zanzibar total	1,439	1,680	1,835	2,024	2,172	2,315
North Unguja	209	246	275	309	337	364
South Unguja	124	138	150	164	176	187
Urban West	683	844	935	1,049	1,136	1,224
North Pemba	221	237	250	265	276	286
South Pemba	202	215	225	237	246	254
Total	7,889	9,905	11,925	13,936	15,797	17492

Source: Task Force Team based on NBS actual data.

Table 4-2.3 Growth rate of Regional Population

Unit: %

	2015/20	2020/25	2025/30	2030/35	2035/40	2015/40
Coast	2.1	1.9	1.7	1.5	1.2	1.7
Dar es Salaam	5.6	4.6	3.6	2.9	2.3	3.8
Zanzibar total	3.1	1.8	2.0	1.4	1.3	1.9
North Unguja	3.3	2.3	2.4	1.8	1.5	2.2
South Unguja	2.2	1.8	1.8	1.4	1.3	1.7
Urban West	4.3	2.1	2.3	1.6	1.5	2.4
North Pemba	1.4	1.1	1.1	0.9	0.7	1.0
South Pemba	1.2	1.0	1.0	0.8	0.6	0.9
Total	4.7	3.8	3.2	2.5	2.1	3.2

Source: same to the above

(3) Regional GDP Forecasts

By using regional actual Regional GDP from 2010 to 2012, the future contributions of the regional GDP are calculated. The contributions are multiplied by real GDP of the whole country for calculating future regional GDP. The results of the regional GDP are as follows:

Table 4-2.4 Regional GDP Forecasts（at 2001 price）

Unit: Billion TZS

	2015	2020	2025	2030	2035	2040
Coast	38	53	75	100	134	172
Dar es Salaam	6,475	9,115	12,832	17,228	23,130	29,601
Zanzibar	642	901	1,263	1,690	2,262	2,887
Total	7,154	10,069	14,170	19,019	25,526	32,660

Source: Task force Team of PSMP 2016 update

Table 4-2.5 Growth Rate of Regional GDP

Unit: %

	2015/20	2020/25	2025/30	2030/35	2035/40	2015/40
Coast	7.1	7.1	6.1	6.1	5.1	6.3
Dar es Salaam	7.1	7.1	6.1	6.1	5.1	6.3
Zanzibar	7.0	7.0	6.0	6.0	5.0	6.2
Total	7.1	7.1	6.1	6.1	5.1	6.3

Source: same to the above

(4) Prediction of Regional Electrification

The regional electrification rates are predicted by the following procedures. As one precondition, the electrification rate in 2020 is referred to the Government target with 50% in country wide. As another precondition, the electrification rate in 2035 will reach 100% in the country wide. Under the two preconditions, the electrification rates of the regions are as follows;

Table 4-2.6 Regional Electrification Prediction

Unit: %

Region names	2015	2020	2025	2030	2035	2040
Coast	45.8	62.8	86.0	92.7	100.0	100.0
Dar es Salaam	89.9	94.8	100.0	100.0	100.0	100.0
Zanzibar	67.9	78.8	93.0	96.4	100.0	100.0

Source: Task Force Team based on TANESCO data

Table 4-2.7 Growth Rate of Regional Electrification Rate

Unit: %

Region names	2015/20	2020/25	2025/30	2030/35	2035/40	2015/40
Coast	6.5	6.5	1.5	1.5	0.0	3.2
Dar es Salaam	1.1	1.1	0.0	0.0	0.0	0.4
Zanzibar	3.0	3.4	0.7	0.7	0.0	1.6

Source: same to the above

(5) Regional Big Projects

The regional big projects selected in the Regional Survey of this study are industrial parks, huge commercial and shopping malls, airport, harbors and so on, as adding condition, the big projects have to use power consumption over 0.5 MW per year, and the projects shall be implemented by 2020. The big projects selected by the above conditions are as follows:

Table 4-2.8 Big Projects in Dar es Salaam

Dar es Salaam Big projects (more than 0.5 MW)		Power demand(MW)			District	Starting year
		2015	2020	2025		
1	Shreeji Alloys Ltd.	15.00	18.00	22.00		
2	Istanbul Cement Products Co. Ltd.	10.00	15.00	20.00		
3	Hui Feng Investment Company Limited	5.00	8.00	12.00		
4	Atik Aluminum and Glass Facede Systems Co. Ltd.	10.00	13.00	18.00		
5	Global Leader Enterprise (T) Ltd.	10.00	12.00	15.00		
6	Simba Steels Ltd.	10.00	12.00	15.00		
7	China East Africa Metal Product Co. Ltd.	9.00	11.00	14.00		
8	China Africa Industry & Trade Group Co. Ltd.	11.00	14.00	18.00		
9	PFG (T) Company Ltd.	11.00	13.00	16.00		
10	Dam Plastics Ltd.	6.00	8.00	12.00		
11	Gabsons (T) Ltd.	8.00	10.00	12.00		
12	Jan Japan Tanzania Ltd.	6.00	8.00	12.00		
13	Wen Xing Plastic Investment Co. Ltd.	1.00	3.00	5.00		
	Total	112.00	145.00	191.00		

Note: Data extracted from Tanzania Investment Centre (TIC) do not indicate specific locations (districts) of the project

Source: Regional survey implemented in December 2015

Table 4-2.9 Big Projects in Coast

Coast Big projects (more than 0.5 MW)		Power demand(MW)			District	Starting year
		2015	2020	2025		
1	T-Better Park Ltd	0.60	0.85	1.70	Mkuranga	2016
2	RK Chudasama	0.00	1.85	2.85	Mkuranga	2017
3	Lodhia Steel Industry	0.00	2.70	3.70	Mkuranga	2016
4	Sain Food	0.00	1.85	2.85	Mkuranga	2017
5	DAWASCO	0.00	1.85	2.85	Mkuranga	2016
6	Neelkanth Salt	0.00	0.85	1.70	Mkuranga	2016
7	Bubugao Footware	0.60	0.85	1.70	Mkuranga	2015
8	Lara Investment	0.60	0.85	1.70	Mkuranga	2015
9	Kamal Industries	0.00	1.00	2.00	Bagamoyo	2015
10	Uongozi Institute	0.00	4.00	4.00	Bagamoyo	2017
11	EPZ & Bagamoyo Port	0.00	10.00	50.00	Bagamoyo	2018
12	Kiluwa Steel Group Co.Ltd	0.00	5.00	10.00	Kibaha	2016
	Total	1.80	31.65	85.05		

Source: Regional survey implemented in December 2015

Table 4-2.10 Big Projects in Zanzibar

Zanzibar Big projects (more than 0.5 MW)		Power demand(MW)			District	Starting year
		2015	2020	2025		
1	Star city	7.00	7.00	7.00	Magharibi-West	2015
2	Mtoni Marine (Hotel)	3.00	4.00	5.00	Mjini (Urban)	2015
	Total	10.00	11.00	12.00		

Source: Regional survey implemented in December 2015

(6) Regional Power Energy Demand Forecasts

By using the country wide power demand of PSMP 2016 update, regional power energy demands are forecasted. The regional power demands are shared by regional population, regional GDP and regional electrification rate. The results are as follows:

Table 4-2.11 Regional Power Energy Demand Forecasts

Unit: GWh

	Region names	2015	2020	2025	2030	2035	2040
Residential	Coast	67	163	291	437	635	924
	Dar es Salaam	900	1,992	3,122	4,782	6,913	10,612
Industry	Coast	77	292	716	1,144	1,895	2,837
	Dar es Salaam	1,795	3,060	5,055	7,954	12,650	18,989
Regional demand	Coast	144	455	1,007	1,581	2,530	3,761
	Dar es Salaam	2,695	5,053	8,177	12,737	19,562	29,601
	Zanzibar	340	650	990	1,310	1,650	1,920
	Sub-total	3,179	6,158	10,174	15,628	23,742	35,282
T/D loss	Coast	15	27	55	106	179	349
	Dar es Salaam	278	301	449	853	1,383	2,750
	Zanzibar	35	39	54	88	117	178
	Sub-total	328	367	558	1,047	1,679	3,277
Total	Coast	159	482	1,062	1,687	2,709	4,110
	Dar es Salaam	2,973	5,353	8,626	13,590	20,946	32,352
	Zanzibar	375	689	1,044	1,398	1,767	2,098
	Sub-total	3,507	6,524	10,732	16,675	25,422	38,560

Source: Task Force Team of PSMP 2016 update

Note: Zanzibar does not have the power demands of residential and industry sectors, it is only the power demand of the whole region.

Table 4-2.12 Growth Rates of Regional Power Energy Demand

Unit: %

	Region names	2015/20	2020/25	2025/30	2030/35	2035/40	2015/40
Residential	Coast	19.5	12.3	8.5	7.8	7.8	11.1
	Dar es Salaam	17.2	9.4	8.9	7.6	9.0	10.4
Industry	Coast	30.6	19.7	9.8	10.6	8.4	15.5
	Dar es Salaam	11.3	10.6	9.5	9.7	8.5	9.9
Regional total	Coast	25.9	17.2	9.4	9.9	8.3	14.0
	Dar es Salaam	13.4	10.1	9.3	9.0	8.6	10.1
	Zanzibar	13.8	8.8	5.8	4.7	3.1	7.2
T/D loss	Coast	12.8	15.4	13.9	11.0	14.3	13.5
	Dar es Salaam	1.6	8.4	13.7	10.1	14.7	9.6
	Zanzibar	2.0	7.1	10.0	5.9	8.9	6.7
Total	Coast	24.9	17.1	9.7	9.9	8.7	13.9
	Dar es Salaam	12.5	10.0	9.5	9.0	9.1	10.0
	Zanzibar	12.9	8.7	6.0	4.8	3.5	7.1

Source: Task Force Team of PSMP 2016 update

Note: Note: Zanzibar does not have the power demands of residential and industry sectors, it is only the power demand of the whole region.

(7) Regional power consumption per capita

Regional power consumption per capita is as following table. The power consumption per capita of Coast region extremely is higher than other regions and country average.

Table 4-2.13 Regional Power Consumption per Capita

Unit: kWh/person

	Region names	2015	2020	2025	2030	2035	2040	40/15 times
Per capita power consumption (kWh/ person)	Coast	134	367	737	1,077	1,608	2,296	17.1
	Dar es Salaam	564	774	997	1,314	1,754	2,417	4.3
	Zanzibar	261	410	569	691	813	906	3.5

Source: Same to the above

(8) Regional peak demand forecasts

Regional peak demand is calculated by using regional power energy demand and load factor of PSMP 2016 update. And the two peak demands are calculated, one is based on domestic power energy demand and another is based on the power energy demand of the Government targets. The results are as follow:

Table 4-2.14 Regional Peak Demand Forecasts

Unit : % for Load factor MW for Peak demand

	Region names	2015	2020	2025	2030	2035	2040
Peak demand without additional demand (Unit MW)	Coast	24	79	173	275	442	670
	Dar es Salaam	459	873	1,407	2,216	3,416	5,276
	Zanzibar	58	112	170	228	288	342
	Sub-total	541	1,064	1,750	2,719	4,146	6,288
Peak demand with additional demand (Unit MW)	Coast	24	100	202	303	470	698
	Dar es Salaam	459	1,113	1,637	2,440	3,631	5,491
	Zanzibar	58	112	170	228	288	342
	Sub-total	541	1,325	2,009	2,971	4,389	6,531

Source Task Force Team of PSMP 2016 update

Note: Additional demand in the table does not include export. It includes grid demand from auto producers and backup demand for sustainable power supply.

Table 4-2.15 Growth rate of Regional Peak Demands

Unit : %

	Region names	2015/20	2020/25	2025/30	2030/35	2035/40	2015/40
Peak demand without additional demand (Unit MW)	Coast	26.3	17.1	9.7	9.9	8.7	14.2
	Dar es Salaam	13.7	10.0	9.5	9.0	9.1	10.3
	Zanzibar	14.2	8.7	6.0	4.8	3.5	7.4
Peak demand with additional demand (Unit MW)	Coast	32.6	15.0	8.5	9.2	8.2	14.3
	Dar es Salaam	19.4	8.0	8.3	8.3	8.6	10.4
	Zanzibar	14.2	8.7	6.0	4.8	3.5	7.4

Source: Same to the above

4-3 Power Demand Forecast for Dar es Salaam and Coast Regions

4-3-1 Method of Power Demand Forecast for Dar es Salaam and Coast Regions

The municipal councils of the Dar es Salaam Region are Kinondoni, Ilala and Temeke. The Coast Region has seven district councils: Bagamoyo, Kibaha, Kibaha Town, Kisarawe, Mkuranga, Rufiji and Mafia. In each district there are wards as shown in Table 4-3.1.

Although Rufiji and Mafia district councils are not targeted by the project, they are necessary for the power distribution in the Coast Region. Also, though the island of Zanzibar is not covered by the project, it is included in the scope of the power demand forecast as it is supplied with power from Kinondoni in the Dar es Salaam Region.

Figure 4-3.1 Area for Power Demand Forecast

Table 4-3.1 Number of Wards

	District / Council	Ward
Dar es Salaam Region		**90**
	Kinondoni Municipal Council	34
	Ilala Municipal Council	26
	Temeke Municipal Council	30
Coast Region		**111**
	Bagamoyo District Council	22
	Kibaha District Council	11
	kibaha Town District Council	11
	Kisarawe District Council	15
	Mkuranga District Council	18
	Rufiji District Council	26
	Mafia District Council	8
Zanzibar		**-**

The power demand forecast for the Dar es Salaam and Coast Regions was carried out by allocating "regional electric power demand assumption", as formulated by PSMP 2016 update, ward by ward. The method of allocation is as follows.

STEP A. "Regional Power demand forecast" is divided into residential demand and industrial demand.

STEP B. Establish population forecasts on ward basis, also considering the City Development Plan.

STEP C. Divide the PSMP 2016 update's regional energy demand into residential and industrial use and calculate per capita energy demand for residential use.

STEP D. For industrial energy demand, the per capita energy demand is calculated based on the results of the local demand survey, after allocating energy demand per TANESCO business segment.

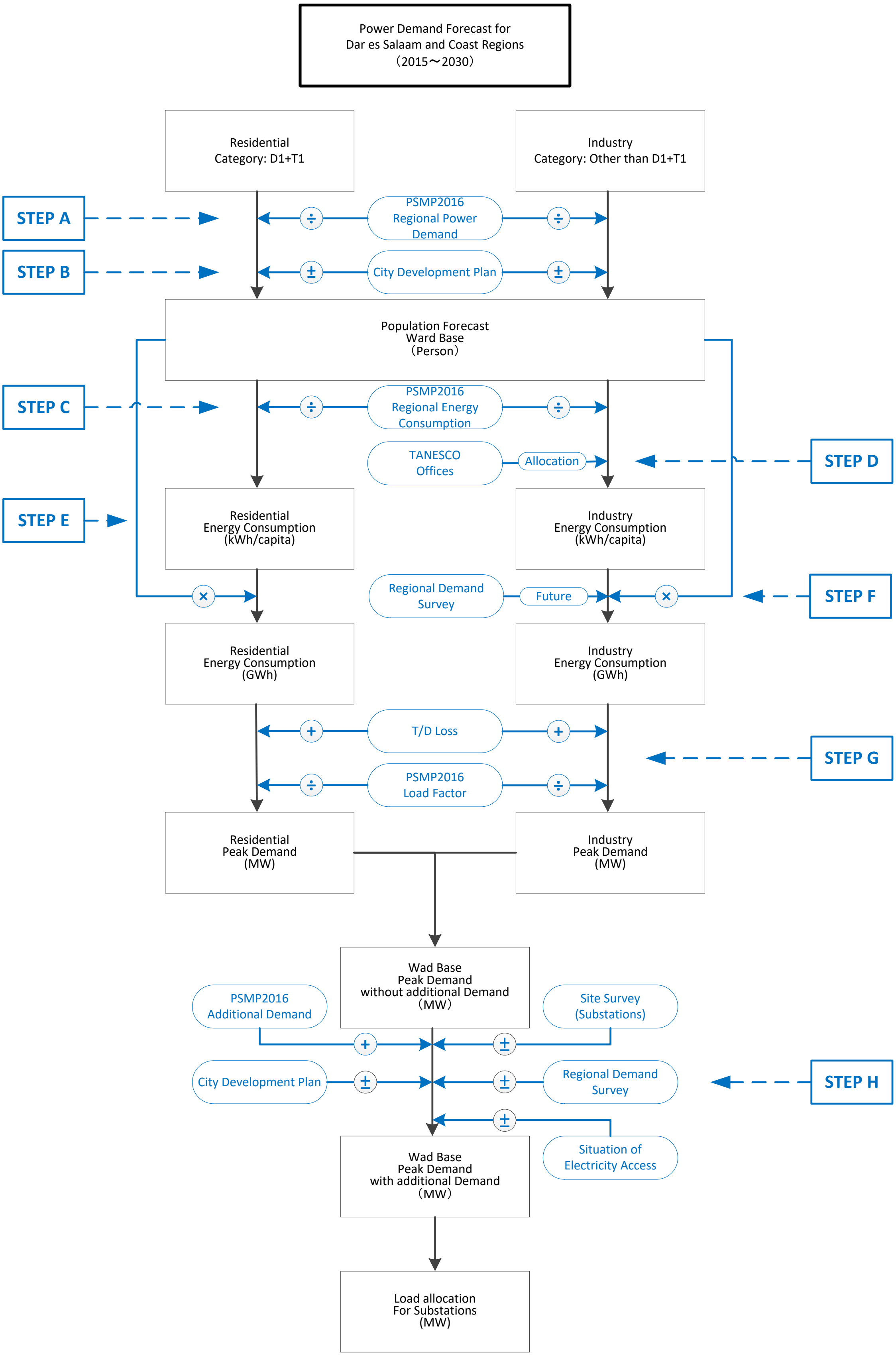
STEP E. Calculate residential energy demand based on the population forecast.

STEP F. Calculate industrial energy demand based on the population forecast, while also considering the results of the regional demand survey.

STEP G. T/D loss is added to the calculated energy demand, and the peak power demand for both residential use and industrial use is set using the load factor of the PSMP 2016 update.

STEP H. As in the PSMP 2016 update, with additional demand, the load allocation for substations is determined by forecasting the peak power demand by ward based on City Development Plan, substation surveys, regional demand survey results and the electrification situation.

Figure 4-3.2 shows the flow of the power demand forecast for the Dar es Salaam and Coast Regions.



Source: JICA Study Team

Figure 4-3.2 Flow of Power Demand Forecast for Dar es Salaam and Coast Regions

4-3-2 Power Demand Forecast by Ward

(1) Population Forecast by Ward

The population by ward is based on the regional population forecast predicted in the PSMP 2016 update, with population transitions according to the City Development Plan considered. The prediction results so far are as shown in the table below.

Table 4-3.2 Population Forecast by Ward (Summary)

Unit: 1,000 persons

	Ward	2015	2020	2025	2030
Dar es Salaam Region	90	5,102	6,956	8,314	10,188
Kinondoni Municipal Council	34	2,075	2,545	3,008	3,824
Ilala Municipal Council	26	1,427	1,880	2,208	2,608
Temeke Municipal Council	30	1,600	2,530	3,097	3,757
Coast Region	89	1,164	1,312	1,435	1,586
Bagamoyo District Council	22	329	373	407	447
Kibaha District Council	11	75	84	92	102
Kisarawe District Council	15	108	121	133	147
Mkuranga District Council	18	237	266	291	323
Rufiji District Council	26	231	259	284	314
Mafia District Council	8	49	55	61	67
kibaha Town District Council	11	136	153	168	186
Zanzibar total		1,439	1,679	1,836	2,024

Source: JICA Study Team based on PSMP2016 Update and City Development Plan

Table 4-3.3 Growth Rate of Population by Ward (Summary)

Unit: %

	Ward	2015/20	2020/25	2025/30	2015/30
Dar es Salaam Region	90	6.4	3.6	4.2	4.7
Kinondoni Municipal Council	34	4.2	3.4	4.9	4.2
Ilala Municipal Council	26	5.7	3.3	3.4	4.1
Temeke Municipal Council	30	9.6	4.1	3.9	5.9
Coast Region	89	2.4	1.8	2.0	2.1
Bagamoyo District Council	22	2.5	1.8	1.9	2.1
Kibaha District Council	11	2.4	1.8	2.1	2.1
Kisarawe District Council	15	2.4	1.8	2.1	2.1
Mkuranga District Council	18	2.4	1.8	2.1	2.1
Rufiji District Council	26	2.4	1.8	2.1	2.1
Mafia District Council	8	2.4	1.8	2.1	2.1
kibaha Town District Council	11	2.4	1.8	2.1	2.1
Zanzibar total		3.1	1.8	2.0	2.3

Source: JICA Study Team based on PSMP2016 Update and City Development Plan

(2) Energy Demand Forecast by Ward and Power Consumption per capita (Residential)

Based on the national power demand forecast of the PSMP 2016 update, the regional power energy amount is predicted based on regional population, regional GDP and regional electrification rate. The results are as follows.

Table 4-3.4 Energy Demand Forecast by Ward (Residential)

		Unit	2015	2020	2025	2030
Power Consumption	Dar es Salaam	GWh	900	1,992	3,122	4,782
Residential	Coast	GWh	67	163	291	437
(D1+T1) *	Zanzibar	GWh	340	650	990	1,310
T/D loss	Dar es Salaam	GWh	93	119	171	320
Residential	Coast	GWh	7	10	16	29
(D1+T1) *	Zanzibar	GWh	35	39	54	88
Total Consumption	Dar es Salaam	GWh	993	2,111	3,293	5,102
Residential	Coast	GWh	74	173	307	466
(D1+T1)	Zanzibar	GWh	375	689	1,044	1,398
Power Consumption	Dar es Salaam	kWh/capita	195	304	396	501
per capita	Coast	kWh/capita	63	132	214	293
Residential(D1+T1) *	Zanzibar	kWh/capita	261	410	569	691
Load Factor		%	74	70	70	70
Peak Demand	Dar es Salaam	MW	459	873	1,407	2,216
(Total)	Coast	MW	24	79	173	275
*	Zanzibar	MW	58	112	170	228
Peak Demand	Dar es Salaam	MW	153	344	537	832
Residential	Coast	MW	11	28	50	76
(D1+T1) *	Zanzibar	MW	58	112	170	228

Source: PSMP 2016 update

Table 4-3.5 Growth Rate of Energy Demand by Ward (Residential)

		Unit	2015	2020	2025	2030
Power Consumption	Dar es Salaam	%	17.2	9.4	8.9	11.8
Residential Coast	Coast	%	19.5	12.3	8.5	13.3
(D1+T1) Zanzibar	Zanzibar	%	13.8	8.8	5.8	9.4
T/D loss	Dar es Salaam	%	5.0	7.6	13.3	8.6
Residential	Coast	%	6.7	10.4	13.0	10.0
(D1+T1) *	Zanzibar	%	2.2	6.7	10.3	6.3
Total Power Consumption	Dar es Salaam	%	16.3	9.3	9.1	11.5
Residential	Coast	%	18.5	12.2	8.7	13.1
(D1+T1)	Zanzibar	%	12.9	8.7	6.0	9.2
Power Consumption	Dar es Salaam	%	9.3	5.5	4.8	6.5
per capita	Coast	%	15.7	10.2	6.5	10.7
Residential(D1+T1)	Zanzibar	%	9.5	6.8	4.0	6.7
Load Factor		-	-	-	-	-
Peak Demand	Dar es Salaam	%	13.7	10.0	9.5	11.1
(Total)	Coast	%	26.3	17.1	9.7	17.5
*	Zanzibar	%	14.2	8.7	6.0	9.6
Peak Demand	Dar es Salaam	%	17.6	9.3	9.1	11.9
Residential	Coast	%	19.8	12.2	8.7	13.5
(D1+T1) *	Zanzibar	%	14.2	8.7	6.0	9.6

Source: PSMP 2016 update

(3) Energy Demand Forecast by Ward and Power Consumption per capita (Industry)

Based on the national power demand forecast of the PSMP 2016 update, the regional power energy amount is predicted based on regional population, regional GDP and regional electrification rate. The results are as follows.

Table 4-3.6 Energy Demand Forecast by Ward (Industry)

		Unit	2015	2020	2025	2030
Power Consumption Industry (T2+T3)	Dar es Salaam	GWh	1,795	3,060	5,055	7,954
	Coast	GWh	77	292	716	1,144
*	Zanzibar	GWh	340	650	990	1,310
T/D loss Industry (T2+T3)	Dar es Salaam	GWh	185	182	278	533
	Coast	GWh	8	17	39	77
*	Zanzibar	GWh	35	39	54	88
Total Consumption Industry (T2+T3)	(Dar es Salaam)	GWh	1,980	3,242	5,333	8,487
	Kimara	GWh	209	385	680	1157
	City Center	GWh	543	826	1276	1902
	Tabata	GWh	23	47	90	166
	Industrial	GWh	218	350	571	898
	Gongola Mboto	GWh	23	41	78	142
	Temeke	GWh	424	728	1242	2045
	Kinondoni North	GWh	539	865	1397	2177
	(Coast)	GWh	85	309	755	1,221
	Rufiji	GWh	0.0	7	28	68
	Mkuranga	GWh	18.3	106	287	502
	Kibaha	GWh	33.8	90	188	255
	Bagamoyo	GWh	16.5	46	96	129
	Kisarawe	GWh	11.0	33	80	126
	Mafia	GWh	5.5	27	77	140
	(Zanzibar)	GWh	375	689	1,044	1,398
Power Consumption per capita Industry (T2+T3)	(Dar es Salaam)	kWh/capita	388	467	641	833
	Kimara	kWh/capita	180	272	414	570
	City Center	kWh/capita	3190	3977	6062	9694
	Tabata	kWh/capita	56	88	139	212
	Industrial	kWh/capita	402	493	675	878
	Gongola Mboto	kWh/capita	78	97	154	234
	Temeke	kWh/capita	265	288	401	544
	Kinondoni North	kWh/capita	593	764	1023	1213
	(Coast)	kWh/capita	73	236	526	768
	Rufiji	kWh/capita	0	28	98	217
	Mkuranga	kWh/capita	77	399	984	1,555
	Kibaha	kWh/capita	160	378	724	888
	Bagamoyo	kWh/capita	50	123	235	287
	Kisarawe	kWh/capita	102	271	604	859
	Mafia	kWh/capita	111	495	1,270	2,086
*	(Zanzibar)	kWh/capita	261	410	569	691
Load Factor		%	74	70	70	70
Peak Demand (Total)	Dar es Salaam	MW	459	873	1,407	2,216
	Coast	MW	24	79	173	275
*	Zanzibar	MW	58	112	170	228
Peak Demand Industry (T2+T3)	Dar es Salaam	MW	305	500	823	1,309
	Coast	MW	13	48	116	188
*	Zanzibar	MW	58	112	170	228

Source: JICA Study Team

Table 4-3.7 Growth Rate of Energy Demand by Ward (Industry)

		Unit	2015	2020	2025	2030
Power Consumption	Dar es Salaam	%	11.3	10.6	9.5	10.4
Industry	Coast	%	30.6	19.6	9.8	19.7
(T2+T3) *	Zanzibar	%	13.8	8.8	5.8	9.4
T/D loss	Dar es Salaam	%	(0.3)	8.8	13.9	7.3
Industry	Coast	%	16.7	17.7	14.4	16.2
(T2+T3) *	Zanzibar	%	2.2	6.7	10.3	6.3
Total Consumption	(Dar es Salaam)	%	10.4	10.5	9.7	10.2
Industry	Kimara	%	13.0	12.0	11.2	12.1
(T2+T3)	City Center	%	8.7	9.1	8.3	8.7
Total Power Consumption	Tabata	%	15.2	13.8	13.0	14.0
	Industrial	%	10.0	10.3	9.5	9.9
	Gongola Mboto	%	12.0	13.6	12.8	12.8
	Temeke	%	11.4	11.3	10.5	11.1
	Kinondoni North	%	9.9	10.1	9.3	9.8
	(Coast)	%	29.5	19.6	10.1	19.4
	Rufiji	%	274.0	30.6	19.7	80.1
	Mkuranga	%	42.1	22.0	11.8	24.7
	Kibaha	%	21.5	16.0	6.3	14.4
	Bagamoyo	%	22.7	15.9	6.2	14.7
	Kisarawe	%	24.6	19.5	9.5	17.7
	Mafia	%	38.0	22.9	12.7	24.1
	(Zanzibar)	%	12.9	8.7	6.0	9.2
Power Consumption	(Dar es Salaam)	%	3.7	6.6	5.4	5.2
per capita	Kimara	%	8.7	8.7	6.6	8.0
Industry	City Center	%	4.5	8.8	9.8	7.7
(T2+T3)	Tabata	%	9.3	9.7	8.8	9.3
	Industrial	%	4.2	6.5	5.4	5.4
	Gongola Mboto	%	4.6	9.7	8.8	7.7
	Temeke	%	1.6	6.9	6.3	4.9
	Kinondoni North	%	5.2	6.0	3.5	4.9
	(Coast)	%	26.4	17.4	7.9	17.0
	Rufiji	%	389.8	28.2	17.3	94.6
	Mkuranga	%	38.8	19.8	9.6	22.2
	Kibaha	%	18.7	13.9	4.2	12.1
	Bagamoyo	%	19.8	13.8	4.1	12.4
	Kisarawe	%	21.7	17.3	7.3	15.3
	Mafia	%	34.8	20.7	10.4	21.6
*	(Zanzibar)	%	9.5	6.8	4.0	6.7
Load Factor		-	-	-	-	-
Peak Demand	Dar es Salaam	%	13.7	10.0	9.5	11.1
(Total)	Coast	%	26.3	17.1	9.7	17.5
Peak Demand *	Zanzibar	%	14.2	8.7	6.0	9.6
Peak Demand	Dar es Salaam	%	10.4	10.5	9.7	10.2
Industry	Coast	%	29.5	19.6	10.1	19.4
(T2+T3) *	Zanzibar	%	14.2	8.7	6.0	9.6

Source: JICA Study Team

(4) Power Demand Forecast by Ward (Summary)

Regional peak demand is obtained by applying the load factor used in the PSMP 2016 update to regional power energy. The prediction of peak demand also includes predictions of cases where various power supply measures are incorporated in order to achieve government goals. The results are as follows.

Table 4-3.8 Power Demand Forecast by Ward (Summary)

Unit: Load factor % Peak Demand: MW

	Region Name	Unit	2015	2020	2025	2030
Load Factor	Dar es Salaam	%	74	70	70	70
	Coast	%	74	70	70	70
	Zanzibar	%	74	70	70	70
Power Demand Without Additional Demand	Residential	Unit	2015	2020	2025	2030
	Dar es Salaam Region	MW	153	345	537	832
	Kinondoni Municipal Council	MW	62	126	194	312
	Ilala Municipal Council	MW	43	93	143	213
	Temeke Municipal Council	MW	48	125	200	307
	Coast Region	MW	11	28	50	76
	Bagamoyo District Council	MW	3	8	14	21
	Kibaha District Council	MW	1	2	3	5
	Kisarawe District Council	MW	1	3	5	7
	Mkuranga District Council	MW	2	6	10	15
	Rufiji District Council	MW	2	6	10	15
	Mafia District Council	MW	0	1	2	3
	kibaha Town District Council	MW	1	3	6	9
	Zanzibar Region	MW	58	112	170	228
	Industry	Unit	2015	2020	2025	2030
	Dar es Salaam Region	MW	305	529	870	1,384
	Kinondoni Municipal Council	MW	115	204	339	544
	Ilala Municipal Council	MW	125	206	329	507
	Temeke Municipal Council	MW	65	119	202	333
	Coast Region	MW	13	50	123	199
	Bagamoyo District Council	MW	3	7	16	21
	Kibaha District Council	MW	2	5	11	15
	Kisarawe District Council	MW	2	5	13	21
	Mkuranga District Council	MW	3	17	47	82
	Rufiji District Council	MW	0	1	5	11
	Mafia District Council	MW	1	4	13	23
	kibaha Town District Council	MW	3	9	20	27
	Zanzibar Region	MW	58	112	170	228
	Sector Total	Unit	2015	2020	2025	2030
	Dar es Salaam Region	MW	459	873	1,407	2,216
	Kinondoni Municipal Council	MW	178	330	533	856
	Ilala Municipal Council	MW	167	299	471	720
	Temeke Municipal Council	MW	113	244	403	640
	Coast Region	MW	24	79	173	275
	Bagamoyo District Council	MW	6	15	30	42
	Kibaha District Council	MW	3	7	14	20
	Kisarawe District Council	MW	3	8	18	28
	Mkuranga District Council	MW	5	23	57	97
	Rufiji District Council	MW	2	7	14	26
	Mafia District Council	MW	1	6	15	26
	kibaha Town District Council	MW	5	13	26	36
	Zanzibar Region	MW	58	112	170	228
Power Demand With Additional Demand	Sector Total	Unit	2015	2020	2025	2030
	Dar es Salaam Region	MW	459.2	1,113.3	1,637.4	2,440.2
	Kinondoni Municipal Council	MW	208.9	444.6	640.0	963.0
	Ilala Municipal Council	MW	147.5	369.7	505.2	735.7
	Temeke Municipal Council	MW	102.9	299.0	492.2	741.5
	Coast Region	MW	24.4	100.1	202.5	303.1

	Region Name	Unit	2015	2020	2025	2030
	Bagamoyo District Council	MW	5.0	18.8	42.7	63.6
	Kibaha District Council	MW	2.6	9.5	17.1	26.3
	Kisarawe District Council	MW	2.0	10.3	20.5	32.0
	Mkuranga District Council	MW	3.4	23.5	51.6	87.0
	Rufiji District Council	MW	1.2	6.8	8.9	16.1
	Mafia District Council	MW	0.8	5.7	10.4	18.4
	kibaha Town District Council	MW	9.4	25.5	51.4	59.7
	Zanzibar Region	MW	57.9	112.2	170.4	228.0

Source: PSMP 2016 update

Note: Additional demand in the table does not include export. It includes grid demand from auto producers and backup demand for sustainable power supply.

Table 4-3.9 Growth Rate of Power Demand Forecast by Ward (Summary)

Unit: %

	Region Name	Unit	2015	2020	2025	2030
Load Factor	Dar es Salaam	%	74	70	70	70
	Coast	%	74	70	70	70
	Zanzibar	%	74	70	70	70
Power Demand Without Additional Demand	Residential	Unit	2015/20	2020/25	2025/30	2015/30
	Dar es Salaam Region	%	17.6	9.3	9.1	11.9
	Kinondoni Municipal Council	%	15.1	9.0	9.9	11.3
	Ilala Municipal Council	%	16.8	8.9	8.3	11.3
	Temeke Municipal Council	%	21.1	9.8	8.9	13.2
	Coast Region	%	19.9	12.2	8.7	13.5
	Bagamoyo District Council	%	20.0	12.1	8.5	13.5
	Kibaha District Council	%	19.8	12.2	8.7	13.5
	Kisarawe District Council	%	19.8	12.2	8.7	13.5
	Mkuranga District Council	%	19.8	12.2	8.7	13.5
	Rufiji District Council	%	19.8	12.2	8.7	13.5
	Mafia District Council	%	19.8	12.2	8.7	13.5
	kibaha Town District Council	%	19.8	12.2	8.7	13.5
	Zanzibar Region	%	14.1	8.7	6.0	9.6
	Industry	Unit	2015/20	2020/25	2025/30	2015/30
	Dar es Salaam Region	%	11.6	10.5	9.7	10.6
	Kinondoni Municipal Council	%	12.0	10.7	9.9	10.9
	Ilala Municipal Council	%	10.6	9.8	9.1	9.8
	Temeke Municipal Council	%	12.6	11.3	10.5	11.5
	Coast Region	%	30.9	19.6	10.1	19.9
	Bagamoyo District Council	%	24.2	15.8	6.1	15.1
	Kibaha District Council	%	22.9	16.0	6.3	14.9
	Kisarawe District Council	%	26.0	19.5	9.5	18.1
	Mkuranga District Council	%	43.7	22.0	11.8	25.2
	Rufiji District Council	%	64.2	30.6	19.7	36.9
	Mafia District Council	%	39.5	22.9	12.7	24.6
	kibaha Town District Council	%	22.9	16.0	6.3	14.9
	Zanzibar Region	%	14.1	8.7	6.0	9.6
	Sector Total	Unit	2015/20	2020/25	2025/30	2015/30
	Dar es Salaam Region	%	13.7	10.0	9.5	11.1
	Kinondoni Municipal Council	%	13.2	10.1	9.9	11.0
	Ilala Municipal Council	%	12.3	9.5	8.8	10.2
	Temeke Municipal Council	%	16.5	10.5	9.7	12.2
	Coast Region	%	26.3	17.1	9.7	17.5
	Bagamoyo District Council	%	21.9	14.0	7.3	14.2
	Kibaha District Council	%	22.0	15.0	6.9	14.5
	Kisarawe District Council	%	23.7	17.3	9.3	16.6
	Mkuranga District Council	%	35.0	19.8	11.3	21.7
	Rufiji District Council	%	24.5	16.4	12.6	17.7

	Region Name	Unit	2015	2020	2025	2030
	Mafia District Council	%	33.6	21.0	12.2	22.0
	kibaha Town District Council	%	22.0	15.0	6.9	14.5
	Zanzibar Region	%	14.1	8.7	6.0	9.6
Power Demand With Additional Demand	Sector Total	Unit	2015/20	2020/25	2025/30	2015/30
	Dar es Salaam Region	%	19.4	8.0	8.3	11.8
	Kinondoni Municipal Council	%	16.3	7.6	8.5	10.7
	Ilala Municipal Council	%	20.2	6.4	7.8	11.3
	Temeke Municipal Council	%	23.8	10.5	8.5	14.1
	Coast Region	%	32.6	15.1	8.4	18.3
	Bagamoyo District Council	%	30.2	17.8	8.3	18.4
	Kibaha District Council	%	30.1	12.4	9.0	16.8
	Kisarawe District Council	%	38.4	14.8	9.3	20.2
	Mkuranga District Council	%	47.2	17.0	11.0	24.1
	Rufiji District Council	%	40.8	5.7	12.6	18.8
	Mafia District Council	%	48.6	12.9	12.2	23.4
	kibaha Town District Council	%	22.0	15.0	3.1	13.1
	Zanzibar Region	%	14.1	8.7	6.0	9.6

Source: PSMP 2016 update

(5) Summary of the Power Demand Forecast

The power demand forecasts of Coast regions (Dar es Salaam, Coast and Zanzibar regions) are implemented by the same scenario as PSMP 2016 update. That is “Without additional demand” and “With additional demand”. The power demand forecasting results of the Dar es Salaam, Coast and Zanzibar regions are as the following figure. Back line shows power demand without additional demand and Red line is with additional demand.

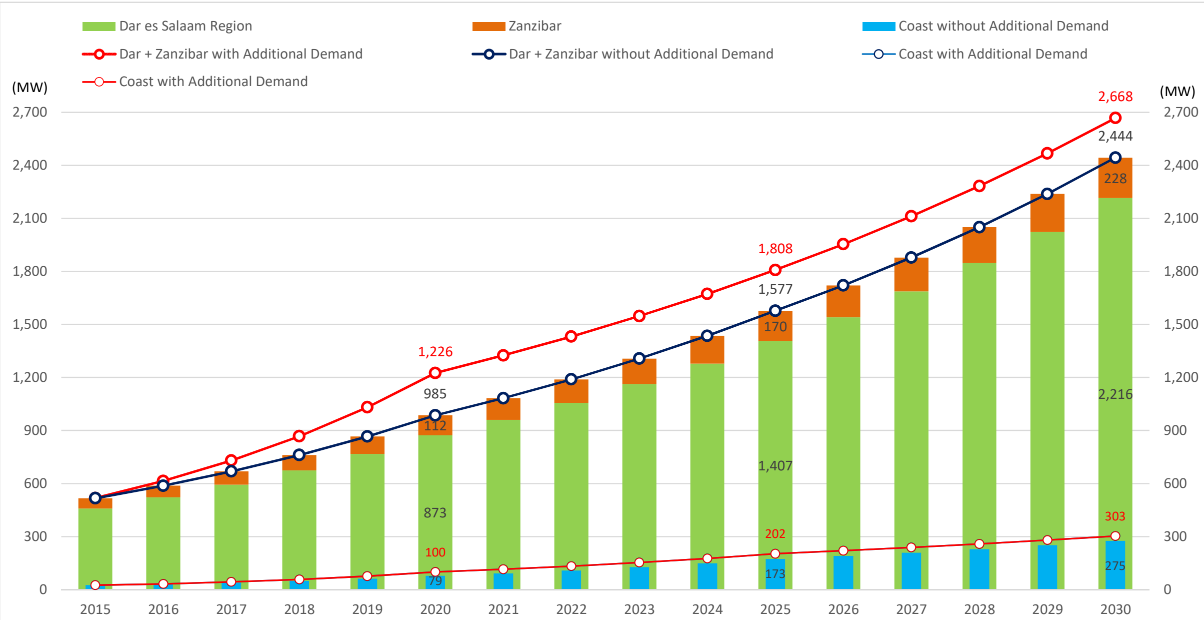


Figure 4-3.3 Power Demand Forecast for Dar es Salaam and Coast Regions

Chapter 5 Present Situation of Network in Dar es Salaam and Coast Region, and Development plan

5-1 Present Situation of Power System Network

Upon formulating the development plan of the system, the present power system network should be confirmed.

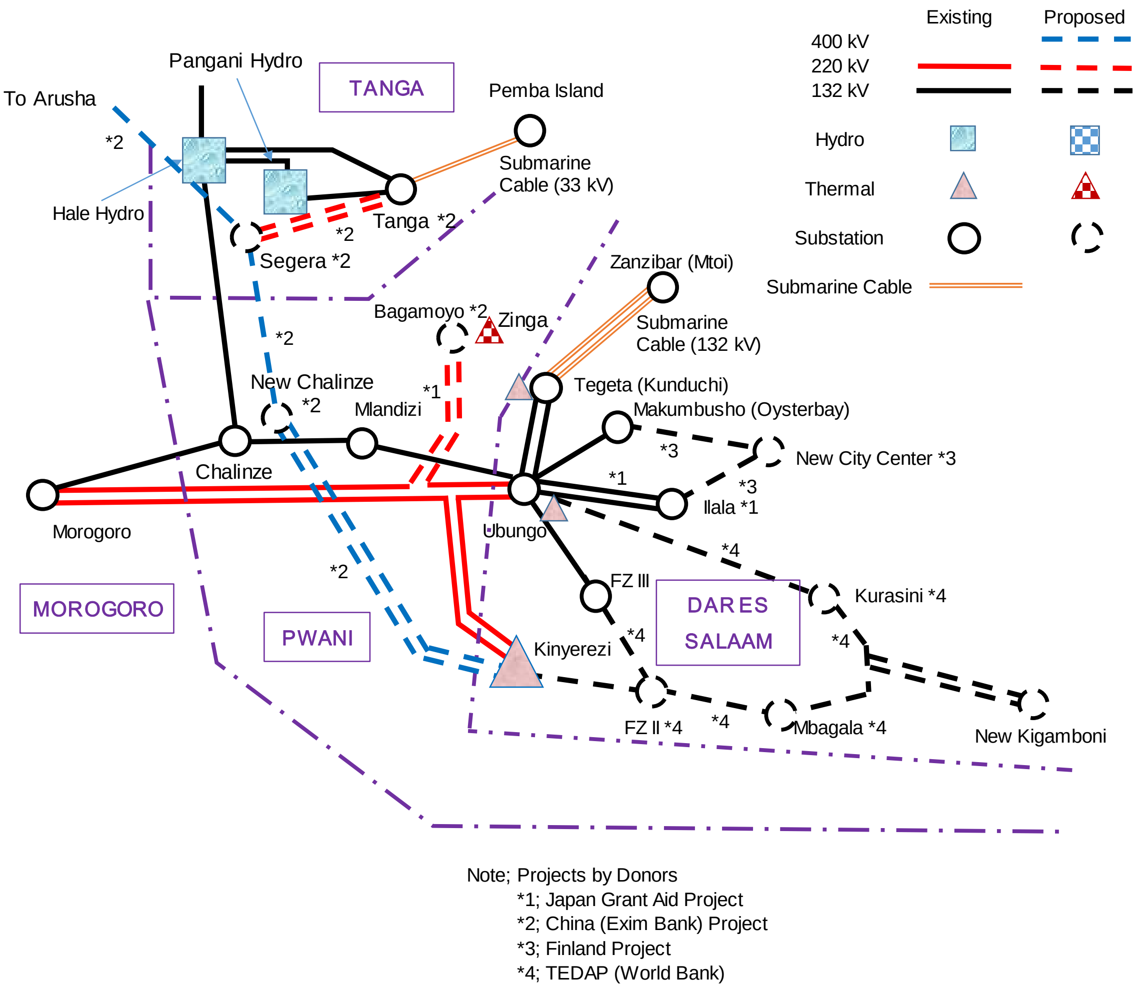
5-1-1 Transmission Line and Substations

In this section, the actual situation is described below concerning 220, 132 and 33 kV transmission line and substation facilities.

(1) Existing Network in Dar es Salaam and Coast Region

220/132 kV Ubungo substation with thermal power plants is the center of the power system network in Dar es Salaam and Coast region as shown in Figure 5-1.1. Since Kinyerezi Gas power plant (200 MW) has been commissioned in 2015, the power supply condition in the area is getting improved. However, Kinyerezi power plant is not connected to FZ-II as shown, the power is still distributed to the city as radial type system at Ubungo 132 kV busbar. In order to cope with the growth of the city, various projects by several donors have been planned and in progress at present. (Projects in progress as of December 2016 are shown by broken lines in the Figure 5-1.1) The power for Zanzibar Island is supplied by 2 x submarine cables from 132 kV Tegeta substation.

In addition, 400 kV network is also planned for increasing the power demand in the country. The 400 kV project are ongoing by Chinese fund, as shown in the Figure 5-1.1 by blue broken lines. Figure 5-1.1 shows also the projects by other donors.



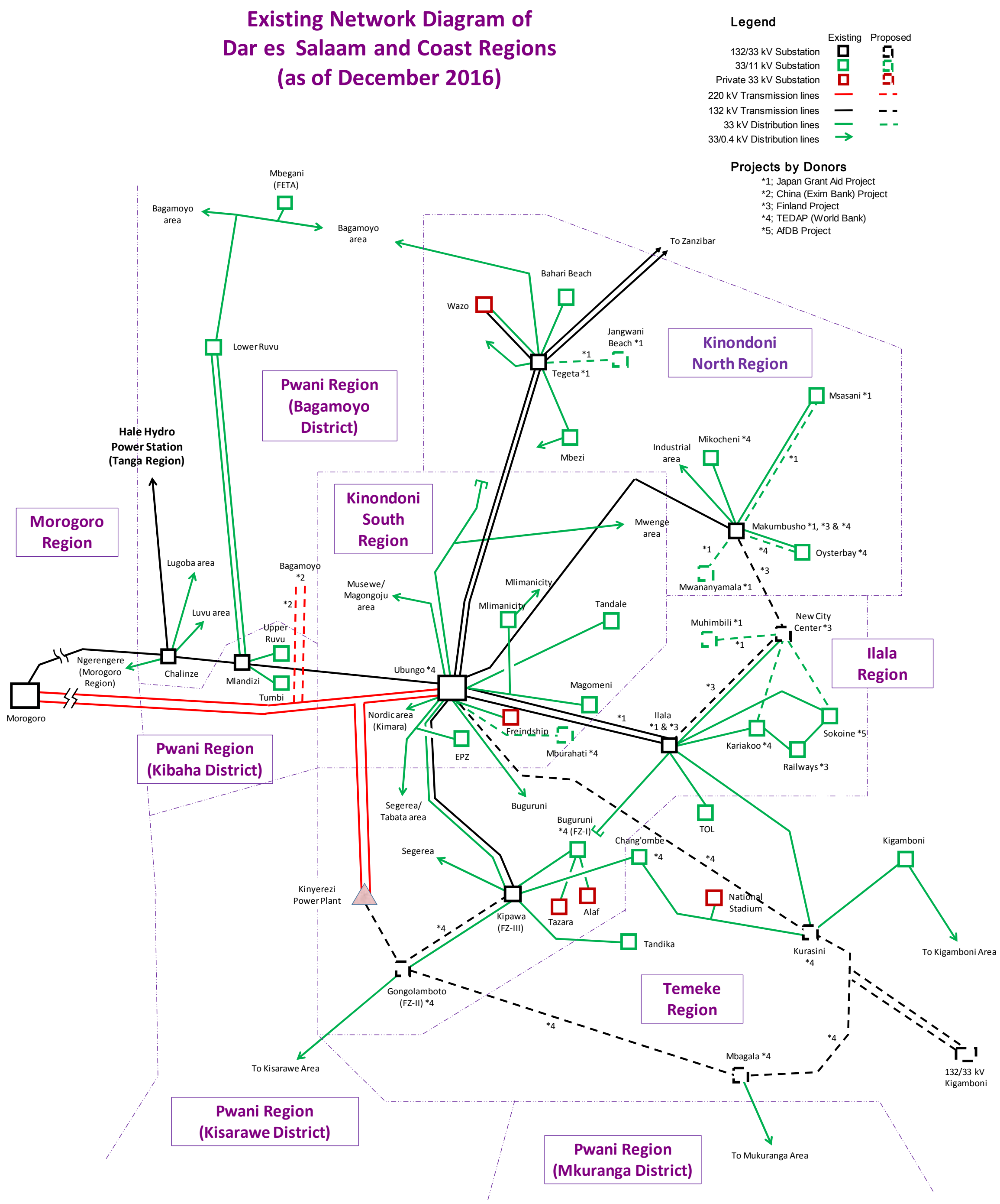
Source: JICA Study Team by TANESCO Data

Figure 5-1.1 Power System Network in Dar es Salaam and Coast region (as of December 2016)

The power supply to the customers is conducted through 33 kV and 11 kV. There are two cases for the power supply, one by 33 kV through 132/33 kV substations and the other is by 11 kV through 33/11 kV substations in the city. There are four (4) Regional offices in Dar es Salaam and one (1) Regional office in Coast region for power supply management, as listed below.

- North Kinondoni Regional Office
- South Kinondoni Regional Office
- Ilala Regional Office
- Temeke Regional Office
- Coast Regional Office

Figure 5-1.2 shows Network diagram of Dar es Salaam and Coast regions as of December 2016. 132/33/11 kV single line diagrams was made in each region and interconnected between substations, based on the site survey and the hearing from Regional offices.



Source: JICA Study Team by TANESCO Data

Figure 5-1.2 Existing Network Diagram of Dar es Salaam and Coast regions (as of December 2016)

(2) Site Surveys

As shown in Section 5-1-2, it is necessary to know the present conditions of the existing facilities in order to plan the development of Network. Hence, the site survey was conducted for all substations in Dar es Salaam and Coast regions, specifically for the locations with coordinates, the possibility of the expansion of the equipment inside/outside of the substations, detailed specification of the equipment, the present load flows, and other items.

1) Survey Items

The survey items are as follows;-

- ✓ Location (GPS coordinates)
- ✓ Dimensions
- ✓ Voltage class
- ✓ Specifications of Main Equipment (Bus system, Bus capacity, Capacity and Specifications of Transformers, Switchgear specifications, etc.)
- ✓ Possibility of Expansion within Substation
- ✓ Outside condition of Substation (including the direction of the Transmission/Distribution lines, etc.)
- ✓ Loading conditions
- ✓ Others

2) Substations surveyed

Substations surveyed are listed as follows;-

- ✓ Kinondoni South Area (9 Substations)
  - Makumbusho Substation
  - Tegeta Substation
  - Bahari Beach Substation
  - Jangwani Beach Substation
  - Mbezi Substation
  - Mikocheni Substation
  - Msasani Substation
  - Mwananyamala Substation
  - Oysterbay Substation

- ✓ Kinondoni North Area (6 Substations)
  - Ubungo Substation (220/132 kV and 132/33/11 kV)
  - EPZ Substation
  - Magomeni Substation
  - Mlimanicity Substation
  - Mburahati Substation
  - Tandale Substation

- ✓ Ilala Area (9 Substations)
  - Ilala Substation
  - City Center Substation (132/33 kV and 33/11 kV)
  - FZ-I (Buguruni) Substation
  - FZ-II (Gongolamboto) Substation
  - FZ-III (Kipawa) Substation

- Kariakoo Substation
- Muhimbili Substation
- Railway Substation
- Sokoine Substation

✓ Temeke Area (7 Substations)

- Kurasini Substation
- Mbagala Substation (132/33 kV and 33/11 kV)
- New Kigamboni Substation (Tentative) (Site survey of future 132/33/11 kV Substation)
- Chang’ombe Substation
- Kigamboni Substation
- Tandika Substation
- TOL Substation

✓ Coast Region (8 Substations)

- Chalinze Substation
- New Chalinze Substation (Tentative) (Site survey of future 400/220/132 kV Substation)
- Mlandizi Substation
- Zinga (Bagamoyo) Substation (Tentative) (Site survey of future 220/132 kV Substation)
- Lower Ruvu Substation
- Mbegani Substation
- Mwanamakuta Substation
- Tumbi Substation

3) Summary of Substation surveyed

The results of the survey are summarized in the Table below. The possibility of the Expansion of the substation and specific issues are listed particularly in the Table. The details of the survey are shown in Attachment S-2.

Summary of Existing Substation Survey
Abbreviation in the Table;
Yes- Possible, No- Not possible
Tr- Transformer, Swgr- Switchgear

➢ Kinondoni North Area

Substation Name	Project Name	Extension		Issues and Others
		Inside	Outside	
Makumbusho		YES (Tr. & 132/33/11 kV Swgr)	No	JICA’s Grant Aid in 2010
Tegeta		YES (Tr. &132/33 kV Swgr)	No	
Bahari Beach		YES (New substation)	Yes	
Jangwani Beach	JICA’s Grant Aid	Yes (Tr. & 33/11 kV	No	

Substation Name	Project Name	Extension		Issues and Others
		Inside	Outside	
		Swgr)		
Mbezi		Yes (New substation)	No	Being operated by two different vector group of transformers
Mikocheni	TEDAP	Yes (supposed to be 33/11 kV Swgr)	No	
Msasani	JICA's Grant Aid	Yes (33/11 kV Swgr)	No	
Mwananyamala	JICA's Grant Aid	Yes (Tr. & 33/11 kV Swgr)	No	
Oysterbay	TEDAP	Yes (33/11 kV Swgr)	No	

- Kinondoni South Area

Substation Name	Project Name	Extension		Issues and Others
		Inside	Outside	
Ubungo (220/132 kV)	TANESCO has plan of 220/132 kV, 300 MVA transformer	Yes (220/132 kV Tr.)	No	
Ubungo (132/33/11 kV)	TEDAP (for Kurasini transmission line)	Yes (Tr. & 33/11 kV Swgr)	No	Need to check the extension, taking into account of power concentration in Ubungo
EPZ		No	No	Exclusive use for EPZ
Magomeni		No	No	
Mlimani city	Mlimani city Mall	Yes (33/11 kV Swgr)	No	Exclusive use for Mlimani city mall and DSM University
Mburahati	TEDAP	Yes (supposed to be 33/11 kV Swgr)	Yes	
Tandale		Yes	No	

- Ilala Area

Substation Name	Project Name	Extension		Issues and Others
		Inside	Outside	
Ilala	JICA's Grant Aid	Yes (Tr. & 132/33/11 kV Swgr)	No	
City Center (132/33 kV)	Finland fund	Yes (Tr. & 132/33 kV Swgr)	No	
City Center (33//11 kV)	TEDAP	Yes (Tr. & 33/11 kV Swgr)	No	
FZ-I	TEDAP	Yes (Tr.) , Yes (supposed to be on 33/11 kV Swgr)	No	
FZ-II	TEDAP	Yes(Tr. & 33/11 kV Swgr)	Yes (North)	
FZ-III		Yes (Tr. & 132/33/11 kV Swgr)	No	

Substation Name	Project Name	Extension		Issues and Others
		Inside	Outside	
Kariakoo	TEDAP	Yes (Tr. & 11 kV Swgr)	No	
Muhimbili	JICA's Grant Aid	Yes (Tr. & 33/11 kV Swgr)	No	
Railway	Finland fund	Yes (Tr. & 33 kV Swgr)	No	
Sokoine		No	No	Substation completed by AfDB fund

- Temeka Area

Substation Name	Project Name	Extension		Issues and Others
		Inside	Outside	
Kurasini	TEDAP	Yes (Tr. & 132/33/11 kV Swgr)	No	
Mbagala (132/33 kV)	TEDAP	Yes (Tr. & 132/33 kV Swgr)	No	
Mbagala (33//11 kV)	TEDAP	Yes (Tr. & 33 kV Swgr)	No	Being operated by two different vector group of transformers
New Kigamboni	-	-	-	New site
Chang'ombe	TEDAP	No	No	
Kigamboni		Yes (Tr. & 33/11 kV Swgr)	Yes	Being operated on no control and protection at all --> Need to install suitable equipment as soon as possible
Tandika		Yes (Tr.)	No	
TOL		No	No	

- Coast Region

Substation Name	Project Name	Extension		Issues and Others
		Inside	Outside	
Chalinze (132/33 kV)		Yes (Tr. & 132/33 kV Swgr)	Yes	
New Chalinze (400/220/132 kV)	Project by Chinese fund	-	-	New site
Mlandizi		No	Yes	Tapped directly from 132 kV transmission line --> Need to construct suitable substation as soon as possible
Zinga (220/132 kV)	Project by Chinese fund	-	-	New site
Lower Ruvu		No	No	Exclusive use for Water Factory (DAWASCO)
Mbegani	-	No	Yes	Exclusive use for FETA (Fishery Education Training Association) Being operated on no control and protection at all --> Need

Substation Name	Project Name	Extension		Issues and Others
		Inside	Outside	
				to install suitable equipment as soon as possible
Mwanamakuta		No	No	Removed all connection from the circuits
Tumbi		Yes	Yes	Being operated on no control and protection at all --> Need to construct suitable substation as soon as possible

5-1-2 Distribution Line

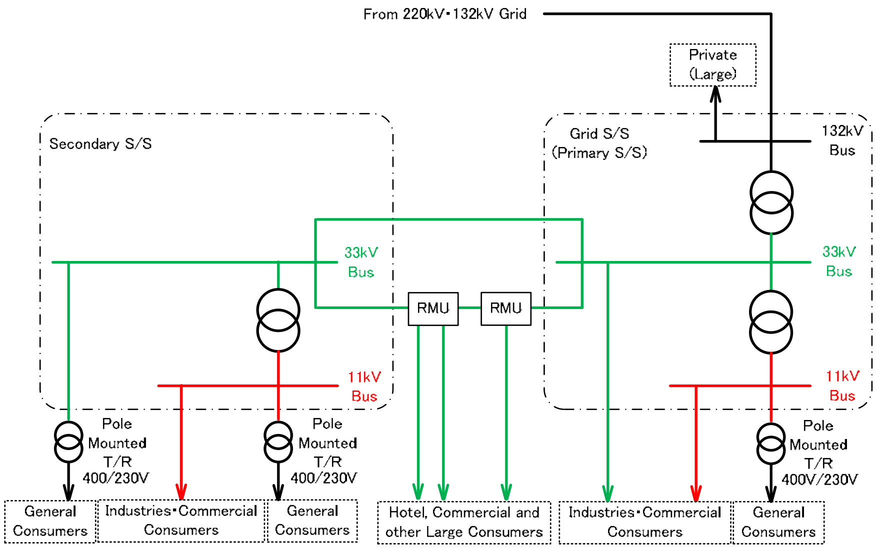
(1) Existing Distribution System

TANESCO owns Distribution and Customer Services department in Ubungo headquarters and manages power selling and power distribution. Distribution planning and customer services are managed by the headquarters mainly however regional distribution planning and actual operation and maintenance are carried out by regional offices and to be reported to headquarters. In Dar es Salaam, four regional offices such as Kinondoni North, Kinondoni South, Ilala and Temeke control the distributed area and Coast regional office controls coastal regions.

Service voltage consists of 33 kV and 11 kV. Low voltage is distributed in either a three-phase 4-wire system or single-phase 2-wire system at 400/230V and utilizes a tree system.

Input voltage form 132kV transmission line step-down to 33kV or 11kV in grid substations and supplies to distribution substation (secondary power substation) or big consumers. The power supplies to big consumers directly or supplies to consumers through Ring Main Unit (RMU) in another case. General consumers mainly receive power in 400/230V after step-down from 11kV on the pole-mount distribution transformers. However in some area with long distance distribution line such as coastal region, 400/230V service voltage is step-down from 33kV distribution voltage.

Figure 5-1.3 shows distribution configuration in Dar es Salaam and coastal region.



Source: Created by JICA Study Team based on the data from TANESCO

Figure 5-1.3 Distribution Configuration in Dar es Salaam and Coastal Region

(2) Major Standard for Distribution System

Tanzania has established a "Tanzanian Grid Code," which is regulated by the Energy and Water Utilities Regulatory Authority (EWURA) and TANESCO is developing and managing power distribution facilities based on its Engineering Instructions and Standard Specifications. Major standards are listed below.

Table 5-1.1 Major Standard for Distribution System

Contents	33kV System	11kV System	Low Voltage
Frequency (Permissible Variation)	50Hz (±2.5%)		
Nominal Voltage (Permissible Limit)	33kV (±10%)	11kV (±10%)	400V (±5%)
Neutral Earthing System	Effectively Earthed		
Wayleave (Distance from the center)	10.0m (5.0m)	5.0m (2.5m)	-
Phase to Earth Clearance	600mm	350mm	-
Phase to Phase Clearance	600mm	350mm	-
Ground Clearance (Normal)	6.0m	6.0m	5.5m

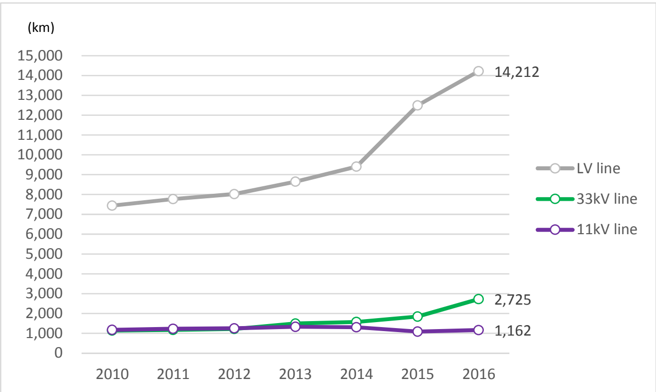
Source: JICA Study Team based on the data from TANESCO

(3) Distribution Line

Distribution lines consist of overhead lines and underground cable. Under TANESCO standards, overhead line uses ACSR 50 mm^2 (rabbit), 100 mm^2 (dog), 150 mm^2 (wolf/dingo) lines, while underground cable uses (for single core) 185 mm^2, 240 mm^2, 300 mm^2 and (for three core) 5 mm^2, 50 mm^2, 70 mm^2, 95 mm^2, 185 mm^2.

As of October 2016 there is 2,725 km of 33 kV medium voltage line, 1,162 km of 11kV medium voltage line and 14,212 km of low voltage line. Of all TANESCO lines on the mainland, 33 kV medium voltage lines constitute 10.4%, 11 kV medium voltage lights constitute 19.4%, and low voltage lines constitute 13.9% of the total.

Figure 5-1.4 shows the cumulative length of distribution lines in Dar es Salaam and the Coast. From the graph we can see that there has been a rapid increase of low voltage power connections made to general consumers.



Source: JICA Study Team based on the data from TANESCO

Figure 5-1.4 Length of Distribution Line in Dar es Salaam and Coast Regions

TANESCO has been implementing a project to establish a GIS database for power distribution equipment. By October 2016, the company completed GIS surveys and data collection from regional offices in Kinondoni North, Ilala, Temeke and the Coast, and established databases at each office. It should be noted, however, the format of the Kinondoni South office database differs from other regions since it already began development of a GIS database on its own before the GIS project with the other three administrative districts.

The Table below shows distribution line lengths of each substation, and was made based on databases collected from each TANESCO region's office. As shown, overhead lines make up most of the length, the longest of these being a 133.2 km 33 kV distribution line and 37.8 km 11 kV distribution line.

There are some incomplete items in the database. There also some items with different feeder names on the substation side since supply destinations change depending on operating conditions. This survey took measures to reflect actual conditions as close as possible by surveying substations and holding interviews with TANESCO. We also decided not to modify unknown feeder names, etc.

Table 5-1.2 Existing Distribution Line (Kinondoni South)

Substation	Voltage	Feeder No.	Feeder Name	Total	Overhead Line (m)	Line Type (m)						Cable (m)	Mean(m)	33kV Mean(km)	11kV Mean(km)
						AAC100	AAC120	ACSR50	ACSR100	ACSR150	ACSR240				
Kinondoni South															
Ubungo	33kV		Wazo2	21,983	21,892	–	–	9,014	12,832	46	–	91			
			Nordic	151,031	151,031	–	–	43,531	107,500	–	–	–			
			Tazara	–	–	–	–	–	–	–	–	–			
			FZ3-1	3,781	3,746	–	–	419	3,327	–	–	35			
			Nordic	243,298	243,298	–	–	107,979	134,190	1,129	–	–			
			FZ3-2	4,567	4,567	–	–	–	4,567	–	–	–			
			Magomeni/Mlimani C	9,496	8,938	–	–	554	7,871	513	–	558			
			Wazo1	15,118	15,118	–	–	–	15,118	–	–	–			
			Tandale	1,500	1,500	–	–	–	1,500	–	–	–			
			Texile	1,500	1,500	–	–	–	1,500	–	–	–			
		9		**452,274**	**451,590**							**684**	**50,253**	**50.3**	
	11kV	U1	Mandela Road	14,448	14,056	–	–	6,604	7,452	–	–	392			
		U2	Ubungo Terminal	7,139	6,962	–	–	4,774	1,711	477	–	177			
		U7	NIT	7,759	7,598	–	–	1,490	6,108	–	–	161			
		U8	Ubungo	–	–	–	–	–	–	–	–	–			
		U9	TANESCO	19,056	18,356	–	–	11,886	5,814	656	–	700			
		4		**48,402**	**46,972**							**1,430**	**12,101**		**12.1**
Tandale	33kV		Ubungo	1,500	1,500	–	–	–	1,500	–	–	–			
			Ilala	–	–	–	–	–	–	–	–	–			
		1		**1,500**	**1,500**							**0**	**1,500**	**1.5**	
	11kV	Tan1		3,550	3,550	–	–	1,696	1,854	–	–	–			
		Tan2		3,859	3,859	–	–	2,506	1,353	–	–	–			
		Tan4		1,921	1,921	–	–	–	1,921	–	–	–			
		3		**9,330**	**9,330**							**0**	**3,110**		**3.1**
Magomeni	33kV		Ubungo/Mlimanicity	9,496	8,938	–	–	554	7,871	513	–	558			
		1		**9,496**	**8,938**							**558**	**9,496**	**9.5**	
	11kV	MG1		5,381	5,381	–	–	1,641	3,740	–	–	–			
		MG2		2,625	2,566	–	–	437	2,129	–	–	59			
		MG3		7,305	7,305	–	–	1,440	5,865	–	–	–			
		MG4		2,697	2,697	–	–	586	2,111	–	–	–			
		4		**18,008**	**17,949**							**59**	**4,502**		**4.5**
Mlimanicity	33kV		Ubungo/Mlimanicity	9,496	8,938	–	–	554	7,871	513	–	558			
				22,239	21,210	–	–	9,082	12,128	–	–	1,029			
		2		**31,735**	**30,148**							**1,587**	**15,868**	**15.9**	
	11kV	K1	Mlimanicity(Ring)	–	–	–	–	–	–	–	–	–			
		K2	Mlimanicity(Ring)	–	–	–	–	–	–	–	–	–			
		K7	University	–	–	–	–	–	–	–	–	–			
EPZ	33kV		Ubungo	4,567	4,567	–	–	–	4,567	–	–	–			
		1		**4,567**	**4,567**								**4,567**	**4.6**	
Mburahati	33kV		Ubungo	–	–	–	–	–	–	–	–	–			

Source: JICA Study Team based on the data from TANESCO

Table 5-1.3 Existing Distribution Line (Kinondoni North)

Substation	Voltage	Feeder No.	Feeder Name	Total	Overhead Line (m)	Line Type (m)						Cable (m)	Mean(m)	33kV Mean(km)	11kV Mean(km)
						AAC100	AAC120	ACSR50	ACSR100	ACSR150	ACSR240				
Kinondoni North															
Tegeta	33kV	TG1	Wazo II	24,361	24,294	–	–	–	24,294	–	–	67			
		TG2	Mbeji	8,445	8,341	114	–	–	8,227	–	–	104			
		TG3	Bagamoyo	139,314	138,991	38,172	–	–	100,819	–	–	323			
		TG4	Bahari Beach	3,192	3,164	–	–	–	3,164	–	–	28			
		TG5	Wazo area	3,268	3,133	3,097	–	–	36	–	–	135			
		TG6	Spare	7,684	7,682	294	–	–	7,388	–	–	2			
		TG7	Jangwani Beach	6,490	6,400	–	–	–	–	6,400	–	90			
		7		**192,754**	**192,005**							**749**	**27,536**	**27.5**	
Makumbusho	33kV	H00	Msasani2	7,600	7,500	–	–	–	–	7,500	–	100			
		H02	Msasani1	8,334	8,293	–	–	–	8,293	–	–	41			
		H03	Oysterbay	1,604	1,563	–	–	–	1,563	–	–	41			
		H09	Industry	5,645	5,463	2,434	–	–	3,029	–	–	182			
		H10	Mikocheni	3,209	3,076	–	–	–	3,076	–	–	133			
		H13	Mwananyamala	1,060	900	–	–	–	–	900	–	160			
		J07	Mak3	11,834	10,919	10,714	–	–	205	–	–	915			
		J08	Mak4	13,357	12,765	–	–	–	12,765	–	–	592			
		8		**52,643**	**50,479**							**2,164**	**6,580**	**6.6**	
Oysterbay	33kV		Makumbusho	1,604	1,563	–	–	–	1,563	–	–	41			
		1		**1,604**	**1,563**							**41**	**1,604**	**1.6**	
	11kV			3,533	3,414	–	–	–	3,414	–	–	119			
				14,546	14,055	–	–	–	14,055	–	–	491			
				6,066	5,953	–	–	–	5,953	–	–	113			
				5,286	5,157	–	–	–	5,157	–	–	129			
		4		**29,431**	**28,579**							**852**	**7,358**		**7.4**
Msasani	33kV		Makumbusho1	8,334	8,293	–	–	–	8,293	–	–	41			
			Makumbusho2	7,600	7,500	–	–	–	–	7,500	–	100			
		2		**15,934**	**15,793**							**141**	**7,967**	**8.0**	
	11kV	F1		16,216	15,016	162	–	4,978	9,876	–	–	1,200			
		F2		9,892	9,000	9,000	–	–	–	–	–	892			
		F3		11,582	10,889	–	–	2,360	8,529	–	–	693			
		3		**37,690**	**34,905**							**2,785**	**12,563**		**12.6**
Mikocheni	33kV		Makumbusho	3,209	3,076	–	–	–	3,076	–	–	133			
		1		**3,209**	**3,076**							**133**	**3,209**	**3.2**	
	11kV			5,271	5,092	5,092	–	–	–	–	–	179			
				12,860	12,364	12,364	–	–	–	–	–	496			
				10,082	9,098	625	–	–	8,473	–	–	984			
				8,744	8,499	–	–	–	8,499	–	–	245			
				373	17	17	–	–	–	–	–	356			
				11,578	11,206	10,668	–	–	538	–	–	372			
		6		**48,908**	**46,276**							**2,632**	**8,151**		**8.2**
Mbezi	33kV		Tegeta	8,445	8,341	114		–	8,227	–		104			
		1		**8,445**	**8,341**							**104**	**8,445**	**8.4**	
	11kV		Kunduchi	21,281	21,035	4,799	–	–	16,236	–	–	246			
			Packers	22,826	22,274	–	–	–	22,274	–	–	552			
			Lugalo	16,697	16,524	412	–	–	16,112	–	–	173			
			Mwenge	17,915	17,633	17,633	–	–	–	–	–	282			
		4		**78,719**	**77,466**							**1,253**	**19,680**		**19.7**
Bahari Beach	33kV		Tegeta	–	–	–	–	–	–	–	–	–			
			Wazo area	3,192	3,164	–	–	–	3,164	–	–	28			
		1		**3,192**	**3,164**							**28**	**3,192**	**3.2**	
	11kV	BB1		12,160	11,965	586	–	–	11,379	–	–	195			
		BB2		59,724	59,483	10,087	–	–	49,396	–	–	241			
		BB5		41,374	40,625	1,765	–	–	38,860	–	–	749			
		3		**113,258**	**112,073**							**1,185**	**37,753**		**37.8**
Mwananyamala	33kV		Makumbusho	1,060	900	–	–	–	–	900	–	160			
		1		**1,060**	**900**							**160**	**1,060**	**1.1**	
Jangwani Beach	33kV		Tegeta	6,490	6,400	–	–	–	–	6,400	–	90			
		1		**6,490**	**6,400**							**90**	**6,490**	**6.5**	

Source: JICA Study Team based on the data from TANESCO

Table 5-1.4 Existing Distribution Line (Ilala)

Substation	Voltage	Feeder No.	Feeder Name	Total	Overhead Line (m)	Line Type (m)						Cable (m)	Mean(m)	33kV Mean(km)	11kV Mean(km)
						AAC100	AAC120	ACSR50	ACSR100	ACSR150	ACSR240				
Ilala															
Ilala	33kV	H02	Kariakoo UG1	–	–	–	–	–	–	–	–	–			
		H05	Kurasini(KR)	6,997	6,997	–	–	–	6,997	–	–	–			
		H06	Tanzania Oxigen(TO	2,971	2,883	–	–	–	2,883	–	–	88			
		H07	Factory Zone1	–	–	–	–	–	–	–	–	–			
		H09	Factory Zone2	–	–	–	–	–	–	–	–	–			
		H17	City Center2	3,486	2,073	–	–	–	2,073	–	–	1,413			
		H18	City Center1	3,728	3,463	–	–	–	3,463	–	–	265			
		H20	Sokoine	–	0		–	–	–	–	–	–			
		H21	Kariakoo	3,486	2,073	–	–	–	2,073	–	–	1,413			
		H23	Kariakoo UG2	–	0	–	–	–	–	–	–	–			
		K02	Kariakoo	–	–	–	–	–	–	–	–	–			
		K05	Muhimbili	6,998	5,599	5,540	–	–	59	–	–	1,399			
		K06	Buguruni Sokoni	9,383	9,136	8,763	–	–	373	–	–	247			
		K10	Uhuru Road	4,659	3,871	35	–	–	3,836	–	–	788			
		K13	Nyerere Road/Shaur	1,544	1,377	–	–	–	1,377	–	–	167			
		K14	Buguruni Reline	6,354	5,714	–	–	–	5,714	–	–	640			
		K17	Kariakoo	–	–	–	–	–	–	–	–	–			
		K18	Breweries	–	–	–	–	–	–	–	–	–			
		K21	Magomeni	–	–	–	–	–	–	–	–	–			
				5,319	5,194	5,194	–	–	–	–	–	125			
				5,369	5,126	5,126	–	–	–	–	–	243			
				2,662	2,149	–	–	–	2,149	–	–	513			
		13		**62,956**	**55,655**							**7,301**	**4,843**	**4.8**	
FZI(Buguruni)	33kV		Kipawa	7,421	7,388	33	–	–	7,355	–	–	33			
			Ilala	–	–	–	–	–	–	–	–	–			
			FZ II	–	–	–	–	–	–	–	–	–			
			Tazara	–	–	–	–	–	–	–	–	–			
			ALAF	8,469	8,444	–	–	–	8,444	–	–	25			
		2		**15,890**	**15,832**							**58**	**7,945**	**7.9**	
	11kV			11,485	10,985	–	–	–	10,985	–	–	500			
				9,917	9,497	–	–	–	9,497	–	–	420			
				6,751	5,986	–	–	–	5,986	–	–	765			
		3		**28,153**	**26,468**							**1,685**	**9,384**		**9.4**
FZII(Gongo'boto)	33kV		Kipawa	99,300	99,300	–	–	–	99,300	–		–			
		1		**99,300**	**99,300**								**99,300**	**99.3**	
	11kV	F22		14,904	14,826	6,409	–	–	8,417	–	–	78			
		F23		17,002	16,930	–	–	–	16,930	–	–	72			
		F24		101,240	101,144	32,596	–	–	68,548	–	–	96			
		F25		496	0	–	–	–	–	–	–	496			
		4		**133,642**	**132,900**							**742**	**33,411**		**33.4**
FZIII(Kipawa)	33kV		Ubungo	30,717	30,572	151	–	–	462	29,959	–	145			
			FZ I	9,866	9,389	–	–	–	9,389	–	–	477			
			FZ II	99,300	99,300	–	–	–	99,300	–	–	–			
			Buguruni	7,421	7,388	33	–	–	7,355	–	–	33			
			Tandika	10,445	10,445	–	–	–	10,445	–	–	–			
			Segerea	57,257	57,257	12,634	–	–	44,623	–	–	–			
			Chamgombe	–	–	–	–	–	–	–	–	–			
				44,464	44,464	585	–	–	43,879	–	–	–			
		7		**259,470**	**258,815**							**655**	**37,067**	**37.1**	
	11kV		F3-2												
			F3-3	8,328	7,651	–	–	–	7,651	–	–	677			
			F3-4	6,315	6,150	–	–	–	6,150	–	–	165			
		3		**14,643**	**13,801**							**842**	**4,881**		**4.9**
Sokoine	33kV	1	Sokoine SP-1	–	–	–	–	–	–	–	–	–			
		3	Sokoine-Railway	–	–	–	–	–	–	–	–	–			
		4	RMU	–	–	–	–	–	–	–	–	–			
		6	New City Center	5,048	2,694	–	–	–	2,694	–		2,354			
		8	Kempinski Hotel	–	–	–	–	–	–	–	–	–			
		10	Sokoine SP-2	8,776	6,157	–	–	–	6,157	–	–	2,619			
		2		**13,824**	**8,851**							**4,973**	**6,912**	**6.9**	
	11kV	PL01	Sokoine-1	944	504	–	–	–	504	–		440			
		PL02	Sokoine-2	–	–	–	–	–	–	–	–	–			
		PL04	Sokoine-3	4,353	1,994	–	–	–	1,994	–		2,359			
		PL05	Sokoine-4	1,870	1,255	–	–	–	1,255	–	–	615			
		PL08	Sokoine-5	838	838	–	–	–	567	271	–	–			
		4		**8,005**	**4,591**							**3,414**	**2,001**		**2.0**

Substation	Voltage	Feeder No.	Feeder Name	Total	Overhead Line (m)	Line Type (m)						Cable (m)	Mean(m)	33kV Mean(km)	11kV Mean(km)
						AAC100	AAC120	ACSR50	ACSR100	ACSR150	ACSR240				
Ilala															
Kariakoo	33kV		Ilalla, Railway	3,486	2,073	–	–	–	2,073	–		1,413			
			New City Center	–	–	–	–	–	–	–	–	–			
		2		**3,486**	**2,073**							**1,413**	**1,743**	**1.7**	
	11kV	KAR1		4,778	4,764	–	–	–	4,764	–	–	14			
		KAR2		2,355	1,745	80	–	–	1,665	–	–	610			
		KAR3		–	–	–	–	–	–	–	–	–			
		KAR4		3,682	2,599	–	–	–	2,599	–	–	1,083			
		3		**10,815**	**9,108**							**1,707**	**3,605**	**3.6**	
Railway	33kV		Kariakoo, Ilala	3,486	2,073	–	–	–	2,073	–	–	1,413			
			Sokoine		0										
		1		**3,486**	**2,073**							**1,413**	**3,486**	**3.5**	
	11kV	F01	Water Front	7,418	6,262	–	–	–	6,262	–	–	1,156			
		F02	Clock Tower	0	0	–	–	–		–	–	–			
		F03	Sokoine Ohio	2,502	1,725	–	–	–	1,725	–	–	777			
		3		**9,920**	**7,987**							**1,933**	**3,307**		**3.3**
City Center	33kV		New City Center	–	–	–	–	–	–	–	–	–	–		
	11kV	F1		–	–	–	–	–	–	–	–	–			
		F2		5,583	4,972	–	–	–	4,972	–	–	611			
		F3		1,626	1,137	–	–	–	1,137	–	–	489			
		F4		2,556	1,607	–	–	–	1,607	–	–	949			
		F5		1,959	993	–	–	–	993	–	–	966			
		F6		8,851	7,884	–	–	–	7,884	–	–	967			
		F7		–	–	–	–	–	–	–	–	–			
		F8		2,764	2,012	–	–	–	2,012	–	–	752			
		6		**23,339**	**18,605**							**4,734**	**3,890**		**3.9**
New City Center	33kV		New City Center	–	–	–	–	–	–	–	–	–			
			Ilala	3,964	3,712	–	–	–	3,712	–	–	252			
			Sokoine	5,048	2,694	–	–	–	2,694	–	–	2,354			
			RMU	–	0	–	–	–	–	–	–	–			
			Muhimbili	2,070	1,700	–	–	–	–	1,700	–	370			
			Kariakoo	–	–	–	–	–	–	–	–	–			
		3		**11,082**	**8,106**							**2,976**	**3,694**	**3.7**	
Muhimbili	33kV		New City Center	2,070	1,700	–	–	–	–	1,700	–	370			
		1		**2,070**	**1,700**							**370**	**2,070**	**2.1**	
	11kV	F1		–	–	–	–	–	–	–	–	–	–		
		F2		–	–	–	–	–	–	–	–	–	–		
		F3		–	–	–	–	–	–	–	–	–	–		

Source: JICA Study Team based on the data from TANESCO

Table 5-1.5 Existing Distribution Line (Temeke)

Substation	Voltage	Feeder No.	Feeder Name	Total	Overhead Line (m)	Line Type (m)						Cable(m)	Mean(m)	33kV Mean(km)	11kV Mean(km)
						AAC100	AAC120	ACSR50	ACSR100	ACSR150	ACSR240				
Temeke															
Kurasini	33kV		Ilala-Kurasini	7,145	7,145	–	–	–	–	–	7,145	–			
			Ilala	1,483	1,483	1,483	–	–	–	–	–	–			
			Kigamboni	8,667	8,462	–	–	–	8,462	–	–	205			
			Chango'mbe	13,595	13,470	–	–	–	13,470	–	–	125			
			Mbagala	8,946	8,946	52	–	–	8,894	–	–	–			
		5		**39,836**	**39,506**							**330**	**7,967**	**8.0**	
	11kV	KR1	Mtoni, Azizi	7,786	7,473	–	–	–	7,473	–	–	313			
		KR2	Kurasini	14,181	14,020	–	–	–	14,020	–	–	161			
		KR3	Tandika, Sabasaba	13,496	13,421	–	–	–	13,421	–	–	75			
		KR4	DSM Port Area	7,654	7,465	–	–	–	7,465	–	–	189			
		4		**43,117**	**42,379**							**738**	**10,779**		**10.8**
Kigamboni	33kV		Kurasini	8,667	8,462	–	–	–	8,462	–	–	205			
			Feeder	136,736	136,609	–	–	–	136,609	–	–	127			
		2		**145,403**	**145,071**							**332**	**72,702**	**72.7**	
	11kV		Feeder	16,668	16,503	–	–	–	16,503	–	–	165			
		1		**16,668**	**16,503**							**165**	**16,668**		**16.7**
Chamgombe	33kV		Kurasini	13,595	13,470	–	–	–	13,470	–	–	125			
			Kipawa (FZ-III)	3,384	3,384	–	–	–	3,384	–	–	–			
		2		**16,979**	**16,854**							**125**	**8,490**	**8.5**	
	11kV	CG1		2,513	2,408	–	–	–	2,408	–	–	105			
		CG2		1,273	1,147	–	–	–	1,147	–	–	126			
		CG3		369	305	–	–	–	305	–	–	64			
		CG4		4,258	4,210	–	–	–	4,210	–	–	48			
		CG5		2,236	2,036	–	–	–	2,036	–	–	200			
		5		**10,649**	**10,106**							**543**	**2,130**		**2.1**
TOL	33kV		Ilala	2,156	2,104	–	–	–	2,104	–	–	52			
		1		**2,156**	**2,104**							**52**	**2,156**	**2.2**	
	11kV	TOL1		9,665	9,355	–	–	–	9,355	–	–	310			
		TOL2		7,811	7,601	–	–	–	7,601	–	–	210			
		TOL3		1,971	1,483	–	–	–	1,483	–	–	488			
		TOL4		433	248	–	–	–	248	–	–	185			
		TOL5		5,507	5,156	5,156	–	–	–	–	–	351			
		5		**25,387**	**23,843**							**1,544**	**5,077**		**5.1**
Tandika	33kV		Kipawa (FZ-III)	8,958	8,958	33	8,925	–	–	–	–	–			
		1		**8,958**	**8,958**								**8,958**	**9.0**	
	11kV	TD2		11,462	11,360	–	–	–	11,360	–	–	102			
		TD3		22,857	22,821	22,821	–	–	–	–	–	36			
		TD4		16,435	16,407	–	–	–	16,407	–	–	28			
		TD5		10,333	10,087	10,087	–	–	–	–	–	246			
		4		**61,087**	**60,675**							**412**	**15,272**		**15.3**
Mbagala	33kV	1	Mkuranga	8,938	8,938	–	–	–	8,938	–	–	–			
		2		21,367	21,208	–	–	–	21,208	–	–	159			
		3		13,216	13,216	–	–	–	13,216	–	–	–			
		4		125,523	125,393	–	–	–	125,393	–	–	130			
		5		8,946	8,946	52	–	–	8,894	–	–	–			
		5		**177,990**	**177,701**							**289**	**35,598**	**35.6**	
	11kV	MBF1		46,556	46,462	–	–	–	46,462	–	–	94			
		MBF2		17,902	17,827	–	–	–	17,827	–	–	75			
		MBF3		18,163	18,018	–	–	–	18,018	–	–	145			
		MBF4		36,368	36,145	–	–	–	36,145	–	–	223			
		4		**118,989**	**118,452**							**537**	**29,747**		**29.7**

Source: JICA Study Team based on the data from TANESCO

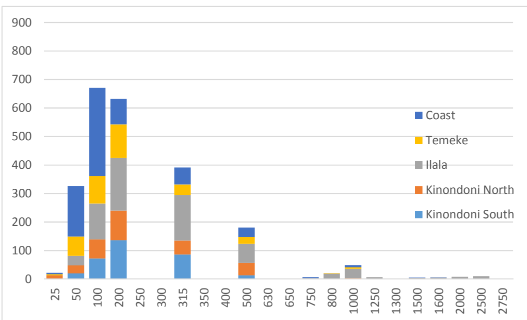
Table 5-1.6 Existing Distribution Line (Coast)

Substation	Voltage	Feeder No.	Feeder Name	Total	Overhead Line (m)	Line Type (m) AAC100	AAC120	ACSR50	ACSR100	ACSR150	ACSR240	Cable (m)	Mean(m)	33kV Mean(km)	11kV Mean(km)
Coast															
Mlandizi	33kV	H0	Upper Luvu	478	–	–	–	–	298	–	–	180			
		H1	Lower Luvu 1	29,925	29,923	–	–	–	29,923	–	–	2			
		H3	Chalinze	134,991	134,991	85,037	–	–	49,954	–	–	0			
		H5	Kibaha	133,187	132,615	57,525	–	–	75,090	–	–	572			
		H7	Lower Luvu 2	27,700	27,671	27,671	–	–	–	–	–	29			
		H8	Zegereni	11,142	0	–	–	–	–	–	–	11,142			
		H9	Kiluwa	0	0	–	–	–	–	–	–	–			
		7		**337,423**	**325,200**							**11,925**	**48,203**	**48.2**	
Chalinze	33kV		Ngerengere	71,125	71,125	–	–	–	71,125	–	–	–			
			Lugoba	169,707	169,160	105,119	–	–	64,041	–	–	547			
			Ruvu	81,293	81,293	79,681	–	–	1,612	–	–	–			
		3		**322,125**	**321,578**							**547**	**107,375**	**107.4**	
Upper Luvu	33kV			–	–	–	–	–	–	–	–	–			
Tumbi(Kibaha)	33kV	H5	Mlandizi, Kibaha	133,187	132,615	57,525	–	–	75,090	–	–	572			
		H3	Chalinze	0	0	–	–	–	–	–	–	–			
		1		**133,187**	**132,615**							**572**	**133,187**	**133.2**	
	11kV		Picha Ya Ndege	9,617	9,613	–	–	–	9,613	–	–	4			
				8,771	8,771	–	–	–	8,771	–	–	0			
		1		**18,388**	**18,384**							**4**	**18,388**		
Lower Luvu	33kV		Mlandizi 1	29,925	29,923	–	–	–	29,923	–	–	2			
			Mlandizi 2	27,700	27,671	27,671	–	–	–	–	–	29			
				122,255	122,087	276	–	–	121,811	–	–	168			
		3		**179,880**	**179,681**							**199**	**59,960**	**60.0**	
Mbegani	33kV		Lower Luvu	–	–	–	–	–	–	–	–	–			
Mwanamakuka	33KV			122,255	122,087	276	–	–	121,811	–	–	168			
		1		**122,255**	**122,087**							**168**	**122,255**	**122.3**	

Source: JICA Study Team based on the data from TANESCO

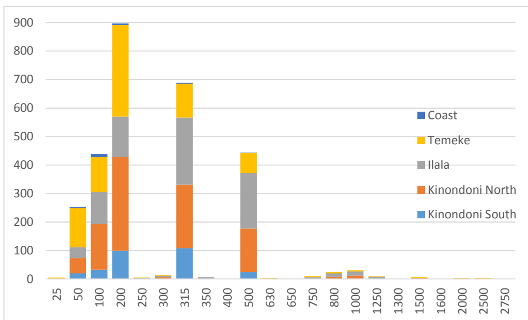
(4) Transformer

The following images show type and quantity of distribution transformers at each substation, made based on the databases collected from each Region's office. There are a total of 2,344 33/0.4 kV transformers and 2,850 11/0.4 kV transformers. As evident from Figures 5-1.5 and 5-1.6, there is a diverse mix of 22 types ranging from 22 kVA to 2,750 kVA.



Source: JICA Study Team based on the data from TANESCO

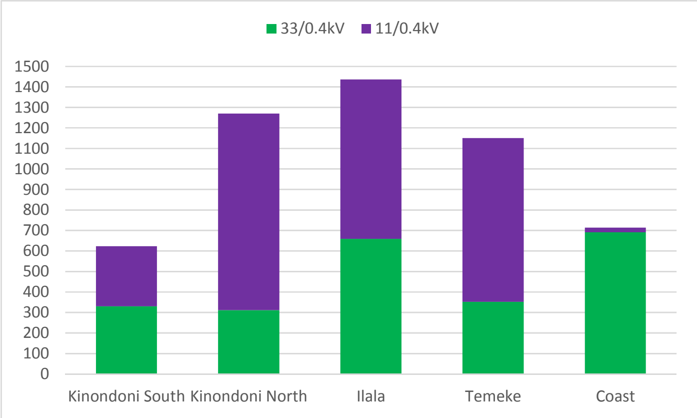
Figure 5-1.5 Quantity of Distribution Transformer (33kV)



Source: JICA Study Team based on the data from TANESCO

Figure 5-1.6 Quantity of Distribution Transformer (11kV)

Figure 5-1.7 shows the quantity of distribution transformers by region. Many feeders employ 33 kV distribution lines in areas with long distribution distances such as the Coast.



Source: JICA Study Team based on the data from TANESCO

Figure 5-1.7 Quantity of Distribution Transformers by Region

Although there is some missing data in the database, it will be used as a reference in planning.

Table 5-1.7 Existing Distribution Transformer (Kinondoni North)

Substation	Voltage	Feeder No.	Feeder Name	Distribution Transformer																						Total
				25	50	100	200	250	300	315	350	400	500	630	650	750	800	1000	1250	1300	1500	1600	2000	2500	2750	
Kinondoni North			33kV	12	28	67	104	0	0	49	0	0	44	0	0	0	0	3	0	1	1	1	0	1	0	**311**
			11kV	1	54	161	329	1	6	223	2	0	152	1	0	2	7	9	3	0	4	0	2	1	1	**959**
Tegeta	33kV	TG1	Wazo II	0	2	6	12	0	0	6	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**27**
		TG2	Mbeji	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	**3**
		TG3	Bagamoyo	12	21	40	47	0	0	7	0	0	4	0	0	0	0	0	0	0	0	1	0	0	0	**132**
		TG4	Bahari Beach																							
		TG5	Wazo area	0	0	2	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	**6**
		TG6	Spare	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	**1**
		TG7	Jangwani Beach																							
				12	**23**	**49**	**61**	**0**	**0**	**13**	**0**	**0**	**8**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**169**
Makumbusho	33kV	H00	Msasani2																							
		H02	Msasani1																							
		H03	Oysterbay																							
		H09	Industry	0	0	0	2	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	**8**
		H10	Mikocheni	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**2**
		H13	Mwananyamala																							
		J07	Mak3	0	4	10	15	0	0	17	0	0	18	0	0	0	0	1	0	0	1	0	0	0	0	**66**
		J08	Mak4	0	1	7	24	0	0	19	0	0	9	0	0	0	0	0	0	1	0	0	0	0	0	**61**
				0	**5**	**17**	**42**	**0**	**0**	**36**	**0**	**0**	**34**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**137**
Oysterbay	33kV		Makumbusho																							
	11kV			0	1	4	3	0	0	3	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	**14**
				0	2	9	28	0	1	21	0	0	8	0	0	0	0	3	0	0	0	0	0	0	0	**72**
				0	2	3	5	0	0	11	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	**25**
				0	0	3	3	0	0	4	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	**21**
				0	**5**	**19**	**39**	**0**	**1**	**39**	**0**	**0**	**25**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**132**
Msasani	33kV		Makumbusho1																							
			Makumbusho2																							
	11kV	F1		0	2	7	28	0	1	26	0	0	16	0	0	0	1	2	0	0	0	0	0	0	0	**83**
		F2		0	5	9	21	0	0	13	0	0	2	0	0	0	2	0	2	0	0	0	0	0	0	**54**
		F3		0	3	4	15	0	1	18	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	**57**
				0	**10**	**20**	**64**	**0**	**2**	**57**	**0**	**0**	**34**	**0**	**0**	**0**	**3**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**194**
Mikocheni	33kV		Makumbusho	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**2**
				0	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**
	11kV			0	1	6	6	0	0	7	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	**25**
				0	2	6	13	0	1	17	0	0	8	0	0	0	1	0	0	0	0	0	0	0	0	**48**
				0	1	3	12	0	1	16	0	0	19	0	0	0	0	0	1	0	2	0	0	0	0	**55**
				0	6	3	10	0	0	5	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	**32**
				0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	**3**
				0	3	2	14	0	0	13	0	0	9	0	0	0	1	1	0	0	0	0	0	0	0	**43**
				0	**13**	**20**	**55**	**0**	**2**	**58**	**0**	**0**	**49**	**0**	**0**	**1**	**2**	**1**	**1**	**0**	**2**	**0**	**1**	**0**	**1**	**206**
Mbezi	33kV		Tegeta	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	**3**
				0	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**
	11kV		Kunduchi	0	3	11	27	0	0	13	0	0	5	1	0	0	0	1	0	0	0	0	0	0	0	**61**
			Packers	0	2	15	32	0	0	13	0	0	5	0	0	0	1	1	0	0	2	0	0	0	0	**71**
			Lugalo	0	3	2	20	0	0	3	0	0	9	0	0	1	0	0	0	0	0	0	0	0	0	**38**
			Mwenge	0	2	7	23	0	1	5	0	0	5	0	0	0	1	0	0	0	0	0	0	0	0	**44**
				0	**10**	**35**	**102**	**0**	**1**	**34**	**0**	**0**	**24**	**1**	**0**	**1**	**2**	**2**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**214**
Bahari Beach	33kV		Tegeta																							
			Wazo area																							
	11kV	BB1		0	1	3	8	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	**15**
		BB2		1	6	39	30	1	0	13	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	**101**
		BB5		0	9	25	31	0	0	22	0	0	9	0	0	0	0	0	0	0	0	0	0	1	0	**97**
				1	**16**	**67**	**69**	**1**	**0**	**35**	**2**	**0**	**20**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**213**
Mwananyamala	33kV		Makumbusho																							
Jangwani Beach	33kV		Tegeta																							

Source: JICA Study Team based on the data from TANESCO

Table 5-1.8 Existing Distribution Transformer (Kinondoni South)

Substation	Voltage	Feeder No.	Feeder Name	Distribution Transformer																						Total
				25	50	100	200	250	300	315	350	400	500	630	650	750	800	1000	1250	1300	1500	1600	2000	2500	2750	
Kinondoni South			33kV	1	20	72	136	0	2	86	0	0	13	0	0	0	1	0	0	0	0	0	0	0	0	331
			11kV	1	20	33	100	0	1	108	0	0	25	0	0	0	1	3	0	0	0	0	0	0	0	292
Ubungo	33kV		Wazo2	0	2	5	11	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27
			Nordic	0	6	17	40	0	0	16	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	81
			Tazara																							
			FZ3-1	0	0	2	3	0	2	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	10
			Nordic	0	7	36	66	0	0	50	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	166
			FZ3-2																							
			Magomeni/Mlimani C	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
			Wazo1																							
			Tandale	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Texile	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
				0	**15**	**61**	**120**	**0**	**2**	**76**	**0**	**0**	**10**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**285**
	11kV	U1	Mandela Road	1	6	8	18	0	0	14	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	52
		U2	Ubungo Terminal	0	1	8	6	0	0	13	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	33
		U7	NIT	0	1	3	8	0	0	10	0	0	1	0	0	0	1	3	0	0	0	0	0	0	0	27
		U8	Ubungo	0																						
		U9	TANESCO	0	2	5	11	0	0	10	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	32
				1	**10**	**24**	**43**	**0**	**0**	**47**	**0**	**0**	**15**	**0**	**0**	**0**	**1**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**144**
Tandale	33kV		Ubungo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Ilala																							
				0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	11kV	Tan1		0	0	1	5	0	0	10	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	17
		Tan2		0	1	1	6	0	0	13	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	23
		Tan4		0	1	0	2	0	0	7	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	14
				0	**2**	**2**	**13**	**0**	**0**	**30**	**0**	**0**	**7**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**54**
Magomeni	33kV		Ubungo/Mlimanicity	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
				0	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**
	11kV	MG1		0	5	0	13	0	0	8	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	28
		MG2		0	2	1	3	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
		MG3		0	1	3	17	0	1	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
		MG4		0	0	3	11	0	0	7	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	22
				0	**8**	**7**	**44**	**0**	**1**	**31**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**94**
Mlimanicity	33kV		Ubungo/Mlimanicity	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
				1	5	9	16	0	0	10	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	44
				1	**5**	**10**	**16**	**0**	**0**	**10**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**45**
	11kV	K1	Mlimanicity(Ring)																							
		K2	Mlimanicity(Ring)																							
		K7	University																							
EPZ	33kV		Ubungo																							
Mburahati	33kV		Ubungo																							

Source: JICA Study Team based on the data from TANESCO

Table 5-1.9 Existing Distribution Transformer (Ilala)

Substation	Voltage	Feeder No.	Feeder Name	Distribution Transformer																						Total
				25	50	100	200	250	300	315	350	400	500	630	650	750	800	1000	1250	1300	1500	1600	2000	2500	2750	
Ilala			33kV	0	34	126	186	0	0	160	0	1	67	0	0	3	18	33	7	0	3	4	8	9	0	**659**
			11kV	1	38	111	141	3	5	236	5	0	196	1	0	5	12	15	6	0	0	1	1	0	0	**777**
Ilala	33kV	H02	Kariakoo UG1																							
		H05	Kurasini(KR)																							
		H06	Tanzania Oxigen(TO	0	0	6	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**7**
		H07	Factory Zone1																							
		H09	Factory Zone2																							
		H17	City Center2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**1**
		H18	City Center1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	3	0	0	0	0	0	0	0	**5**
		H20	Sokoine																							
		H21	Kariakoo	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	2	0	**6**
		H23	Kariakoo UG2																							
		K02	Kariakoo																							
		K05	Muhimbili	0	0	5	12	0	0	16	0	0	16	0	0	0	0	1	0	0	0	1	0	0	0	**51**
		K06	Buguruni Sokoni	0	1	8	5	0	0	18	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	**37**
		K10	Uhuru Road	0	0	16	14	0	0	13	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	**49**
		K13	Nyerere Road/Shaur	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**2**
		K14	Buguruni Reline	0	1	5	5	0	0	7	0	0	5	0	0	0	0	1	0	0	0	0	1	0	0	**25**
		K17	Kariakoo																							
		K18	Breweries	0	0	5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**6**
		K21	Magomeni																							
				0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**5**
				0	2	1	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**6**
				0	**4**	**53**	**39**	**0**	**0**	**56**	**0**	**0**	**39**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**1**	**1**	**2**	**0**	**200**
FZI(Buguruni)	33kV		Kipawa	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**5**
			Ilala																							
			FZ II																							
			Tazara																							
			ALAF	0	0	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	**9**
				0	**0**	**10**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**14**
	11kV			0	0	1	8	0	0	19	0	0	10	0	0	0	1	0	0	0	0	0	0	0	0	**39**
				0	0	6	6	0	0	14	0	0	7	0	0	0	0	1	0	0	0	0	0	0	0	**34**
				0	3	3	11	0	0	10	0	0	7	0	0	1	0	1	0	0	0	0	0	0	0	**36**
				0	**3**	**10**	**25**	**0**	**0**	**43**	**0**	**0**	**24**	**0**	**0**	**1**	**1**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**109**
FZII(Gongo'boto)	33kV		Kipawa	0	8	5	26	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**47**
				0	**8**	**5**	**26**	**0**	**0**	**8**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**47**
	11kV	F22		0	2	7	9	0	0	6	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	**29**
		F23		0	8	6	6	0	0	11	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**32**
		F24		1	21	39	30	0	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**99**
		F25		0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**
				1	**31**	**53**	**45**	**0**	**0**	**21**	**4**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**161**
FZIII(Kipawa)	33kV		Ubungo	0	3	1	13	0	0	30	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	**50**
			FZ I	0	0	6	3	0	0	12	0	1	1	0	0	0	0	1	0	0	0	0	1	1	0	**26**
			FZ II	0	8	5	26	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**47**
			Buguruni	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**5**
			Tandika	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**8**
			Segerea	0	7	11	37	0	0	35	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	**94**
			Chamgombe	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**3**
				0	4	19	39	0	0	11	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	**75**
				0	**22**	**58**	**118**	**0**	**0**	**96**	**0**	**1**	**9**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**1**	**1**	**0**	**308**
	11kV		F3-2																							
			F3-3	0	0	1	7	0	0	10	0	0	8	0	0	1	1	1	1	0	0	1	0	0	0	**31**
			F3-4	0	0	1	2	0	1	12	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	**19**
				0	**0**	**2**	**9**	**0**	**1**	**22**	**0**	**0**	**10**	**0**	**0**	**1**	**1**	**2**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**50**
Sokoine	33kV	1	Sokoine SP-1																							
		3	Sokoine-Railway																							
		4	RMU																							
		6	New City Center	0	0	0	0	0	0	0	0	0	3	0	0	1	6	8	2	0	1	1	2	0	0	**24**
		8	Kempinski Hotel																							
		10	Sokoine SP-2	0	0	0	1	0	0	0	0	0	4	0	0	1	6	11	2	0	1	1	2	0	0	**29**
				0	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**7**	**0**	**0**	**2**	**12**	**19**	**4**	**0**	**2**	**2**	**4**	**0**	**0**	**53**
	11kV	PL01	Sokoine-1	0	0	0	1	0	0	0	0	0	6	0	0	1	0	0	0	0	0	0	0	0	0	**8**
		PL02	Sokoine-2	0	0	0	0	0	0	0	0	0	3	0	0	0	2	1	1	0	0	0	0	0	0	**7**
		PL04	Sokoine-3	0	0	4	3	0	0	8	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	**30**
		PL05	Sokoine-4	0	0	1	0	0	0	1	0	0	7	0	0	0	3	2	1	0	0	0	0	0	0	**15**
		PL08	Sokoine-5	0	0	0	0	0	0	0	0	0	3	0	0	0	0	1	0	0	0	0	1	0	0	**5**
				0	**0**	**5**	**4**	**0**	**0**	**9**	**0**	**0**	**34**	**0**	**0**	**1**	**5**	**4**	**2**	**0**	**0**	**0**	**1**	**0**	**0**	**65**

Substation	Voltage	Feeder No.	Feeder Name	Distribution Transformer																						Total
				25	50	100	200	250	300	315	350	400	500	630	650	750	800	1000	1250	1300	1500	1600	2000	2500	2750	
Kariakoo	33kV		Ilalla, Railway	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	2	0	**6**
			New City Center																							
				0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**6**
	11kV	KAR1		0	1	18	16	0	0	39	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	**84**
		KAR2		0	1	4	4	0	0	4	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	**16**
		KAR3																								
		KAR4		0	0	0	3	2	0	24	0	0	14	0	0	0	1	0	0	0	0	0	0	0	0	**44**
				0	**2**	**22**	**23**	**2**	**0**	**67**	**0**	**0**	**27**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**144**
Railway	33kV		Kariakoo, Ilala	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	2	0	**6**
			Sokoine																							
				0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**6**
	11kV	F01	Water Front	0	0	6	18	0	3	15	1	0	10	0	0	1	0	0	1	0	0	0	0	0	0	**55**
		F02	Clock Tower	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**
		F03	Sokoine Ohio	0	0	1	2	1	0	6	0	0	15	0	0	0	0	2	2	0	0	0	0	0	0	**29**
				0	**0**	**8**	**20**	**1**	**3**	**21**	**1**	**0**	**25**	**0**	**0**	**1**	**0**	**2**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**85**
City Center	33kV		New City Center																							
	11kV	F1																								
		F2		0	0	10	4	0	0	4	0	0	15	1	0	0	0	1	0	0	0	0	0	0	0	**35**
		F3		0	0	0	0	0	0	1	0	0	7	0	0	1	0	1	0	0	0	0	0	0	0	**10**
		F4		0	0	0	2	0	1	3	0	0	17	0	0	0	1	2	0	0	0	0	0	0	0	**26**
		F5		0	0	1	0	0	0	5	0	0	2	0	0	0	2	1	0	0	0	0	0	0	0	**11**
		F6		0	2	0	7	0	0	38	0	0	21	0	0	0	0	0	0	0	0	0	0	0	0	**68**
		F7																								
		F8		0	0	0	2	0	0	2	0	0	8	0	0	0	1	0	0	0	0	0	0	0	0	**13**
				0	**2**	**11**	**15**	**0**	**1**	**53**	**0**	**0**	**70**	**1**	**0**	**1**	**4**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**163**
New City Center	33kV		New City Center																							
			Ilala	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**1**
			Sokoine	0	0	0	0	0	0	0	0	0	3	0	0	1	6	8	2	0	1	1	2	0	0	**24**
			RMU																							
			Muhimbili																							
			Kariakoo																							
				0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**1**	**6**	**8**	**2**	**0**	**1**	**1**	**2**	**0**	**0**	**25**
Muhimbili	33kV		New City Center																							
	11kV	F1																								
		F2																								
		F3																								

Source: JICA Study Team based on the data from TANESCO

Table 5-1.10 Existing Distribution Transformer (Temeke)

Substation	Voltage	Feeder No.	Feeder Name	Distribution Transformer																						Total
				25	50	100	200	250	300	315	350	400	500	630	650	750	800	1000	1250	1300	1500	1600	2000	2500	2750	
Temeke			33kV	4	67	96	117	0	0	37	0	0	24	0	0	0	2	5	0	0	0	0	0	0	0	**352**
			11kV	2	137	124	321	1	3	119	0	0	70	2	0	3	5	4	1	0	3	0	1	3	0	**799**
Kurasini	33kV		Ilala-Kurasini	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Ilala	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**
			Kigamboni	0	1	1	3	0	0	5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**11**
			Chango'mbe	0	2	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**6**
			Mbagala	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**
				0	**4**	**2**	**7**	**0**	**0**	**5**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**19**
	11kV	KR1	Mtoni, Azizi	0	5	3	8	0	0	3	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	**21**
		KR2	Kurasini	1	4	13	22	0	0	8	0	0	4	0	0	1	0	0	0	0	1	0	0	0	0	**54**
		KR3	Tandika, Sabasaba	0	8	4	12	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	**27**
		KR4	DSM Port Area	0	2	5	13	1	1	3	0	0	7	1	0	0	1	0	0	0	2	0	0	0	0	**36**
				1	**19**	**25**	**55**	**1**	**1**	**15**	**0**	**0**	**14**	**1**	**0**	**1**	**2**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**138**
Kigamboni	33kV		Kurasini	0	1	1	3	0	0	5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**11**
			Feeder	2	27	43	60	0	0	17	0	0	11	0	0	0	0	1	0	0	0	0	0	0	0	**161**
				2	**28**	**44**	**63**	**0**	**0**	**22**	**0**	**0**	**12**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**172**
	11kV		Feeder	0	3	5	15	0	0	5	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	**31**
				0	**3**	**5**	**15**	**0**	**0**	**5**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**31**
Chamgombe	33kV		Kurasini	0	2	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**6**
			Kipawa (FZ-III)	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**4**
				0	**2**	**1**	**7**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**10**
	11kV	CG1		0	0	3	5	0	0	3	0	0	6	0	0	1	0	1	0	0	0	0	0	0	0	**19**
		CG2		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	**2**
		CG3		0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**2**
		CG4		0	3	4	4	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	**15**
		CG5		0	2	1	10	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**16**
				0	**6**	**8**	**20**	**0**	**0**	**9**	**0**	**0**	**6**	**0**	**0**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**54**
TOL	33kV		Ilala	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**2**
				0	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**
	11kV	TOL1		0	1	4	17	0	0	8	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	**33**
		TOL2		0	0	1	19	0	1	7	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	**34**
		TOL3		0	1	3	5	0	1	3	0	0	4	1	0	0	0	1	0	0	0	0	0	0	0	**19**
		TOL4		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	**3**
		TOL5		0	4	10	5	0	0	3	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	**28**
				0	**6**	**18**	**46**	**0**	**2**	**21**	**0**	**0**	**19**	**1**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**117**
Tandika	33kV		Kipawa (FZ-III)	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**2**
				0	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**
	11kV	TD2		0	15	5	12	0	0	8	0	0	5	0	0	0	2	0	0	0	0	0	0	0	0	**47**
		TD3		0	5	6	27	0	0	5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**44**
		TD4		0	3	2	16	0	0	10	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	**33**
		TD5		0	2	3	19	0	0	5	0	0	7	0	0	0	1	0	0	0	0	0	0	0	0	**37**
				0	**25**	**16**	**74**	**0**	**0**	**28**	**0**	**0**	**15**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**161**
Mbagala	33kV	1	Mkuranga	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**
		2		0	6	5	22	0	0	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**38**
		3		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		4		2	26	44	13	0	0	6	0	0	10	0	0	0	2	4	0	0	0	0	0	0	0	**105**
		5		0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**
				2	**32**	**49**	**37**	**0**	**0**	**10**	**0**	**0**	**11**	**0**	**0**	**0**	**2**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**145**
	11kV	MBF1		0	33	21	33	0	0	16	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	**108**
		MBF2		0	7	8	19	0	0	7	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**42**
		MBF3		0	11	8	24	0	0	9	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	**54**
		MBF4		1	27	15	35	0	0	9	0	0	5	0	0	1	0	0	0	0	0	0	0	1	0	**94**
				1	**78**	**52**	**111**	**0**	**0**	**41**	**0**	**0**	**13**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**298**

Source: JICA Study Team based on the data from TANESCO

Table 5-1.11 Existing Distribution Transformer (Coast)

Substation	Voltage	Feeder No.	Feeder Name	Distribution Transformer																						Total
				25	50	100	200	250	300	315	350	400	500	630	650	750	800	1000	1250	1300	1500	1600	2000	2500	2750	
Coast			33kV	5	178	310	89	0	0	59	0	0	33	2	1	4	0	8	0	0	1	1	0	0	0	**691**
			11kV	0	4	10	6	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**23**
Mlandizi	33kV	H0	Upper Luvu	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**2**
		H1	Lower Luvu 1	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**6**
		H3	Chalinze	1	24	16	8	0	0	7	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	**59**
		H5	Kibaha	1	18	81	19	0	0	9	0	0	6	0	0	1	0	1	0	0	0	0	0	0	0	**136**
		H7	Lower Luvu 2	0	1	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**5**
		H8	Zegereni	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**3**
		H9	Kiluwa																							
				2	**46**	**105**	**27**	**0**	**0**	**19**	**0**	**0**	**9**	**0**	**0**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**211**
Chalinze	33kV		Ngerengere	1	17	19	4	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**44**
			Lugoba	1	30	22	14	0	0	12	0	0	17	2	1	2	0	5	0	0	1	1	0	0	0	**108**
			Ruvu	0	7	15	3	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**27**
				2	**54**	**56**	**21**	**0**	**0**	**16**	**0**	**0**	**18**	**2**	**1**	**2**	**0**	**5**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**179**
Upper Luvu	33kV																									
Tumbi(Kibaha)	33kV	H5	Mlandizi, Kibaha	1	18	81	19	0	0	9	0	0	6	0	0	1	0	1	0	0	0	0	0	0	0	**136**
		H3	Chalinze																							
				1	**18**	**81**	**19**	**0**	**0**	**9**	**0**	**0**	**6**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**136**
	11kV		Picha Ya Ndege	0	3	7	3	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**16**
				0	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**7**
				0	**4**	**10**	**6**	**0**	**0**	**2**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**23**
Lower Luvu	33kV		Mlandizi 1	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**6**
			Mlandizi 2	0	1	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**5**
				0	28	31	11	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**77**
				0	**32**	**37**	**11**	**0**	**0**	**8**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**88**
Mbegani	33kV		Lower Luvu																							
Mwanamakuka	33KV			0	28	31	11	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**77**
				0	**28**	**31**	**11**	**0**	**0**	**7**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**77**

Source: JICA Study Team based on the data from TANESCO

(5) Support

The standard support structures for overhead lines are wood utility poles, metal utility poles, or in some cases steel towers; however wooden utility poles are used in most areas. TANESCO’s standard is to use has 9 m and 10 m heights for a low voltage poles and 11 m and 12 m heights for medium voltage poles. That being said, many of the wood utility poles were erected decades ago, thus many have been destroyed by weathering. Accordingly, there has been a call for construction of concrete utility poles

As for the distance between stations, the standard span is 100 m for residential areas with single circuit transmission lines and 80 m those with double circuit transmission lines, but as a typical example in the other areas, the standard for 150 mm^2 three-phase single circuit transmission lines is a 90 m span with a maximum span of 101 m.

(6) Insulator

Pin, suspended, and post insulators are all standardly used. Commonly seen materials are glass, porcelain and also some synthetic resin

(7) Switch

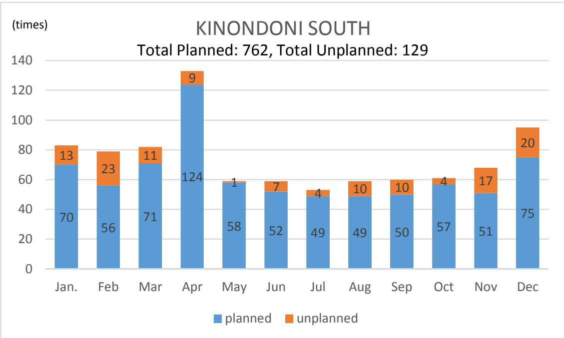
Load break switches and drop out fuses (DOF) are standardly used on distribution lines to protect lines, pass/block load current, change system configuration, etc. Oil circuit breakers and auto reclosers are also employed in some cases.

Ring Main Units (RMU) are also used in urban underground distribution lines for T-off to medium voltage customers or transformers.

(8) Power Supply Reliability

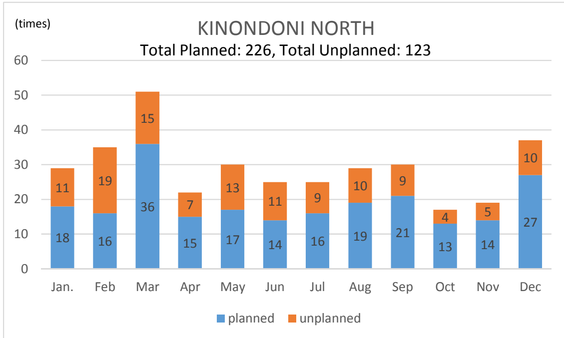
The Figures below show a summary of the planned outages and unplanned outages (caused by damage, etc.) over the project area in 2016 (one year).

Over the entire region, there were an average of 7.9 planned power outages per day and 7.0 unplanned power outages per day. Is clear that there is an overwhelmingly large number of failures in Temeke, where equipment has fallen into a state of deterioration.



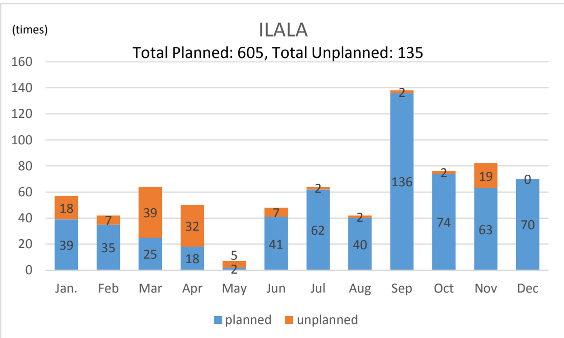
Source: JICA Study Team based on the data from TANESCO

Figure 5-1.8 Power Outage in 2016 (Kinondoni South)



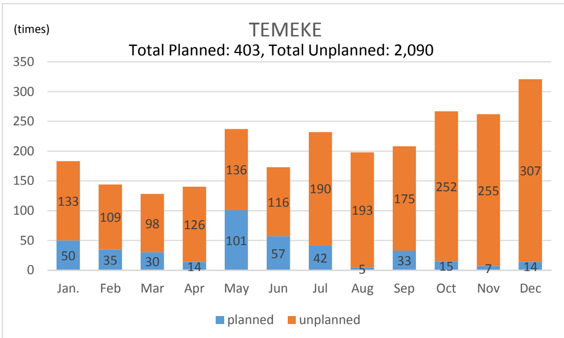
Source: JICA Study Team based on the data from TANESCO

Figure 5-1.9 Power Outage in 2016 (Kinondoni North)



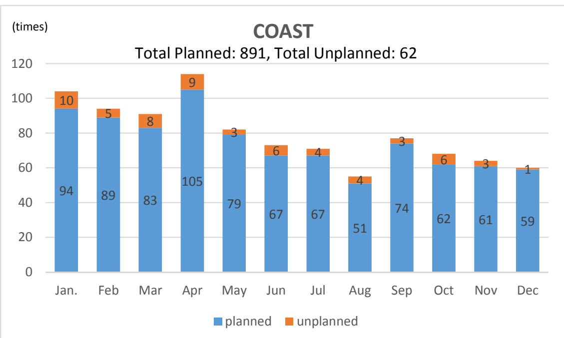
Source: JICA Study Team based on the data from TANESCO

Figure 5-1.10 Power Outage in 2016 (Ilala)



Source: JICA Study Team based on the data from TANESCO

Figure 5-1.11 Power Outage in 2016 (Temeke)



Source: JICA Study Team based on the data from TANESCO

Figure 5-1.12 Power Outage in 2016 (Coast)

Information on planned outages as well as causes of unplanned outages are shown below.

Equipment maintenance and replacement accounted for the majority of planned outages in every region. As for damage-prompted unplanned outages, they seem to result mainly from support structure collapse, equipment failure, and overloads. The data demonstrates that the system has a significantly high failure rate and there is an urgent need to update and augment the distribution network given that reliability of supply in the current distribution system is unsatisfactory.

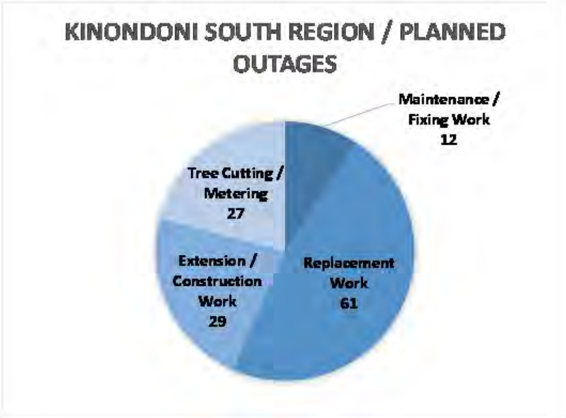
Followings are assumed factors of power outages. There are some duplications in both planned and unplanned outages. This seems like each regional office has different thoughts in categorizing power outages.

[Assumption of Planned Outages]

- ✓ Replacement: Due to replacement work
- ✓ Extension / Construction Work: Due to extension, expansion or new construction work
- ✓ Tree Cutting / Metering: Due to tree cutting near the distribution line or replacement of power meters mostly for big consumers.
- ✓ Touched Conductor, Clearance: Due to tree cutting touched on distribution line or removal of obstacles.
- ✓ General Maintenance / Fixing Work: Due to general maintenance or works
- ✓ Emergency Load Shedding, Load Transfer: Due to emergency load shedding or load transfer
- ✓ Overload, Earth Fault, Power failure: Due to system failures or troubles
- ✓ Broken, Nocked, Flashing: Due to broken equipment, pole/conductor adjustment or flashings.

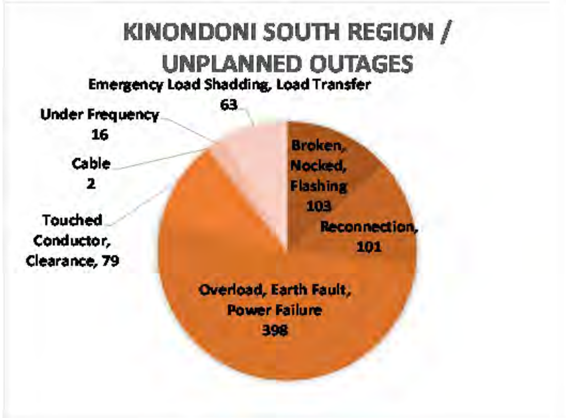
[Assumption of Unplanned Outages]

- ✓ Emergency Load Shedding, Load Transfer: Due to emergency load shedding or load transfer
- ✓ Reconnection: Due to loose connection/slipping out of conductors or jumper connections
- ✓ Touched Conductor, Clearance: Due to tree cutting touched on distribution line or removal of obstacles.
- ✓ Overload, Earth Fault, Power failure: Due to system failures or troubles
- ✓ Broken, Nocked, Flashing: Due to broken equipment, pole/conductor adjustment or flashings.
- ✓ Under Frequency: Due to under frequency



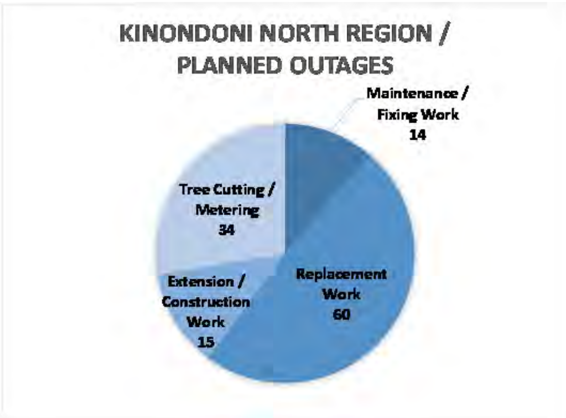
Source: JICA Study Team based on the data from TANESCO

Figure 5-1.13 Planned Outage in 2016 (Kinondoni South)



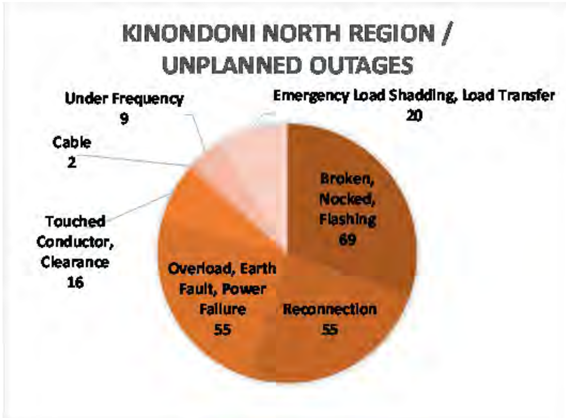
Source: JICA Study Team based on the data from TANESCO

Figure 5-1.14 Unplanned Outage in 2016 (Kinondoni South)



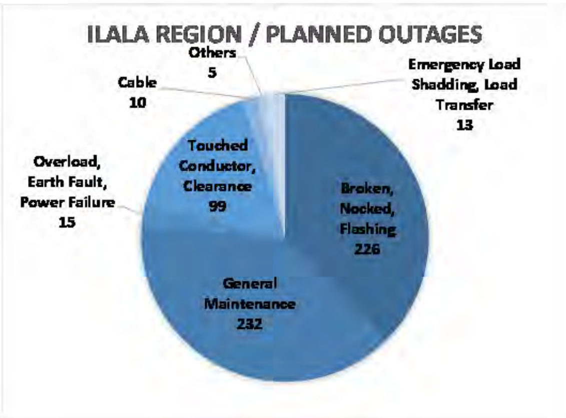
Source: JICA Study Team based on the data from TANESCO

Figure 5-1.15 Planned Outage in 2016 (Kinondoni North)



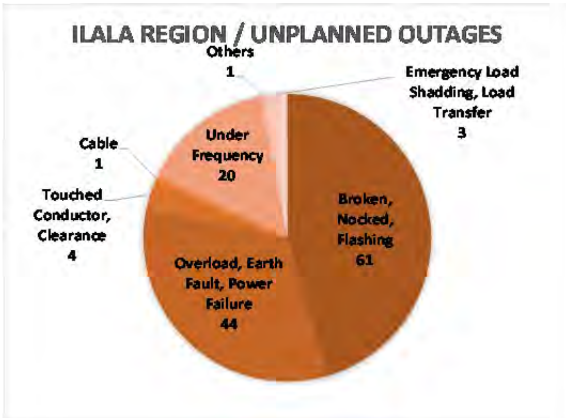
Source: JICA Study Team based on the data from TANESCO

Figure 5-1.16 Unplanned Outage in 2016 (Kinondoni North)



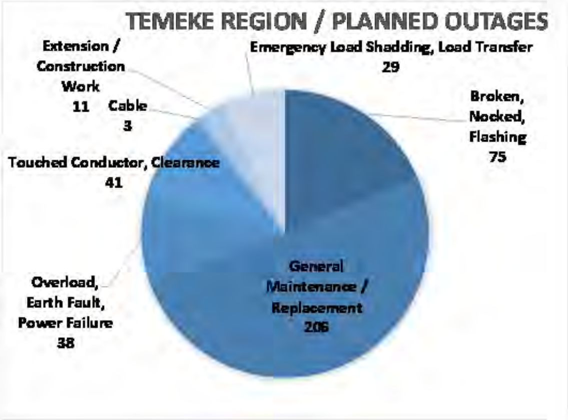
Source: JICA Study Team based on the data from TANESCO

Figure 5-1.17 Planned Outage in 2016 (Ilala)



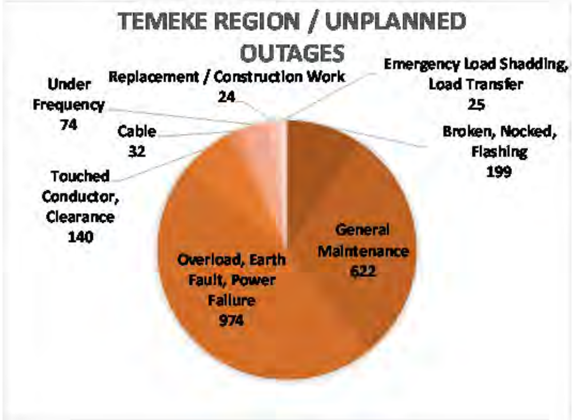
Source: JICA Study Team based on the data from TANESCO

Figure 5-1.18 Unplanned Outage in 2016 (Ilala)



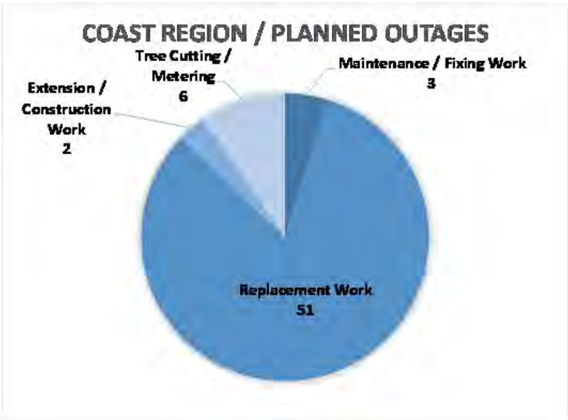
Source: JICA Study Team based on the data from TANESCO

Figure 5-1.19 Planned Outage in 2016 (Temeke)



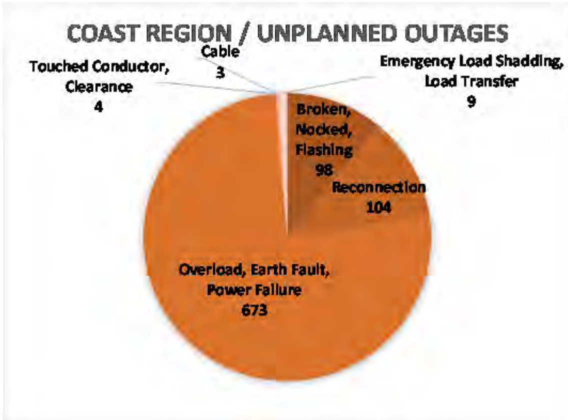
Source: JICA Study Team based on the data from TANESCO

Figure 5-1.20 Unplanned Outage in 2016 (Temeke)



Source: JICA Study Team based on the data from TANESCO

Figure 5-1.21 Planned Outage in 2016 (Coast)



Source: JICA Study Team based on the data from TANESCO

Figure 5-1.22 Unplanned Outage in 2016 (Coast)

(9) Distribution Control Center

Construction of a power distribution control center is currently underway next to the Kinondoni North office with support from the Finnish government. Expansion of the optical fiber network as well as installation of a remote terminal is proceeding in order to establish a framework for supervisory control.

The distribution control center project also includes the construction of a pilot power distribution management system with capabilities such as distributed power load prediction, tidal analysis, and assistance for accident response.

Once this power distribution control center becomes functional, it is expected to improve the operational capacity of substations, raise situational awareness of their operation, reduce power outage time, and boost responsiveness when accidents occur.

5-2 Development plans of Transmission and Substation Facilities

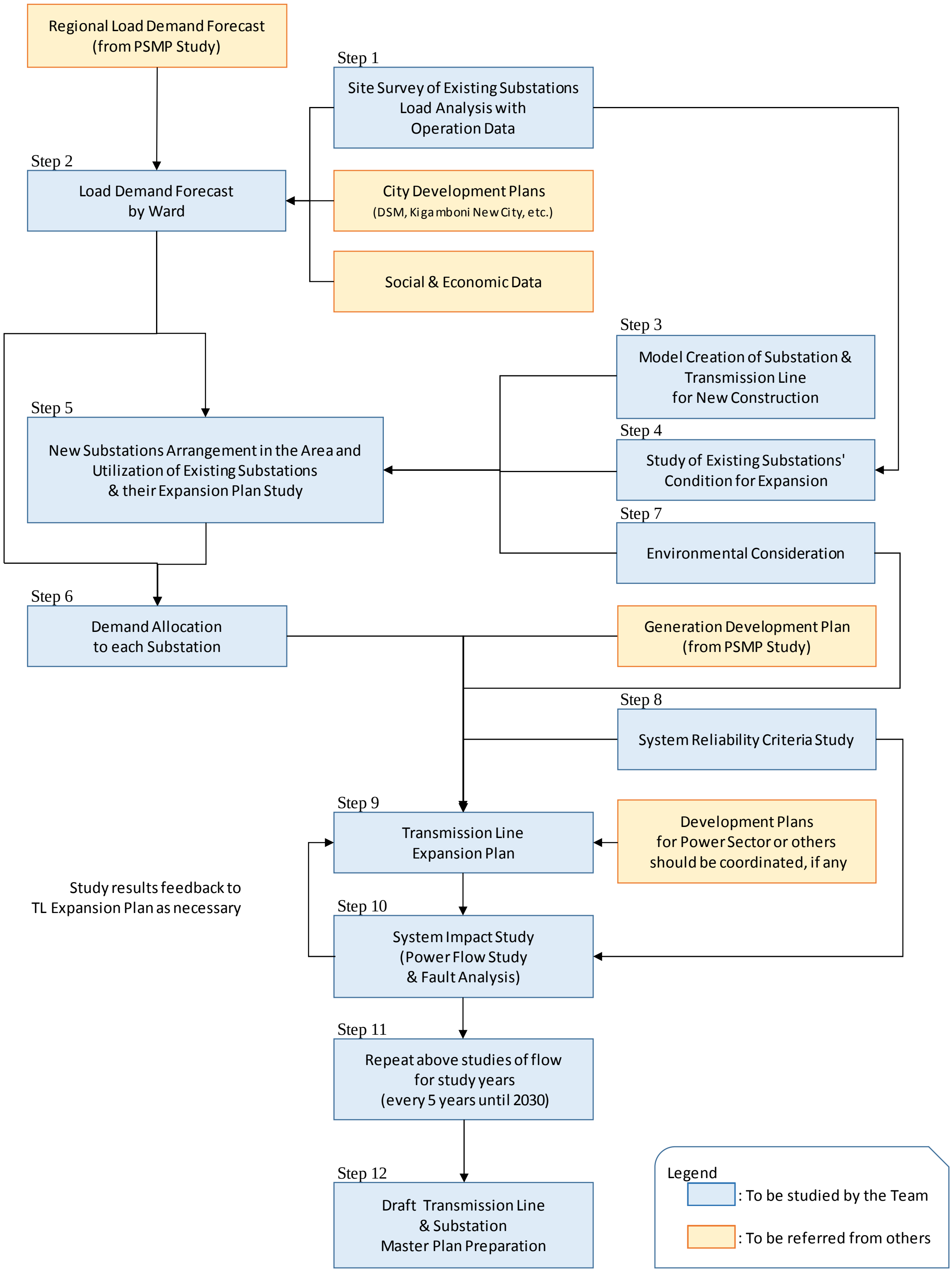
The development plans for Dar es Salaam and Coast region have been studied and their methodologies and study results are mentioned herein after.

5-2-1 Transmission and Substation Facilities

Firstly the development plan for the transmission and substation facilities is described below including the detailed contents of the examination.

(1) Methodology of Transmission and Substation Development Planning

The methodology of Transmission and Substation development planning in Dar es Salaam Power System Master Plan (hereinafter referred to as DSMP) is shown in Figure 5-2.1.



Source: JICA Study Team

Figure 5-2.1 Methodology of Transmission Line and Substation Development Planning

Some materials for DSMP are referred from the existing information such as City Development Plans, social & economic data and from the PSMP study results of regional load demand forecast and generation development plan.

The summary of the methodology is as follows:

- **Step 1 Site Survey of Existing Substations**
  The site survey of the existing whole substations in the study area is conducted to include in the development plan in consideration of the future demand study, expandability of the existing substations and necessity of replacement of particular equipment. The details of site survey contents and results are reported previously in 5.1.1.

- **Step 2 Demand Forecast by Ward**
  Small area (by ward) load demand is forecasted based on the results of regional load demand forecast for the whole country in PSMP study. The load demand forecast study for small area is taken into consideration of the actual demand trend for every substation, of the city development plans which have been designed by the authorities of corresponding area, and of social & economic data which are common indexes of electricity consumption prediction. The detailed study is mentioned in Chapter 4 above.

- **Step 3 Preparation of Standard Model of Substations & Transmission Line Conductors**
  Substations have to be arranged in the demand area to supply electricity sufficiently, however, the switchgear and transformers to be installed in the substations should be easily procured in the market. Therefore, the type and capacity of main equipment of substations for each voltage level are defined previously as model substations. In the study of the model substations, the maximum capacity is defined because the capacity of the facilities have to be matched to the characteristic of demand of the area applied. And the conductor of transmission line to be interconnected to the model substation is also selected.

- **Step 4 Utilization Study of Existing Substations**
  Based on the results of the site survey mentioned in Step 1, it is necessary to identify the substations that can be expanded for future demand, and at the same time the necessity of renewal of the substations which have the issues to be solved is studied. The studied results is reflected to the future plan of DSMP.

- **Step 5 and 6 Study of Development Plan of Substations and Allocation of Demand to Each Substation**
  Under this step, the development plan of substations which can accommodate the loads of small areas forecasted in Step 2 is studied. In particular, the required capacity of both 132/33 kV transformers and 33/11 kV transformers is studied for the demand areas, because the voltage of supply electricity to the customers at substation is 33 kV or 11 kV. As the maximum capacity of transformers is known in the previous step at the model substation preparation, the number of transformers and substations required can be planned, and the new substations planned are geographically arranged in approximate location. Allocation of

forecasted demand by ward is made to each substation, at this time, the existing substations which is resulted to be utilized in Step 4 is also included for allocation. The master plan in this time covers until 2030, however, it is considered for the configuration of substations that are able to respond to future demand forecasted by PSMP such as securing future equipment space. The configuration of substations of 220 kV and above is studied to interconnect to the 132 kV substations introduced above based on PSMP formulation results.

- **Step 7 Environmental Consideration**
  Environmental condition is carefully considered while the geographical arrangement of substations and transmission line routes to avoid natural protected area.

- **Step 8 System Reliability Criteria Study**
  The necessary considerations are made to secure the quality of electricity supplied for customers. Since DSMP is a transmission, distribution and substation system planning so that the maintenance of the voltage within the allowable range is the main issue of quality of electricity. The application of redundancy system (N-1 theory application) is studied to secure or improve electricity supply reliability in consideration of electric accidents caused by natural disasters and other reasons.

- **Step 9 Study of Development Plan of Transmission Lines**
  The substations and/or power stations geographically arranged are mutually interconnected through transmission lines. At this time, several technical issues are considered simultaneously such as the generation development plan from PSMP, system reliability criteria study and environmental restrictions. The result of interconnection plan is the initial transmission expansion plan. The required countermeasures are included in the plan as necessary through the verification by the system impact analysis in Step10 below.

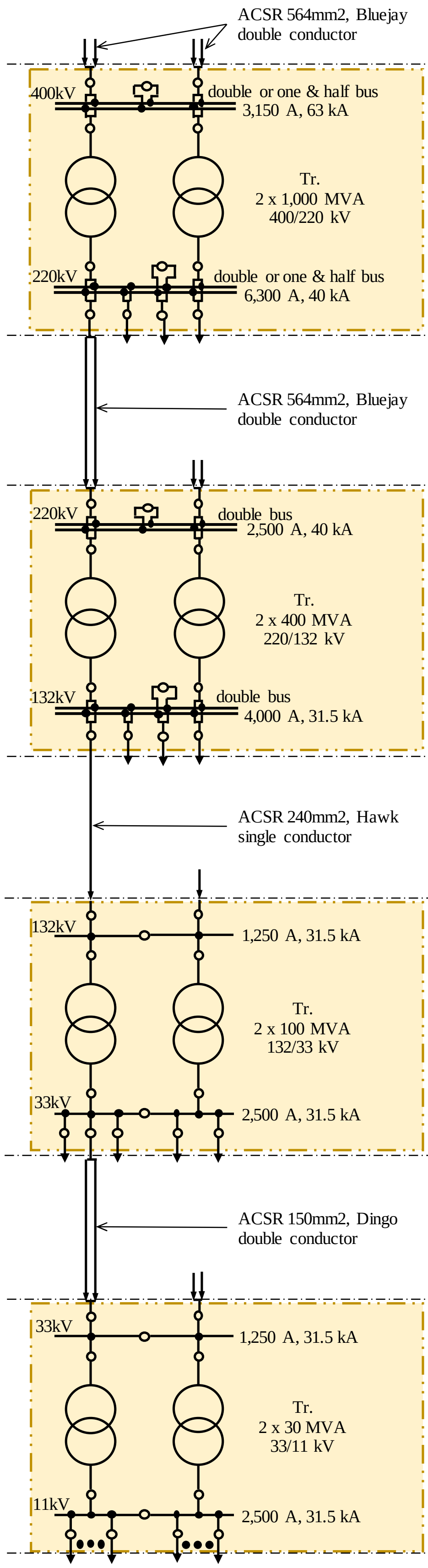
- **Step 10 Power System Analysis**
  The initial transmission expansion plan prepared in Step 9 above is verified by the calculations of power flow and fault current in the grid system utilizing a system impact study application software (PSS@E) and the expansion plan should be modified as necessary to obtain the safe and reliable network system. The detailed explanation is mentioned in Sub-chapter 5.3.

- **Step 11 Study for Every Study Year**
  The necessary studies mentioned above are repeated for study years which is specified every 5 years until 2030 so that it is conducted for 2020, 2025 and 2030 years.

- **Step 12 Preparation of transmission and substation master plan**
  The studies made until Step 11 is summarized as the transmission and substation master plan.

(2) Model Creation of Substation & Transmission Line for New Construction

The model substations and their corresponding transmission lines for the voltage classes have been created as shown in Figure 5-2.2 in consideration of the future high demand, specifications of switchgear which is available in the market, conductors standardly used in TANESCO, etc. Since the maximum capacity of transformer is modeled here, it is possible to adopt a transformer with a smaller capacity than the one determined by the model according to the demand characteristics of the target area of the substation. As for the transmission line, attention must be paid to the fact that it may be necessary for the actual system to select conductors with larger capacities in accordance with the system configuration and adaption of N-1 redundancy.



400 kV Transmission Line Conductor

- Double Bluejay conductor can accommodate 1,210 MVA at 400kV

400/220 kV Substation

- Maximum transformer capacity should be 1,000 MVA and present standardized capacities of 250 & 500 MVAs can be applicable in consideration of demand growth situation.
- Main buses should be double or one & half configuration applied to secure high reliability because of huge capacity accommodation.
- Bus ampacity should be determined to carry whole capacity of line and transformer feeders for the most severe case.
- SWGR rated short time withstand current and rated circuit breaker interrupting current have to be more than fault current value.

220 kV Transmission Line Conductor

- Double Bluejay conductor can accommodate 666 MVA at 220kV

220/132 kV Substation

- Maximum transformer capacity should be 400 MVA to accommodate four 132/33 kV substations and less capacity of 200 MVA for example can be applicable in consideration of demand growth situation.
- Main buses should be double or one & half configuration applied to secure high reliability because of huge capacity accommodation.
- Bus ampacity should be determined to carry whole capacity of line and transformer feeders for the most severe case.
- SWGR rated short time withstand current and rated circuit breaker interrupting current have to be more than fault current value.

132 kV Transmission Line Conductor

- Single Hawk conductor can accommodate 121 MVA at 132kV

132/33 kV Substation

- A common rated bus current of 2,500 A is applied for 33 kV SWGR.
- Maximum transformer capacity by the 33 kV bus rated current 2,500 A selection is 100 MVA and less capacity of 50 MVA for example can be applicable in consideration of demand growth situation.
- 132 kV bus ampacity should be determined to supply 100 MVA transformer and capacity of line feeder(s) to accommodate.
- SWGR rated short time withstand current and rated circuit breaker interrupting current have to be more than fault current value.

33 kV Distribution Line Conductor for power supply to 33/11 kV Substation

- Double Dingo conductor can accommodate 43 MVA at 33kV

33/11 kV Distribution Substation

- A common rated bus current of 2,500 A is applied for 11 kV SWGR.
- Maximum transformer capacity by the 11 kV bus rated current 2,500 A selection is 30 MVA and less capacity of 15 MVA which is widely utilized presently can be applicable in consideration of demand growth situation.
- 33 kV bus ampacity should be determined to supply 30 MVA transformer and capacity of line feeder(s) to accommodate.
- SWGR rated short time withstand current and rated circuit breaker interrupting current have to be more than fault current value.

Source: JICA Study Team

Figure 5-2.2 Model Creation of Substation & Transmission Line for New Construction

(3) Utilization of Existing Substations

The site survey results of existing substations are described in Sub-chapter 5-1-1. Upon the review of the results, it is summarized how to use the existing substations in the development plan.

Basically, the existing electric power system of Dar es Salaam is not a system that can accommodate the high demand forecasted by PSMP 2016 Update, however, since it supplies electricity to many customers, even if the new high demand compatible network is constructed, it is necessary to balance well with the existing transmission and distribution network. Considering this point, the basic utilization concepts of the existing substations are as follows.

Although it is mentioned as existing substation, the substations under construction or rehabilitation which are scheduled to start operation in 2017 are also included in.

1) 132 kV and above voltage Substations

- 220/132 kV Ubungo Substation

  Ubungo substation is playing an important role as the central substation of power supply to the Dar es Salaam area. Since delivering electricity to a huge city from one large capacity substation has risk of wide area power outage at the time of accident, it is planned to construct plurality of 220/132 kV hub substations and to assign role to them in the development plan.

  However, it requires a certain number of years to construct new ultra-high voltage substations and the related necessary transmission network, and the expansion works of Kinyerezi gas power station which locates in Dar es Salaam are in progress so that it is necessary to carry out the role in one place until the new 220/132 kV substations and network are ready to operate, that is delivering high capacity generated electricity to the city where the electric demand continues to increase.

  Therefore, in the short term, it is necessary to install additional facilities with the capacity to accommodate the increased generation power of Kinyerezi Power Station. After the new 220/132 kV substations and their related network start operation, the load to deliver through Ubungo substation will be decreased by sharing to other new substations. This will become easy for maintenance of the substation with partial shutdown of bays and at the same time, it is possible to rehabilitate or update aging facilities so that long-term operation of the substation can be expected.

- 132/33 kV Tegeta Substation

  Tegeta substation is the key substation that is supplying electricity to the northern part of Kinondoni and Zanzibar. Although it is necessary to continue to play an important role in order to deliver electricity to the area, new substations are required to construct and to share the role against the increase in demand for reducing the burden of Tegeta substation. However, it is necessary to consider some countermeasures in short-term to accommodate increasing load until the new substations and their related network are ready to operate.

- 132/33 kV Makumbusho Substation

  Makumbusho substation plays an important role to supply electricity to the southern part of Kinondoni. Although it is necessary to continue to play an important role in order to deliver electricity to the area, new substations are required to construct and to share the role against the increase in demand for reducing the burden of Makumbusho substation. However, it is necessary to consider some countermeasures in short-term to accommodate increasing load until the new substations and their related network are ready to operate. Furthermore, installation of additional transformers is considered to meet the future demand increase in the area.

- 132/33 kV New City Center substation (under construction)

  New City Center substation is under construction as of December 2016 under the support of Finland, and it will play an important role to supply electricity to the city center area. In order to cope with future demand increase, transformer expansion is also considered in the future.

- 132/33 kV Ilala Substation

  This substation is under upgrading as of December 2016 under a Japan Grant Aid Project. Upon the upgrading works, the 33 kV supply capacity of Ilala substation will increase and it results in to deliver electricity to a part of Temeke district other than Ilala district for a while. However, 11 kV supply capacity for distribution is predicted to be short in short period so that additional 33/11 kV transformer is needed. In addition, due to the increase in demand in the Ilala area, it is necessary to construct a new substation in 2030 to reduce the burden by sharing the load with the new substation.

- 132/33 kV FZ II substation (under construction)

  132 kV FZ II substation is under construction with the transmission lines to be interconnected as of December 2016 under World Bank Fund (TEDAP). This substation will play an important role to deliver electricity to the western part of Ilala district and further, it will have also important role to receive the generated power from Kinyerezi power station and to deliver to Dar es Salaam area. It is necessary in short-term to install the second 132/33 kV transformer and additional bays for the double circuit transmission line from Kinyerezi power station.

- 132/33 kV FZ II substation

  FZ II substation is equipped with two sets of 132/33 kV transformer with 117 MVA and its capacity for distribution is sufficient so that it is considered no additional transformers are required until year 2030. However, since the 132 kV transmission line capacity from the Ubungo substation is smaller than the one of transformer, it is necessary to secure the higher capacity of the transmission line.

- 132/33 kV Kurasini substation (under construction)

  Kurasini substation is under construction with the transmission lines to be interconnected as of December 2016 under World Bank Fund (TEDAP). This substation will play an important role to deliver electricity to the northern part of Temeke district. However, it is necessary to install the second 132/33 kV transformer shortly to meet the demand increase in the area.

- 132/33 kV Mbagala substation (under construction)

  Mbagala substation is under construction with the transmission lines to be interconnected as of December 2016 under World Bank Fund (TEDAP). This substation will play an important role to deliver electricity to the western part of Temeke district. However, it is necessary to install the second 132/33 kV transformer shortly to meet the demand increase in the area.

- 132/33 kV Mlandizi substation

  Mlandizi Substation is a substation that branches off from the middle of the 132 kV transmission line between Ubungo substation and Chalinze substation without circuit breakers and installs transformers for distribution. It is an important substation that distributes electricity to a wide area to Kibaha districts and a part of Bagamoyo district, and continuous operation is desired so that circuit breakers with corresponding supervisory facilities for transmission lines shall be installed shortly. It is necessary to install additional distribution transformer and 220 kV switchgear in future because of increase in demand in wide area where Mlandizi substation covers for power delivery.

- 132/33 kV Chalinze Substation

  The Chalinze substation is located in the southern part of the Bagamoyo district and distributes 33 kV electricity to some of the Bagamoyo and Kibaha districts. Continuous operation is desired and it is considered that no additional transformer is required for distribution against the demand increase in the district by 2030.

2) Planned for Expansion of 33/11 kV Substation

- 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. This expanded substation will be operated as New Bahari Beach substation.

- Mbezi substation

  Since there is an unused open space available in Mbezi substation, it is planned to install 132/33 kV switchgear and transformers to the space and to operate together with the existing Mbezi substation as a New Mbezi substation.

- Mburahati substation (under construction)

  Mburahati substation is under construction as a 33/11 kV substation as of December 2016 under World Bank Fund (TEDAP) and will start operation in 2017. In order to meet the demand increase, it is planned to install 132/33 kV switchgear and transformer adjacent to the substation under construction and to operate together with as a New Mburahati substation.

- Tandale Substation

  Since there is an unused open wide space available, it is possible to install additional transformers bank to cope with the demand increase in future.

3) Planned for Renewal of 33/11 kV Substation

- Kigamboni Substation

  Kigamboni Substation is not fully equipped with supervising, control and protection functions, and that results the remote control equipment (Remote Terminal Unit: RTU) from the distribution control center is not able to put into operation as of December 2016. Furthermore, the 33/11 kV transformer which was manufactured in 1970 is very old and seems already deteriorated so that it is predicted that it is impossible to respond to future demand increase. Therefore, it is planned that renewal of the substation will be conducted in early stage as a regular substation accompanied by supervising, control and protection functions and that it will be operated as a New Kigamboni substation. Since the 132 kV substation is planned to construct as an expansion project to cope with the demand increase of the area in near future, the design of 132 kV switchyard has to be considered at the initial renewal of the substation stage.

- Tumbi Substation

  Tumbi substation is protected only by power fuse which is equipped to air insulated switch. It was observed that several arc chute assemblies have fallen out of the switches so that switching function is not complete, and no supervising function is provided. Furthermore, it is forecasted that the capacity of the existing transformers will be insufficient for future demand increase. Therefore, it is planned that renewal of the substation will be conducted in early stage as a regular substation accompanied by supervising, control and protection functions and that it will be operated as a New Tumbi substation.

4) Planned for Expansion of 33/11 kV Transformers

The primary 33/11 kV substations, where one 33/11 kV transformer has been installed with available spare space for the second transformer, and where plural transformers have been installed and considered to be able to secure further installation space for transformer(s), is planned to install additional 33/11 kV transformer(s) and its related facilities in response to demand increase in each coverage area.

- Substations to be applied:

Bahari Beach, Jangwani Beach, Tandale, Mwananyamala, City Center, Muhimbili, Ilala, TOL, FZ I, FZ II, Tandika and Kurasini

(4) Development Plan of Substations

The development plan of substation consists of two kind approaches, one is the plan aimed at distribution substation that installs transformers that secures necessary capacity for power distribution accumulated from demand forecasting, and the other is the plan aimed at grid substation to deliver electricity from transmission network to distribution system, and the study results of two kinds of approaches are integrated in one at last.

1) Demand Side Approach for Substation Planning

Electricity is supplied in two voltage classes of 33 kV or 11 kV from substations to customers. 11 kV is produced by stepping down transformer from 33 kV. Thus, it is necessary to secure the capacity of 132/33 kV transformers that produce distribution voltage of 33 kV larger than the demand of relevant supply area.

Firstly, the demand forecast values by ward for 2020 are integrated according to the supply area of the existing substation. The results of integration are as shown in Table 5-2.1. The MVA value of the demand is calculated based on the forecasted demand active power with a power factor of 90%.

Table 5-2.1 Demand Forecast for each Substation in 2020 and 132/33 kV Transformer Capacity of existing Substations

Substation	Demand Forecast in 2020		Transformer Capacity 132/33 kV
	MW	MVA	MVA
Tegeta	130.6	***145.1***	100
Ubungo	209.1	232.4	240
Makumbusho	104.9	***116.5***	90
New City Center*	50.6	56.2	100
Ilala	143.1	159.0	240
FZ II	59.9	***66.6***	50
FZ III	195.6	217.3	234
Kurasini*	116.3	***129.2***	50
Mbagala*	122.8	***136.4***	50
Mlandizi	35.6	39.6	60
Chalinze	9.4	10.4	55
Zinga**	14.9	16.5	Unknown

Notes *: Under construction and operation will be commenced in 2017
**: Contracted and assumed being under operation in 2020

Source: JICA Study Team

From Table 5.2-1 it can be seen that the forecasted demand values for five substations with italic Figures including the Tegeta substation exceed the capacities of corresponding transformer as of 2020. It is required to make some measures to avoid overload of the transformers, but it is to consider separately afterward.

Secondly, the required transformer capacity by substation in 2025 and 2030 is studied from the values of demand forecast by ward. Here, new substations are planned according to the need from the demand of study year. The results of allocating the forecasted demand to the transformers that can accommodate the required demand, to the new substations where the transformer with the capacity set up in the model substation study is installed, and to the existing substations where the transformers with the capacity that can be expanded, are shown in Table 5-2.2 and Table 5-2.3. The name of new substation is assumed to be the name of ward temporarily.

Table 5-2.2 Demand Forecast in 2025 and Allocation for Substations

Substation	Demand Forecast in 2025		Remarks
	MW	MVA	
Tegeta	60.1	66.7	
Bunju（North DSM*）	50.3	55.9	New
New Bahari Beach	59.5	66.2	New
New Mbezi	33.0	36.6	New
Kawe	34.7	38.6	New
Goba	64.3	71.4	New
Ubungo	125.4	139.3	
Makumbusho	79.5	88.3	
Drive Inn	44.4	49.3	New
New City Center	68.5	76.1	
Luguruni（West DSM*）	48.6	54.0	New
New Mburahati	43.1	47.9	New
Ilala	181.2	201.3	
FZ II	37.6	41.7	
Pugu	66.2	73.5	New
FZ III	84.1	93.5	
Kimanga	44.7	49.6	New
Kivule（South DSM*）	42.6	47.3	New
Kurasini	53.2	59.1	
Mtoni	90.4	100.4	New
Buza	85.7	95.2	New
Somangila（South-east DSM*）	29.3	32.6	New
New Kigamboni	69.9	77.7	New
Kibada	21.8	24.3	New
Mbagala	65.2	72.5	
Mianzini	96.3	107.0	New
Mlandizi	62.2	69.1	
Chalinze	14.3	15.9	
Zinga	35.7	39.7	
Mkuranga	27.5	30.6	New

Note*: 220 kV substations descried in PSMP 2016 Update for DSM supply

Source: JICA Study Team

Table 5-2.3 Demand Forecast in 2030 and Allocation for Substations

Substation	Demand Forecast in 2030		Remarks
	MW	MVA	
Tegeta	71.1	79.0	
Bunju（North DSM*）	82.7	91.8	
New Bahari Beach	88.1	97.9	
New Mbezi	56.3	62.5	
Kawe	49.3	54.8	
Goba	95.2	105.7	
Ubungo	190.0	211.1	
Makumbusho	124.6	138.4	
Drive Inn	70.9	78.7	
New City Center	125.4	139.4	
Lugurni（West DSM*）	65.2	72.4	
New Mburahati	74.2	82.4	
Ilala	159.0	176.7	
New Ilala	82.6	91.7	New
FZ II	49.9	55.5	
Pugu	67.7	75.2	
FZ III	121.9	135.5	
Kimanga	77.2	85.7	
Kivule（South DSM*）	64.4	71.6	
Kurasini	84.7	94.2	
Mtoni	142.2	158.0	
Buza	135.4	150.5	
Somangila（South-east DSM*）	43.7	48.6	
New Kigamboni	95.9	106.6	
Kibada	31.1	34.5	
Mbagala	82.9	92.1	
Mianzini	161.4	179.4	
Mlandizi	75.9	84.3	
Chalinze	19.4	21.5	
Zinga	56.6	62.8	
Mkuranga	47.0	52.3	
Maneromango	15.2	16.9	New

Note*: 220 kV substations descried in PSMP 2016 Update for DSM supply

Source: JICA Study Team

Based on these considerations, the plan for installing the 132/33 kV transformers at each substation is summarized in Table 5.2-4.

Table 5-2.4 132/33 kV Transformer Installation Plan for Substations

No	District	Substations	Existing /New	Required Load (MVA)			Transformaer Capacity (MVA)							
				2020	2025	2030	Existing		2020		2025		2030	
1	Kinondoni	Tegeta SS	E	145.1	66.7	79.0	100	50*2	130	65*2	130	65*2	130	65*2
2	Kinondoni	Bunju SS (N-DSM)	N	-	55.9	91.8	-	-	-	-	200	100*2	200	100*2
3	Kinondoni	N. Bahari Beach SS	N	-	66.2	97.9	-	-	-	-	200	100*2	200	100*2
4	Kinondoni	N. Mbezi SS	N	-	36.6	62.5	-	-	-	-	150	75*2	150	75*2
5	Kinondoni	Kawe SS	N	-	38.6	54.8	-	-	-	-	150	75*2	150	75*2
6	Kinondoni	Goba SS	N	-	71.4	105.7	-	-	-	-	200	100*2	200	100*2
7	Kinondoni	Ubungo SS	E	232.4	139.3	211.1	240	120*2	240	120*2	240	120*2	240	120*2
8	Kinondoni	Makumbusho SS	E	116.5	88.3	138.4	90	45*2	110	55*2	110	55*2	170	55*2 & 60*1
9	Kinondoni	Drive Inn SS	N	-	49.3	78.7	-	-	-	-	200	100*2	200	100*2
10	Kinondoni	NCC SS	E	56.2	76.1	139.4	100	50*2	100	50*2	100	50*2	150	50*3
11	Kinondoni	Lugurni SS (W-DSM)	N	-	54.0	72.4	-	-	-	-	200	100*2	200	100*2
12	Kinondoni	N. Mburahati SS	N	-	47.9	82.4	-	-	-	-	200	100*2	200	100*2
13	Ilala	Ilala SS	E	159.0	201.3	176.7	240	60*4	240	60*4	240	60*4	240	60*4
14	Ilala	N. Ilala SS	N	-	-	91.7	-	-	-	-	-	-	200	100*2
15	Ilala	FZ II SS	E	66.6	41.7	55.5	50	50*1	100	50*2	100	50*2	100	50*2
16	Ilala	Pugu SS	N	-	73.5	75.2	-	-	-	-	200	100*2	200	100*2
17	Ilala	FZ III SS	E	217.3	93.5	135.5	234	117*2	234	117*2	234	117*2	234	117*2
18	Ilala	Kimanga SS	N	-	49.6	85.7	-	-	-	-	200	100*2	200	100*2
19	Ilala	Kivule SS (S-DSM)	N	-	47.3	71.6	-	-	-	-	150	75*2	150	75*2
20	Temeke	Kurasini SS	E	129.2	59.1	94.2	50	50*1	130	65*2	130	65*2	130	65*2
21	Temeke	Mtoni SS	N	-	100.4	158.0	-	-	-	-	200	100*2	300	100*3
22	Temeke	Buza SS	N	-	95.2	150.5	-	-	-	-	200	100*2	300	100*3
23	Temeke	Somangila SS (SE-DSM)	N	-	32.6	48.6	-	-	-	-	100	50*2	100	50*2
24	Temeke	N. Kigamboni SS	N	-	77.7	106.6	-	-	-	-	200	100*2	200	100*2
25	Temeke	Kibada SS	N	-	24.3	34.5	-	-	-	-	100	50*2	100	50*2
26	Temeke	Mbagala SS	E	136.4	72.5	92.1	50	50*1	130	65*2	130	65*2	130	65*2
27	Temeke	Mianzini SS	N	-	107.0	179.4	-	-	-	-	300	100*3	300	100*3
28	Bagamoyo	Chalinze SS	E	10.4	15.9	21.5	55	55*1	55	55*1	55	55*1	55	55*1
29	Kibaha	Mlandezi SS	E	39.6	69.1	84.3	60	10*2 & 20*2	60	10*2 & 20*2	140	20*2 & 50*2	140	20*2 & 50*2
30	Bagamoyo	Zinga SS	N	16.5	39.7	62.8	-	-	180	90*2	180	90*2	180	90*2
31	Mkuranga	Mkuranga SS	N	-	30.6	52.3	-	-	-	-	150	75*2	150	75*2
32	Kisarawe	Maneromango SS	N	-	-	16.9	-	-	-	-	-	-	100	50*2

Source: JICA Study Team

In Table 5-2.4, the brown colored cells indicate that it is necessary to install new transformer(s) or to modify existing one for capacity increase. The selection of transformers in the new substations considered redundancy introducing the N-1 method so that 33 kV distribution supply is possible even when one unit is stopped. It is planned to increase the capacity of existing transformers by modification works implementation by 2020, but details on the measures against increase in demand in 2020 is mentioned later.

Since transformer capacity capable to supply 33 kV was obtained in the above discussion, capacity of 33/11 kV transformers which supplies 11 kV is considered next. In Dar es Salaam the 11 kV distribution area is limited to the central urban area and its surroundings, and the suburbs are mainly 33 kV distribution system adopted. The area where 11 kV distribution system has been adopted at the time of this DSMP study is considered as it is to continue the 11 kV distribution system until 2030.

Demand for only 11 kV distribution area is accumulated as in the case of 33 kV study above. The required capacity in each 132/33 kV primary substation, that the 33/11 kV total transformers of the secondary power substations have to accommodate for each primary substation, and transformers planned to install and existing ones in each substation are listed in Table 5.2-5. New secondary power substations are added with the capacity set up for the model substation as well as the case study for 33kV to meet the demand requirement and whose names are assumed to be the name of ward temporarily. In Table 5-2.5, the brown colored cells indicate that it is necessary to install new transformer(s) or to modify existing one for capacity increase until the year indicated, and the green colored cells indicate that the new same named substation will be constructed on the premises or adjacent to the existing substation and will be operated together with existing one as one substation.

Electric power from the 132/33 kV primary substation to the secondary power substation is basically supplied from the neighboring primary substation in the same Region, however, it is not necessarily carried out actually due to the limitation of 132/33 kV transformer capacity of the primary substation or the existing connection situation. It is considered in the development plan that power source switching program is included for secondary power substations that will eventually receive power from the neighboring primary substation while checking if there is a margin in the capacity of the transformer in the corresponding primary substation.

For details of the demand accumulation by Ward in Table 5-2.1 to 3 and Table 5-2.5, please refer to Attachment.

2) Supply Side Approach for Substation Planning

Regarding the grid transformers of ultra-high voltage (400/220 kV & 220/132 kV) from the power station or transmission system to demand sites, the power flow vary due to several factors such as the redundancy or ring configuration of transmission system for maintaining reliability, the operating condition of power plants, etc. so that the rated transformer capacity is not able to determine easily by simple accumulation of area demand. It is necessary to consider that it can be accommodate power even in the emergency N-1 condition as well as the normal operating condition.

The higher reliability is considered for the power supply network system of Dar es Salaam in comparison with the present situation that four 220 kV substations will be arranged and interconnected with loop configuration of 220 kV transmission lines around Dar es Salaam and its configuration makes multiple power supply to each 220 kV substation from national power grid or Kinyerezi power station.

The required capacity of the 220/132 kV transformers of the above said four substations around Dar es Salaam and the Kinyerezi power station is as shown in Table 5-2.6 and 400/220 kV transformers around Dar es Salaam is as shown in Table 5.2-7 as the results of the power flow calculation.

Table 5-2.5 Required Capacity of 33/11kV Transformers classified by Primary Substations and Secondary Power Substation 33/11 kV Transformer Installation Plan

No	District	132kV Substations	Existing /New	Required 11kV Load (MVA)			33/11kV Substations	Existing /New	Transformaer Capacity (MVA)													
				2020	2025	2030			Existing		C*	2020			C*	2025			C*	2030		
1	Kinondoni	Tegeta SS	E	53.0	0.0	0.0	Bahari Beach SS	E	15	15*1		30	15*2	60	a	-	-	-		-	-	-
							Jangwani Beach SS	E	15	15*1		30	15*2		b	-	-			-	-	
							Mbezi SS	E	30	15*2	c	-	-			-	-			-	-	
2	Kinondoni	Bunju SS (N-DSM)	N	-	9.7	18.0	Mbeweni SS	N	-	-		-	-	-		15	15*1	15		30	15*2	30
3	Kinondoni	N. Bahari Beach SS	N	-	66.2	97.9	N. Bahari Beach SS	N	-	-		-	-	-		60	30*2	90		60	30*2	120
							Bahari Beach SS	E	-	-		-	-		a	30	15*2			30	15*2	
							Kunduchi SS	N	-	-		-	-			-	-			30	30*1	
4	Kinondoni	N. Mbezi SS	N	-	36.6	62.5	Mbezi SS	E	-	-		-	-	-	c	30	15*2	60		30	15*2	90
							N. Mbezi SS	N	-	-		-	-			-	-			30	30*1	
							Jangwani Beach SS	E	-	-		-	-		b	30	15*2			30	15*2	
5	Kinondoni	Kawe SS	N	-	38.6	54.8	Kawe SS	N	-	-		-	-	-		30	30*1	60		60	30*2	90
							Mikocheni SS	E	-	-		-	-		d	30	15*2			30	15*2	
6	Kinondoni	Goba SS	N	-	0.0	0.0	-	-	-	-		-	-	-		-	-	-		-	-	-
7	Kinondoni	Ubungo SS	E	149.6	112.0	164.4	Ubungo SS	E	30	15*2		30	15*2	155		60	15*2+30	155		60	15*2+30	185
							Mlimnamicity SS	E	15	7.5*2		15	7.5*2			15	7.5*2			15	7.5*2	
							Tandale SS	E	15	15*1		30	15*2			30	15*2			30	15*2	
							EPZ SS	E	20	5*4		20	5*4			20	5*4			20	5*4	
							Magomeni SS	E	15	15*1		15	15*1		e	-	-			-	-	
							Mburahati SS	E	15	15*1		15	15*1		f	-	-			-	-	
							Mbezi SS	E	-	-	c	30	15*2		c	-	-			-	-	
							Makongo SS	N	-	-		-	-			-	-			30	30*1	
							Mabibo SS	N	-	-		-	-			30	30*1			30	30*1	
8	Kinondoni	Makumbusho SS	E	116.5	88.3	138.4	Makumbusho SS	E	30	15*2		30	15*2	135		30	15*2	120		45	15*3	165
							Oysterbay SS	E	30	15*2		30	15*2		g	-	-			-	-	
							Mikocheni SS	E	30	15*2		30	15*2		d	-	-			-	-	
							Msasani SS	E	30	15*2		30	15*2			30	15*2			30	15*2	
							Mwananyamala SS	E	15	15*1		15	15*1			30	15*2			30	15*2	
							Kijitonyama SS	N	-	-		-	-			30	30*1			60	30*2	
9	Kinondoni	Drive Inn SS	N	-	49.3	78.7	Drive Inn SS	N	-	-		-	-	-		30	30*1	90		30	30*1	120
							Oysterbay SS	E	-	-		-	-		g	30	15*2			30	15*2	
							N. Msasani SS	N	-	-		-	-			30	30*1			30	30*1	
							Hananasifu SS	N	-	-		-	-			-	-			30	30*1	
10	Kinondoni	NCC SS	E	56.2	76.1	139.4	City Center SS	E	30	15*2		30	15*2	60		45	15*3	105		45	15*3	180
							Muhimbili SS	E	15	15*1		30	15*2			30	15*2			30	15*2	
							Sokoine SS	E	-	-		-	-			-	-		j	30	15*2	
							Railway SS	E	-	-		-	-			-	-		k	15	15*1	
							Jangwani SS	N	-	-		-	-			30	30*1			30	30*1	
							Mchafukoge SS	N	-	-		-	-			-	-		p	30	30*1	
11	Kinondoni	Lugurni SS (W-DSM)	N	-	0.0	0.0	-	-	-	-		-	-	-		-	-	-		-	-	-
12	Kinondoni	N. Mburahati SS	N	-	47.9	82.4	N. Mburahati SS	N	-	-		-	-	-		30	30*1	90		30	30*1	105
							Mburahati SS	E	15	15*1		-	-		f	15	15*1			30	15*2	
							Magomeni SS	E	-	-		-	-		e	15	15*1			15	15*1	
							N. Magomeni SS	N	-	-		-	-			30	30*1			30	30*1	
13	Ilala	Ilala SS	E	159.0	201.3	176.7	Ilala SS	E	45	15*3		60	15*4	180		60	15*4	285		60	15*4	180
							Kariakoo SS	E	30	15*2		30	15*2			30	15*2			30	15*2	
							N. Kariakoo SS	N	-	-		-	-			-	-			30	30*1	
							FZ I SS	E	30	15*2		30	15*2			30	15*2		m	-	-	
							Sokoine SS	E	30	15*2		30	15*2			30	15*2		j	-	-	
							Railway SS	E	15	15*1		15	15*1			15	15*1		k	-	-	
							Mchafukoge SS	N	-	-		-	-			30	30*1		p	-	-	
							Mchikichini SS	N	-	-		-	-			60	30*2			60	30*2	
							TOL SS	E	15	15*1		15	15*1			30	15*2		n	-	-	
14	Ilala	N. Ilala SS	N	-	-	91.7	N. Ilala SS	N	-	-		-	-	-		-	-	-		60	30*2	135
							FZ I SS	E	-	-		-	-			-	-		m	45	15*3	
							TOL SS	E	-	-		-	-						n	30	15*2	
15	Ilala	FZ II SS	E	60.3	41.7	55.5	FZ II SS	E	15	15*1		45	15*3	45		45	15*3	45		45	15*3	75
							Ukonga SS	N	-	-		-	-			-	-			30	30*1	
16	Ilala	Pugu SS	N	-	55.3	64.5	Pugu SS	N	-	-		-	-	-		30	30*1	90		30	30*1	90
							Majohe SS	N	-	-		-	-			60	30*2			60	30*2	
17	Ilala	FZ III SS	E	128.3	40.2	45.6	FZ III SS	E	30	15*2		30	15*2	90		30	15*2	60		30	15*2	60
							Tandika SS	E	15	15*1		30	15*2		h	-	-			-	-	
							Kiwalani SS	N	-	-		-	-			30	30*1			30	30*1	
							Chang'ombe	E	30	15*2		30	15*2		i	-	-			-	-	
18	Ilala	Kimanga SS	N	-	29.9	53.3	Vingunguti SS	N	-	-		-	-	-		60	30*2	60		60	30*2	60
19	Ilala	Kivule SS (S-DSM)	N	-	0.0	0.0	-	-	-	-		-	-	-		-	-	-		-	-	-
20	Temeke	Kurasini SS	E	76.3	59.1	94.2	Kurasini SS	E	30	15*2		30	15*2	60		60	15*2+30	90		90	15*2+30*2	90
							Chang'ombe	E	-	-		-	-		i	30	15*2			30	15*2	
							Kigamboni	E	5	5*1		-	-			-	-			-	-	
							N. Kigamboni SS	N	-	-		30	30*1		q	-	-			-	-	
21	Temeke	Mtoni SS	N	-	100.4	158.0	Mtoni SS	N	-	-		-	-	-		60	30*2	150		90	30*3	180
							Tandika SS	E	-	-		-	-		h	30	15*2			30	15*2	
							Temeke SS	N	-	-		-	-			30	30*1			30	30*1	
							Kijichi SS	N	-	-		-	-			30	30*1			30	30*1	
22	Temeke	Buza SS	N	-	95.2	150.5	Buza SS	N	-	-		-	-	-		60	30*2	120		120	30*4	180
							Yombo Vituka SS	N	-	-		-	-			60	30*2			60	30*2	
23	Temeke	Somangila SS (SE-DSM)	N	-	0.0	0.0	-	-	-	-		-	-	-		-	-	-		-	-	-
24	Temeke	N. Kigamboni SS	N	-	50.3	74.2	N. Kigamboni SS	N	-	-		-	-	-	q	60	30*2	60		90	30*3	90
25	Temeke	Kibada SS	N	-	0.0	0.0	-	-	-	-		-	-	-		-	-	-		-	-	-
26	Temeke	Mbagala SS	E	116.7	66.4	81.8	Mbagala SS	E	30	15*2		30	15*2	30		30	15*2	75		30	15*2	120
							Mbagala II SS	N	-	-		-	-			30	30*1			60	30*2	
							Kiburugwa SS	N	-	-		-	-			15	15*1			30	15*2	
27	Temeke	Mianzini SS	N	-	81.7	136.2	Mianzini SS	N	-	-		-	-	-		60	30*2	120		60	30*2	150
							Charambe SS	N	-	-		-	-			30	30*1			60	30*2	
							Chamazi SS	N	-	-		-	-			30	30*1			30	30*1	
28	Bagamoyo	Chalinze SS	E	0.0	0.0	0.0	-	-	-	-		-	-	-		-	-	-		-	-	-
29	Kibaha	Mlandezi SS	E	2.6	4.7	5.4	Tumbi SS	E	1.5	1+0.5		-	-	5		-	-	5		-	-	10
							N. Tumbi SS	N	-	-		5	5*1			5	5*1			10	5*2	
30	Bagamoyo	Zinga SS	N	0.0	0.0	0.0	-	-	-	-		-	-	-		-	-	-		-	-	-
31	Mkuranga	Mkuranga SS	N	0.0	0.0	0.0	-	-	-	-		-	-	-		-	-	-		-	-	-
32	Kisarawe	Maneromango SS	N	0.0	0.0	0.0	-	-	-	-		-	-	-		-	-	-		-	-	-

Source: JICA Study Team

Table 5-2.6 220/132 kV Transformer Installation Plan

Power Station & Substations	220/132 kV Transformer Capacity（MVA）					
	2020		2025		2030	
Kinyerezi PS	450	50 (existing) 200×2	450	50 200×2	450	50 200×2
Bunju SS（North DSM SS）		—	800	400×2	800	400×2
Luguruni SS（West DSM SS）	—	—	800	400×2	800	400×2
Kivule SS（South DSM SS）	—	—	800	400×2	1,200	400×3
Somangila SS（South-East DSM SS）	—	—	800	400×2	800	400×2

Source: JICA Study Team

Table 5-2.7 400/220 kV Transformer Installation Plan

Power Station & Substations	400/220 kV Transformer Capacity（MVA）					
	2020		2025		2030	
Kinyerezi PS	2,500	500×5	2,500	500×5	2,500	500×5
Zinga SS	—	—	—	—	1,000	500×2
Mkuranga SS	—	—	1,000	500×2	1,000	500×2

Source: JICA Study Team

(5) Reliability of Network

1) Quality of Electricity Maintenance

The voltage at the bus is planned to maintain within the range of 95 to 105% in the normal operation condition. In the emergency condition such as N-1, etc. its range of 95 to 105% is allowed. Those criteria are the same as specified in PSMP.

Specifically for maintaining voltage within allowable range, selection of conductors (size, number of conductors) and number of lines for transmission lines, selection of transformer tap range, etc. are considered, and further, adaption of reactive power compensators which does not become excessive is taken into consideration as necessary. Quality assurance measures are reflected in the development plan after verifying by power flow analysis.

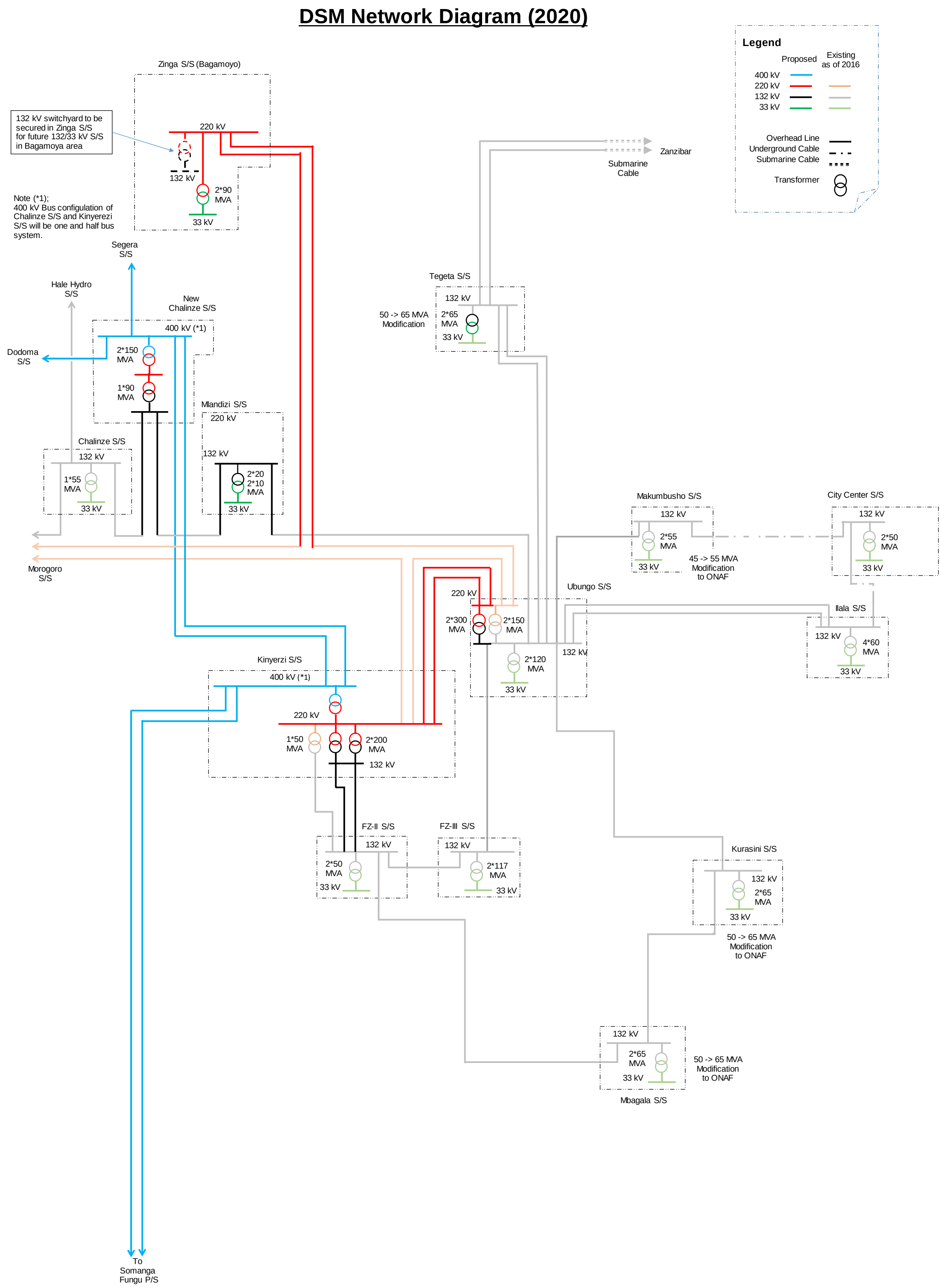
2) Ensuring Reliability

The network system of 132 kV and above is basically to secure high reliability by applying N-1 method redundancy measures for transmission lines and transformers. However, this does not apply to existing operational network. There must be no hindrance in supply with one line stoppage in multiple lines configuration. When configuring the loop system for transmission lines, conductors are selected so as not to overload due to an increase in the load on the sound line when the loop is down. And also when constructing a loop, it is necessary to ensure the conductor(s) capacity that can accommodate the whole load of the substations being interconnected, however, if there are a plurality of substations capable of supplying reliable power, it is sufficient to secure the conductor(s) capacity that can accommodate the load between these substations. Where the “supplying reliable power” here does not include those of which are not able to control producing power like renewable energy power source such as wind and solar.

The connection from the primary substation (132/33 kV) to the secondary power substation (33/11 kV) is planned to follow the current distribution system configuration of tree structure. In the case of a secondary power substation that supplies electricity to important facilities, it is possible to connect with a back-up line from a neighboring substation, but it is necessary to pay attention to measures against overload of facilities of the power source side. Since the importance of particular load in future is not known in like this master plan study, back-up line configuration of 33 kV or less system is not considered.

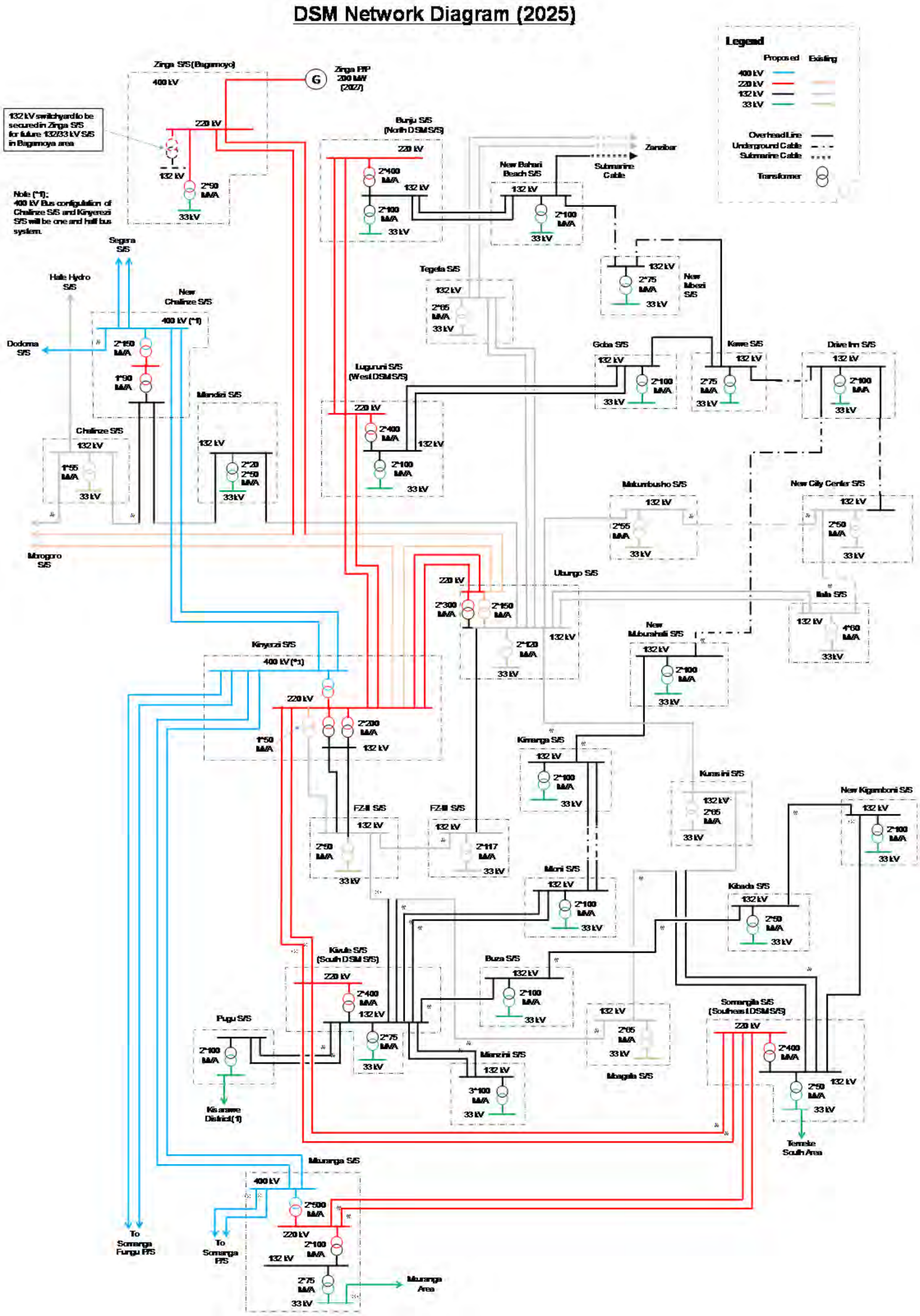
(6) Transmission and Substation Development Plan

In consideration of the various studies discussed above, it is planned to interconnect by transmission lines among power plants and substations. At this time, it is considered together with that the power generation development plan of PSMP 2016 Update and environmental restrictions (avoiding protected areas, etc.) as well. The transmission network diagrams for 2020, 2025, and 2030 are shown in Figures 5-2.3, 5-2.4 and 5-2.5 respectively as the results of the study. The overall general network map including the Coast region for 2020, 2025, and 2030 are shown in Figures 5-2.6, 5-2.7 and 5-2.8 respectively, and the map of enlarged view of the Dar es Salaam for the same years are also shown in Figures 5-2.9, 5-2.10 and 5-2.11 respectively. The transmission lines of 132 kV and above necessary for this development plan are listed in Table 5-2.8 and the necessary substation facilities are listed in Table 5-2.9 as well.



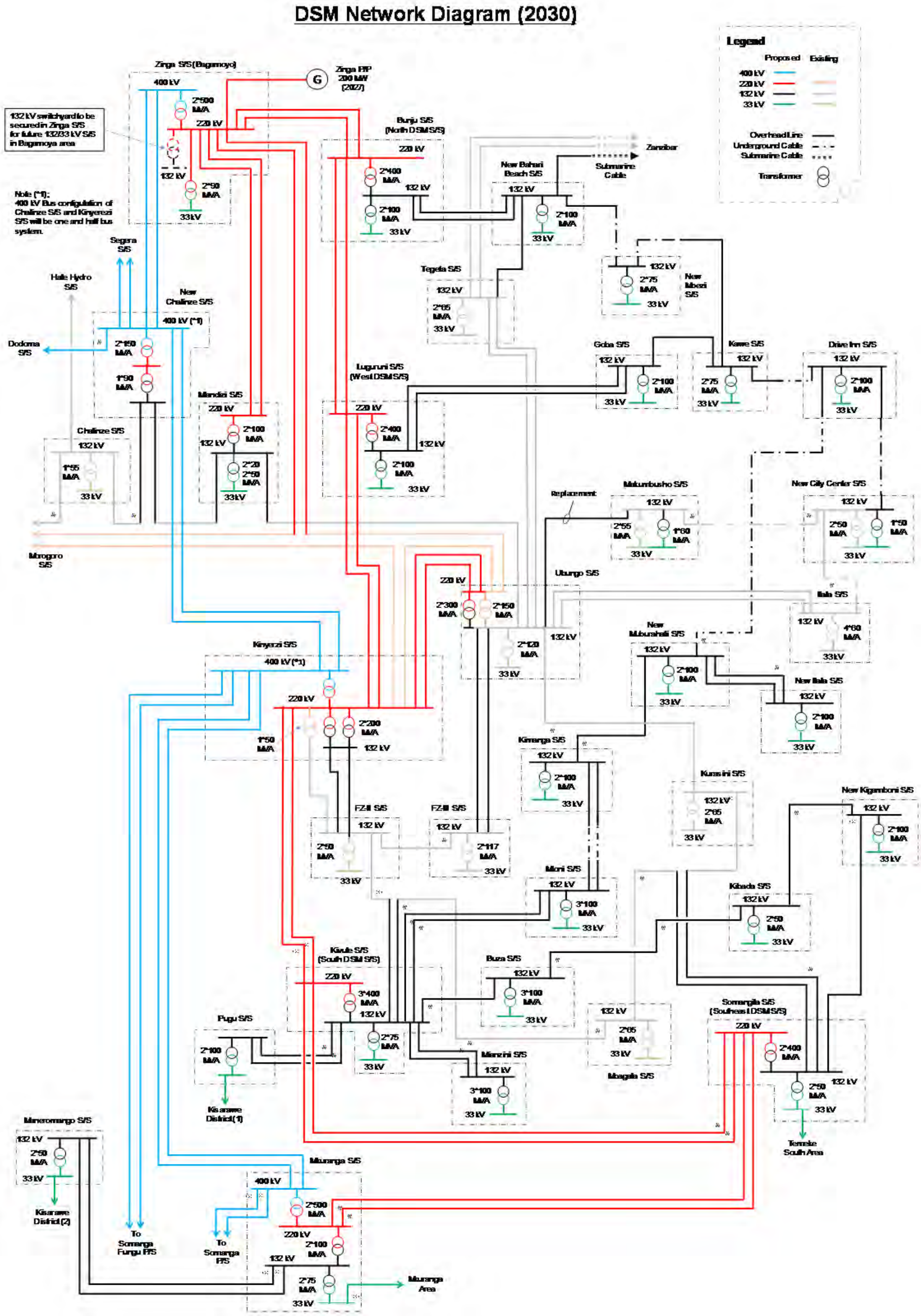
Source: JICA Study Team

Figure 5-2.3 Transmission Network Diagram of Dar es Salaam for year 2020



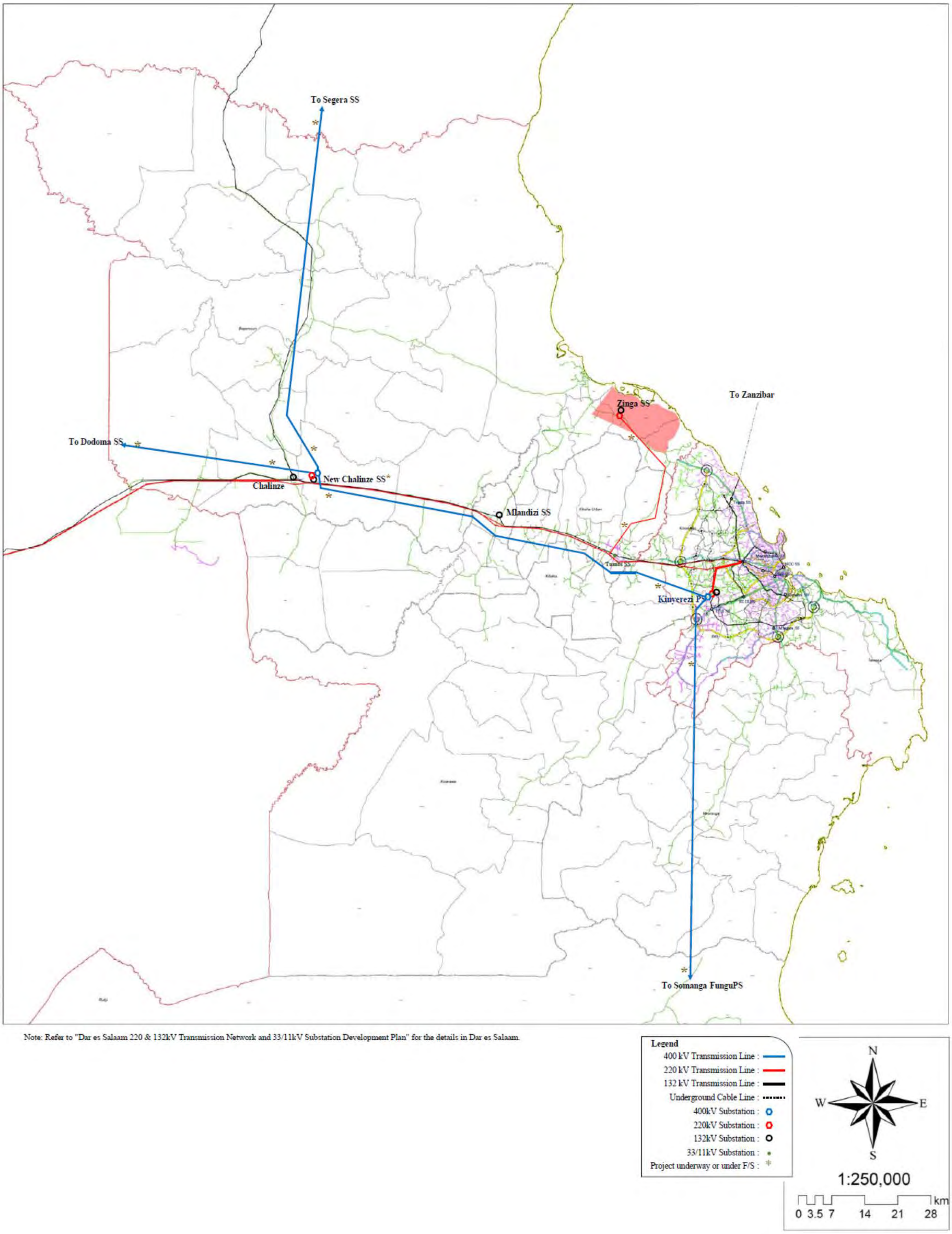
Source: JICA Study Team

Figure 5-2.4 Transmission Network Diagram of Dar es Salaam for year 2025



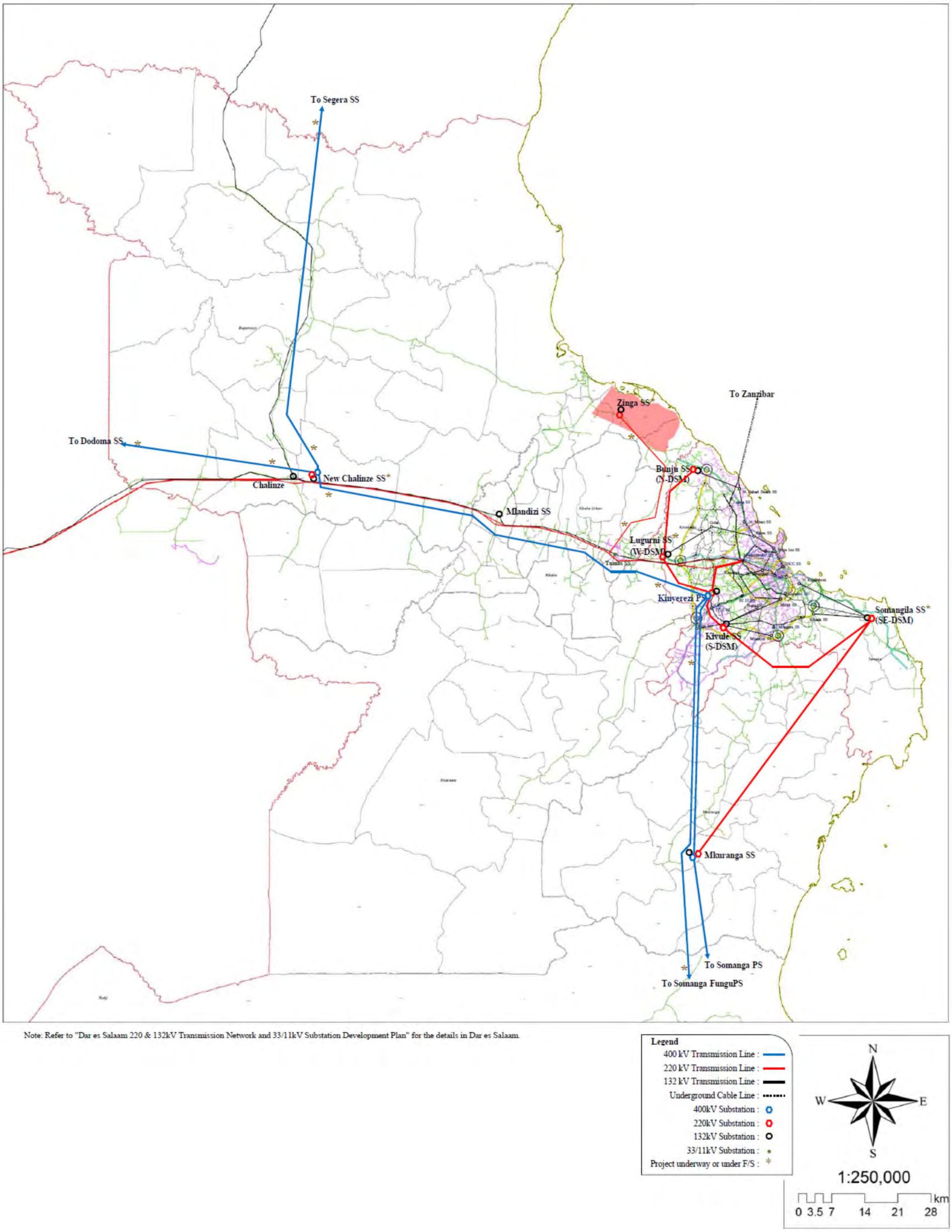
Source: JICA Study Team

Figure 5-2.5 Transmission Network Diagram of Dar es Salaam for year 2030



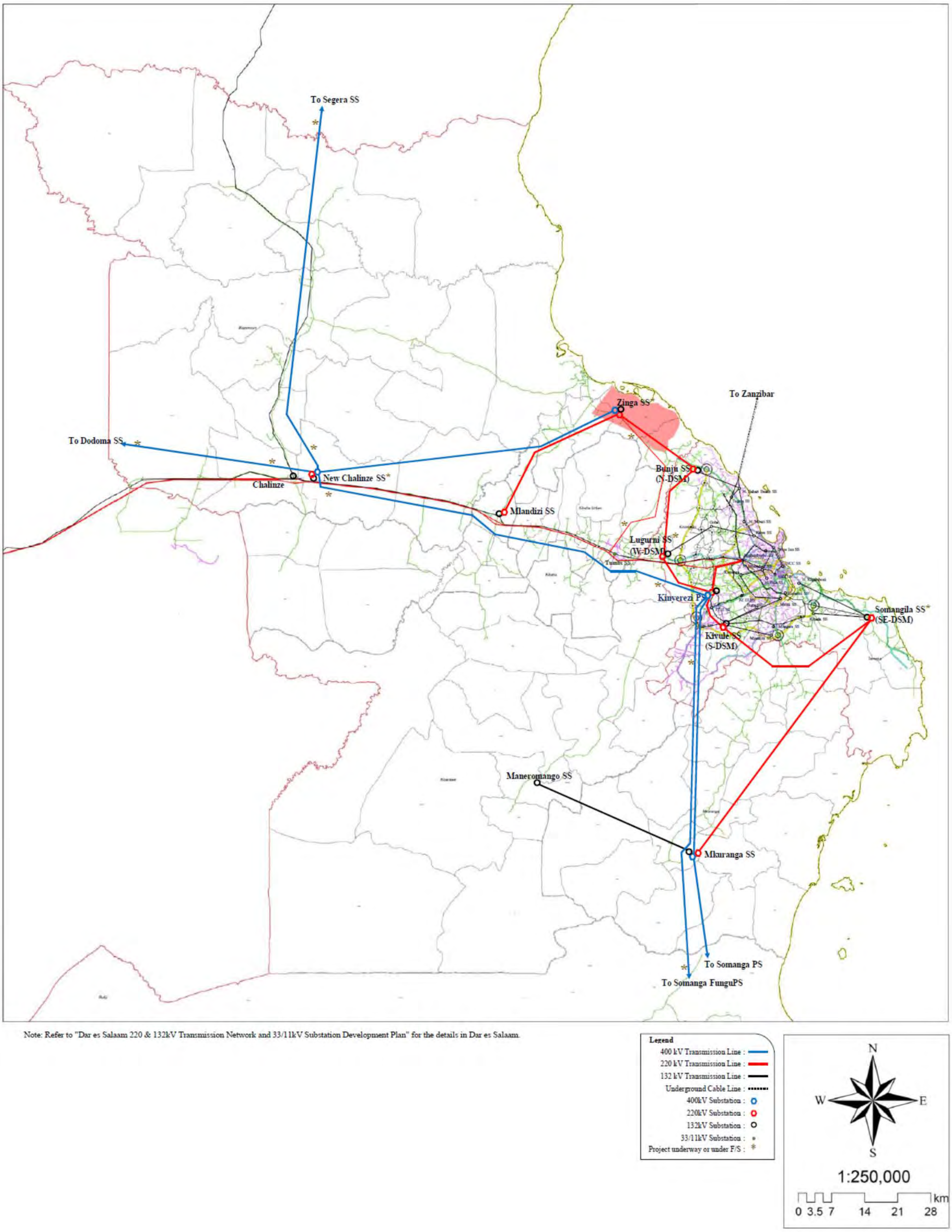
Source: JICA Study Team

Figure 5-2.6 General Transmission Network Map of Dar es Salaam and Coast Region for year 2020



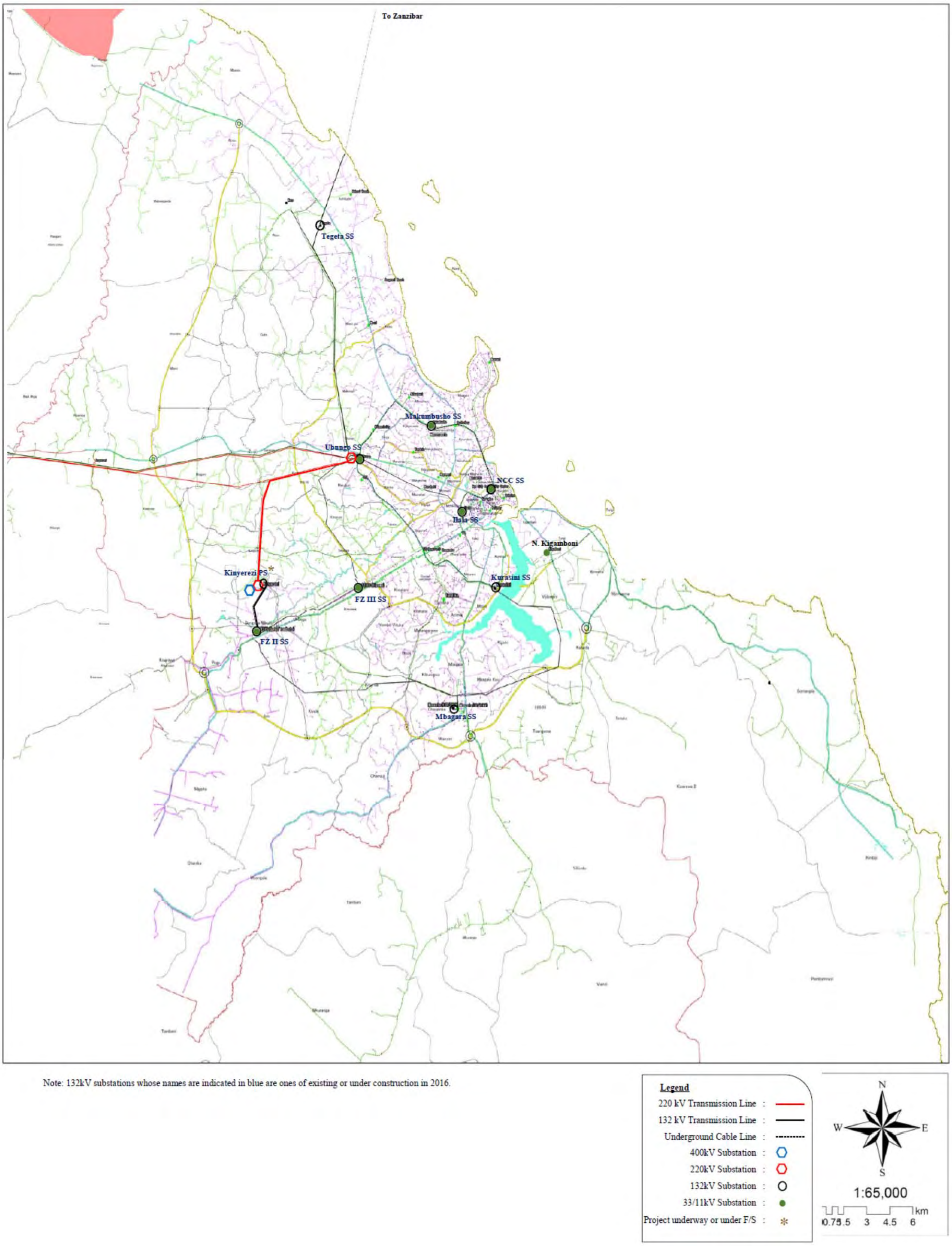
Source: JICA Study Team

Figure 5-2.7 General Transmission Network Map of Dar es Salaam and Coast Region for year 2025



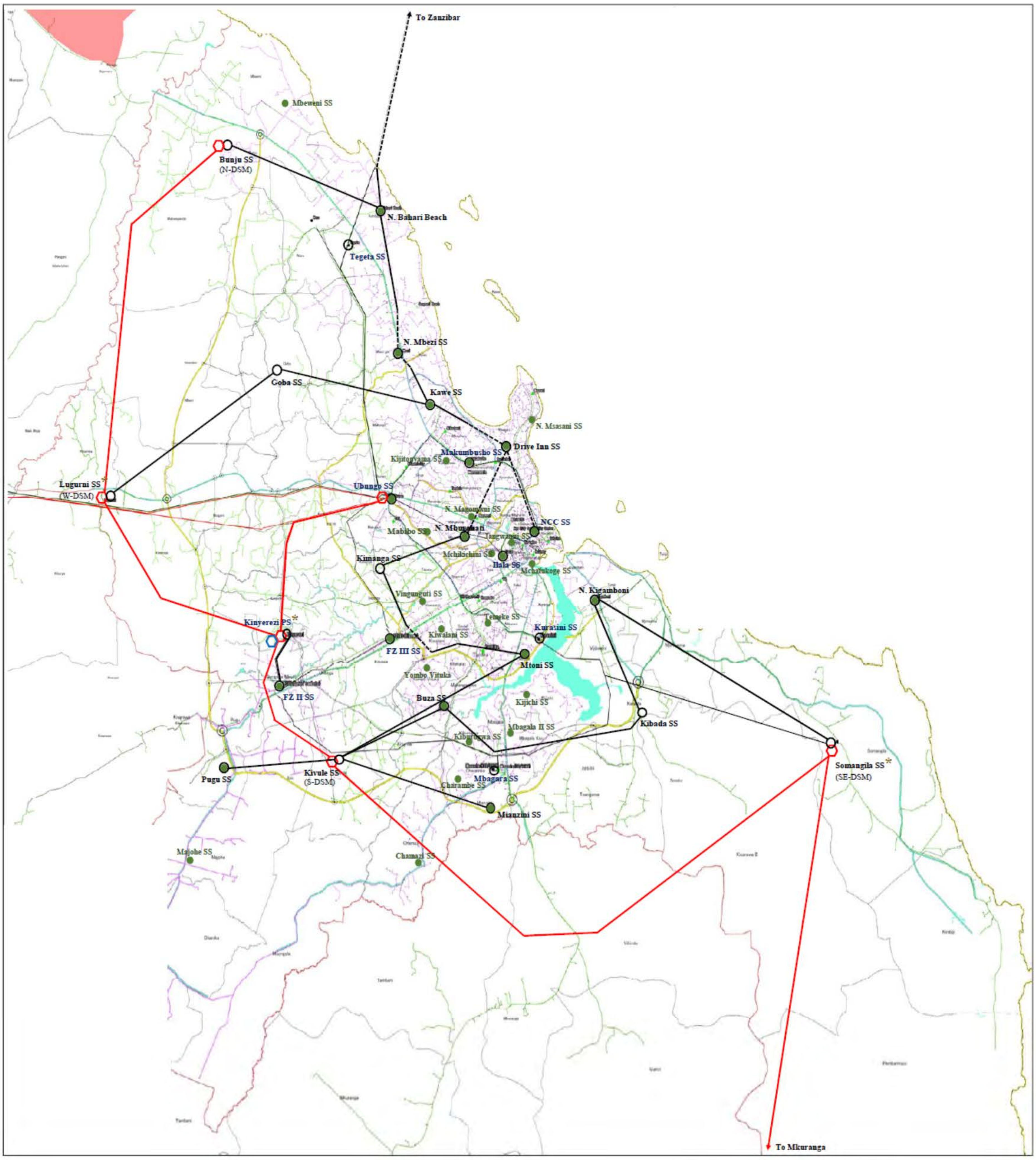
Source: JICA Study Team

Figure 5-2.8 General Transmission Network Map of Dar es Salaam and Coast Region for year 2030

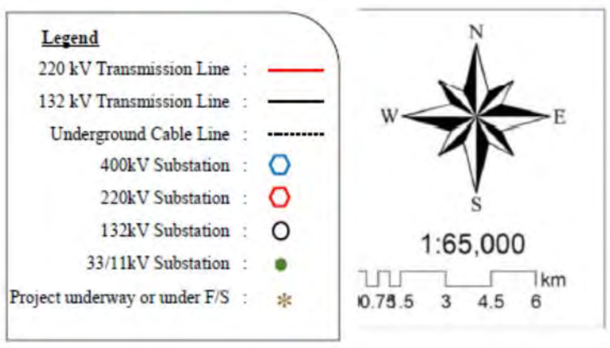


Source: JICA Study Team

Figure 5-2.9 General Transmission Network Map of Dar es Salaam for year 2020

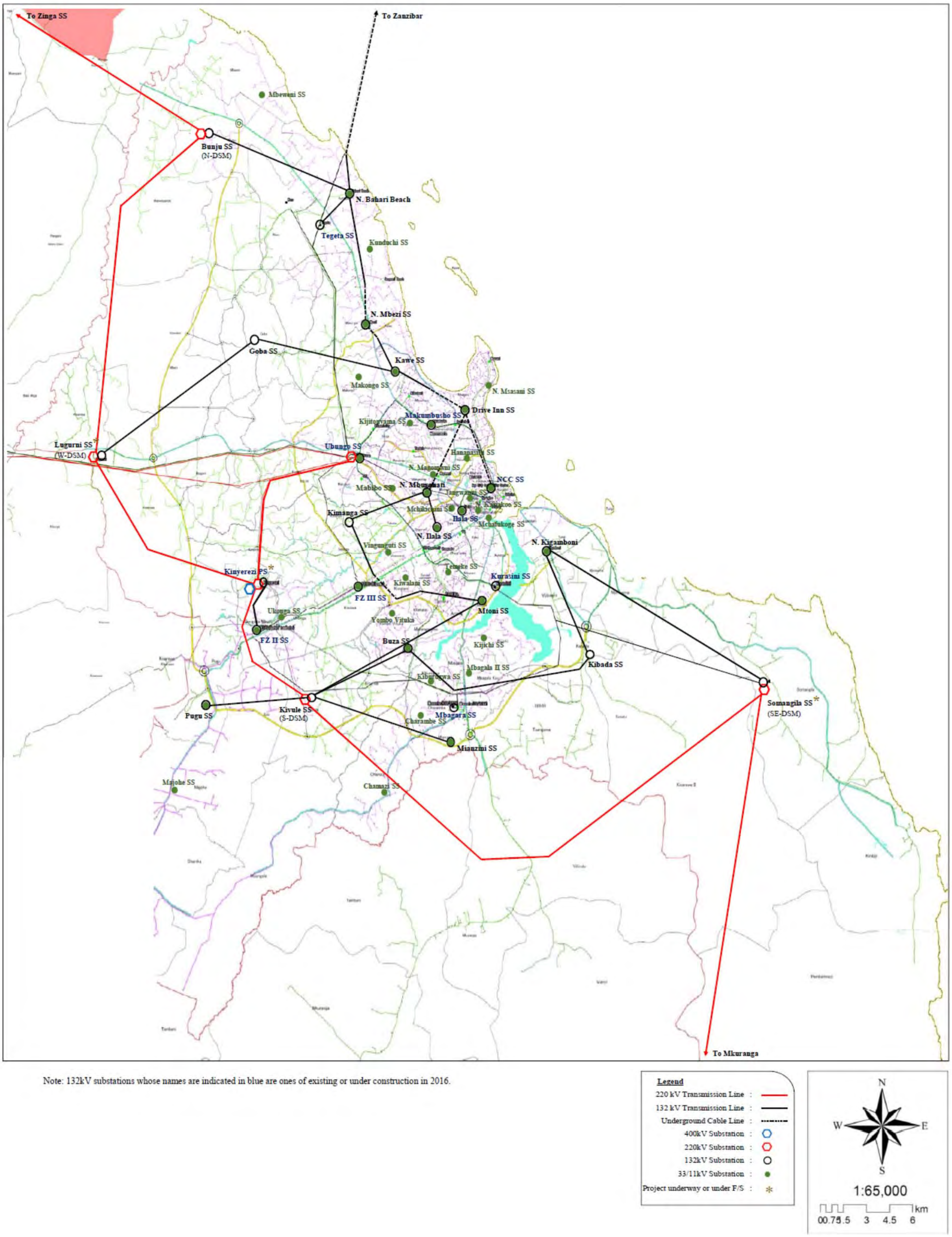


Note: 132kV substations whose names are indicated in blue are ones of existing or under construction in 2016.



Source: JICA Study Team

Figure 5-2.10 General Transmission Network Map of Dar es Salaam for year 2025



Note: 132kV substations whose names are indicated in blue are ones of existing or under construction in 2016.

Source: JICA Study Team

Figure 5-2.11 General Transmission Network Map of Dar es Salaam for year 2030

Table 5-2.8 Transmission Lines 132 kV and above required in DSM and Coast Region until year 2030

No	Rated Voltage (kV)	from	to	Route Length (km)	No. of Circuit	Conductor/Cable			Year to be Com-missioned	Current Rating*1 (Amps)	Full Rating (MVA)	Normal Rating*2 (MVA)	Remarks
						Code Name	No. of Cond. per Phase	Aluminum Sectional Area (mm2)					
1	400	Somanga Fungu PS	Kinyerezi PS	212	2	Bluejay	8	564	2018	1,092	12,105	9,684	Three switching stations between power stations to be considered for Statcom (var compensator) installation
2	400	Kinyerezi PS	N. Chalinze SS	138	2	Bluejay	4	564	2020	1,092	6,052	4,842	Bidding completed
3	400	N. Chalinze SS	Segera SS	175	1	Bluejay	4	564	2020	1,092	3,026	2,421	Bidding completed
4	400	N. Chalinze SS	Segera SS	175	1	Bluejay	4	564	2020	1,092	3,026	2,421	Additional line to the above mentioned is required.
5	400	N. Chalinze SS	Dodoma SS	336	1	Bluejay	2	564	2020	1,092	1,513	1,210	
6	400	Mkuranga SS	Somanga PS	185	2	Bluejay	8	564	2022	1,092	12,105	9,684	To adjust Somanga PS start operation in 2022（Mkuranga PS in PSMP 2016 Update）, Exact location unknown
7	400	Mkuranga SS	Kinyerezi PS	85	2	Bluejay	8	564	2022	1,092	12,105	9,684	To adjust Somanga PS start operation in 2022（Mkuranga PS in PSMP 2016 Update）
8	400	N. Chalinze SS	Zinga SS (Bagamoyo)	100	2	Bluejay	8	564	2030	1,092	12,105	9,684	
9	220	Kinyerezi PS	Ubungo SS	12	2	Bluejay	1	564	2020	1,092	832	666	Special measures required in Ubungo SS
10	220	Bunju SS (North DSM)	Lugurni SS (West DSM)	35	2	Bluejay	2	564	2025	1,092	1,664	1,332	
11	220	Kinyerezi PS	Lugurni SS (West DSM)	21	2	Bluejay	4	564	2025	1,092	3,329	2,663	
12	220	Kinyerezi PS	Kivule SS (South DSM)	15	2	Bluejay	4	564	2025	1,092	3,329	2,663	
13	220	Kivule SS (South DSM)	Somangila SS (South-east DSM)	60	2	Bluejay	2	564	2025	1,092	1,664	1,332	
14	220	Mkuranga SS	Somangila SS (South-east DSM)	95	2	Bluejay	4	564	2025	1,092	3,329	2,663	
15	220	Zinga SS (Bagamoyo)	Bunju SS (North DSM)	29	2	Bluejay	4	564	2030	1,092	3,329	2,663	
16	220	Zinga SS (Bagamoyo)	Mlandizi SS	51	2	Bluejay	1	564	2030	1,092	832	666	Mlandizi SS to be upgraded to 220kV SS
17	132	Kinyerezi PS	FZ-II SS	5	2	Hawk	2	242	2020	659	603	482	
18	132	N. Chalinze SS	Branch to Chalinze SS	0.5	1	Wolf	1	150	2020	406	93	74	To cut-in to existing line from Mlandizi SS to Chalinze SS for interconnecting New Chalinze SS
19	132	N. Chalinze SS	Branch to Mlandizi SS	0.5	1	Wolf	1	150	2020	406	93	74	To cut-in to existing line from Mlandizi SS to Chalinze SS for interconnecting New Chalinze SS
20	132	Bunju SS (North DSM)	N. Bahari Beach SS	15	2	Rail	2	483	2025	993	908	726	
21	132	Buza SS	Kibada SS	20	1	Rail	2	483	2025	993	454	363	
22	132	Drive Inn SS	N. Mburahati SS	15	1	XLPE Cu	2	1,600	2025	882	403	323	
23	132	Drive Inn SS	NCC SS	10	1	XLPE Cu	2	1,600	2025	882	403	323	
24	132	Goba SS	Kawe SS	15	1	Rail	2	483	2025	993	454	363	
25	132	Kawe SS	Drive Inn SS	5	1	Rail	2	483	2025	993	454	363	
26	132	Kawe SS	Drive Inn SS	5	1	XLPE Cu	2	1,600	2025	882	403	323	
27	132	Kivule SS (South DSM)	Mtoni SS	20	2	Rail	2	483	2025	993	908	726	
28	132	Kivule SS (South DSM)	Mianzini SS	15	2	Rail	1	483	2025	993	454	363	
29	132	Kivule SS (South DSM)	Pugu SS	12	2	Rail	1	483	2025	993	454	363	
30	132	Kivule SS (South DSM)	Buza SS	12	1	Rail	2	483	2025	993	454	363	
31	132	Kivule SS (South DSM)	Branch to FZ-II SS	0.5	1	Rail	1	483	2025	993	227	182	To cut-in to existing lone from FZ-II SS to Mbagala SS for interconnecting Kivule SS. To secure high reliability of existing 132 kV ring line.
32	132	Kivule SS (South DSM)	Branch to Mbagala SS	0.5	1	Rail	1	483	2025	993	227	182	To cut-in to existing lone from FZ-II SS to Mbagala SS for interconnecting Kivule SS. To secure high reliability of existing 132 kV ring line.
33	132	Lugurni SS (West DSM)	Goba SS	20	2	Rail	2	483	2025	993	908	726	
34	132	Mtoni	Kimanga SS	15	2	Rail	2	483	2025	993	908	726	
35	132	Mtoni	Kimanga SS	4	2	XLPE Cu	2	1,600	2025	882	807	645	
36	132	N. Bahari Beach SS	N. Mbezi SS	10	1	Rail	2	483	2025	993	454	363	
37	132	N. Bahari Beach SS	N. Mbezi SS	4	1	XLPE Cu	2	1,600	2025	882	403	323	
38	132	N. Kigamboni SS	Kibada SS	12	1	Rail	2	483	2025	993	454	363	
39	132	N. Mbezi SS	Kawe SS	4	1	Rail	1	483	2025	993	227	182	
40	132	N. Mbezi SS	Kawe SS	2	1	XLPE Cu	1	1,600	2025	882	202	161	
41	132	N. Mburahati SS	Kimanga SS	10	1	Rail	2	483	2025	993	454	363	
42	132	Somangila SS (South-east DSM)	N. Kigamboni SS	25	1	Rail	2	483	2025	993	454	363	
43	132	Ubungo SS	Makumbusho SS	7	1	ACCC Hawk	1	310	2026	1,224	280	224	Existing conductor to be replaced for capacity upgrading. After completion of line from Drive Inn SS to NCC SS
44	132	Mkuranga SS	Maneromango SS	55	2	Hawk	1	242	2030	659	301	241	
45	132	N. Bahari Beach SS	Tegeta SS	4	1	Hawk	1	242	2030	659	151	121	
46	132	N. Mburahati SS	N. Ilala SS	5	2	Hawk	2	242	2030	659	603	482	
47	132	Ubungo SS	FZ-III SS	9	2	Hawk	1	242	2030	659	301	241	To secure the capacity of transformers (over 234MVA). To use vacant space of existing towers for doouble circuit.

Source: JICA Study Team

Table 5-2.9 (1) Substation Facilities required in DSM and Coast Region until year 2030

Name of Substations	Year	**Bus Config.**: **1-1/2**; One & Half, **DB**; Double Bus, **SB**; Single Bus, **Line**; Transmission line Bay, **TR**; Transformer Bay, **BC**; Bus Coupler																				Transformer (in MVA)				Capa-citor	Cost (kUS$)
		400 kV				220 kV				132 kV				33 kV				11 kV				Voltage (kV)	Rating (MVA)	Q'ty	Total MVA		
		Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC						
Zinga (Bagamoyo)	2020					DB	2	2	1					SB	8	4	1					220/33	90	2	180		*1
Zinga (Bagamoyo)	2027					DB	1																				*1
Zinga (Bagamoyo)	2030	DB	2	2	1	DB	4	1														400/220	500	2	1,000		*1
Bunju (North DSM)	2025					DB	2	1	1	SB		1	1									220/132	400	1	400		19,180
Bunju (North DSM)	2025					DB		1		SB	2	3		SB	6	2	1					220/132	400	1	400		23,200
																						132/33	100	2	200		
Bunju (North DSM)	2030					DB	2																				1,870
Tegeta	2020									SB		1		SB	1	2		Modification to ONAF (50 -> 65) ->				132/33	65	2	130	60	5,820
Tegeta	2030									SB	1			SB												130	8,080
Bahari Beach	2020													SB		1		SB		1		33/11	15	1	15		1,060
New Bahari Beach	2025									SB	4	3	1	SB	5	4	1	SB	6	2	1	132/33	100	2	200	30	19,030
New bahari Beach	2025																					33/11	30	2	60		
New Bahari Beach	2030									SB	1															140	8,580
New Mbezi	2025									SB	2	2	1	SB	3	2	1	SB	3	1		132/33	75	2	150		11,380
New Mbezi	2030													SB	2	1		SB	3	1	1	33/11	30	1	30		1,990
Kawe	2025									SB	3	2	1	SB	2	3	1	SB	3	1		132/22	75	2	150		13,490
Kawe	2025																					33/11	30	1	30		
Kawe	2030									SB				SB		1		SB	3	1	1	33/11	30	1	30		1,540
Goba	2025									SB	3	2	1	SB	6	2	1					132/33	100	2	200		13,190
Goba	2030													SB	2												300
Drive Inn	2025									SB	3	2	1	SB	3	3	1	SB	3	1		132/33	100	2	200		14,510
Drive Inn	2025																					33/11	30	1	30		
Drive Inn	2030													SB	3												450
Luguruni (West DSM)	2025					DB	4	2	1	DB	2	4	1	SB	6	2	1					220/132	400	2	800		41,840
Luguruni (West DSM)	2025																					132/33	100	2	200		
Kinyerezi	2020					DB	2	2		DB	2	2	1									220/132	200	2	400		16,050
Kinyerezi	2025									DB	4																3,740
Kimanga	2025									SB	3	2	1	SB	6	2	1					132/33	100	2	200		13,190
New Mburahati	2025									SB	2	2	1	SB	5	3	1	SB	3	1		220/132	100	2	200		13,710
New Mburahati	2025																					33/11	30	1	30		
New Mburahati	2030									SB	2																1,400
New City Center	2025									SB	1			SB	1	1	1	SB		1		33/11	15	1	15		1,900
New City Center	2030									SB		1		SB	1	3						132/33	50	1	50	60	6,510
Makumbusho	2020													SB		2		Modification to ONAF (45 -> 55) ->				132/33	55	2	110	35	2,790
Makumbusho	2025													SB	2												300
Makumbusho	2030									SB		1		SB	1	2		SB		1		132/33	60	1	60		3,640
Makumbusho	2030																					33/11	15	1	15		
New Ilala	2030									SB	2	2	1	SB	6	4	1	SB	6	2	1	132/33	100	2	200		16,790
New Ilala	2020																					33/11	30	2	60		
FZ-II	2020									SB	3	1		SB		3		SB		2		132/33	50	1	50		5,530
FZ-II	2020																					33/11	15	2	30		
FZ-III	2020													SB	1	2										15	1,940
FZ-III	2025													SB	1												150
FZ-III	2030									SB	1																700

Source: JICA Study Team

Table 5-2.9 (2) Substation Facilities required in DSM and Coast Region until year 2030

Name of Substations	Year	**Bus Config.**: **1-1/2**; One & Half, **DB**; Double Bus, **SB**; Single Bus, **Line**; Transmission line Bay, **TR**; Transformer Bay, **BC**; Bus Coupler																				Transformer (in MVA)				Capa-citor	Cost (kUS$)
		400 kV				220 kV				132 kV				33 kV				11 kV				Voltage	Rating	Q'ty	Total MVA		
		Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	(kV)	(MVA)				
Kivule (South DSM)	2025					DB	4	1	1	DB		1	1									220/132	400	1	400		20,720
Kivule (South DSM)	2025					DB		1		DB	9	3	1	SB	6	2	1					220/132	400	1	400		26,090
Kivule (South DSM)	2025																					132/33	75	2	150		
Kivule (South DSM)	2030					DB		1		DB		1										220/132	400	1	400		11,970
Mtoni	2025									SB	4	2	1	SB	5	4	1	SB	7	2	1	132/33	100	2	200		17,330
Mtoni	2025																					33/11	30	2	60		
Mtoni	2030									SB		1		SB	1	2		SB	2	1		132/33	100	1	100		5,270
Mtoni	2030																					33/11	30	1	30		
Pugu	2025									SB	2	2	1	SB	4	3	1	SB	3	1		132/33	100	2	200		13,910
Pugu	2025																					33/11	30	1	30		
Kibada	2025									SB	2	2	1	SB	6	2	1					132/33	50	2	100		10,000
New Kigamboni	2020													SB		1		SB	1			33/11	30	1	30		2,690
New Kigamboni	2025									SB	2	2	1	SB	4	3	1	SB	3	1	1	132/33	100	2	200		13,640
New Kigamboni	2025																					33/11	30	1	30		
New Kigamboni	2030													SB		1		SB	3	1		33/11	30	1	30		1,560
Somangila (SE DSM)	2025					DB	4	1	1	DB		1	1									220/132	400	1	400		20,720
Somangila (SE DSM)	2025					DB		1		DB	6	3		SB	6	2	1					220/132	400	1	400		22,100
Somangila (SE DSM)	2025																					33/11	50	2	100		
Kurasini	2020									SB		1		SB		1						132/33	65	1	65	30	4,960
Kurasini	2020																	Modification to ONAF (50 -> 65) ->				132/33	65	1	65		
Kurasini	2025													SB	2	2		SB	3	1		33/11	30	1	30		2,990
Kurasini	2030													SB	2	1	1	SB	3	1	1	33/11	30	1	30		2,140
Buza	2025									SB	2	2	1	SB	5	4	1	SB	7	2	1	132/33	100	2	200		15,570
Buza	2025																					33/11	30	2	60		
Buza	2030									SB	1			SB	3	3		SB	5	2		132/33	100	1	100		6,900
Buza	2030																					33/11	30	1	30		
Mianzini	2025									SB	2	3	1	SB	7	5	1	SB	6	2	1	132/33	100	3	300		19,100
Mianzini	2025																					33/11	30	2	60		
Mbagala	2020									SB		1		SB		2						132/33	65	1	65	45	6,530
Mbagala	2020																	Modification to ONAF (50 -> 65) ->				132/33	65	1	65		
Mbagala	2025													SB	4												600
Mlandizi	2020									DB	3		1														2,690
Mlandizi	2025									DB		2		SB	6	2	1					132/33	50	2	100		5,330
Mlandizi	2030					DB	2	2	1	DB		2										220/132	100	2	200		12,790
New Chalinze	2020	1-1/2	5	3		DB		3	1	DB		1	1									220/132	90	1	90	50	*1
New Chalinze	2020									DB	2																1,400
New Chalinze	2025	1-1/2	2			DB		1		DB		1										220/132	90	1	90		11,425
Mkuranga	2022	DB	2		1																						13,930
Mkuranga	2025	DB		3		DB	2	2	1													400/220	500	2	1,000	50	42,580
Mkuranga	2025					DB		2		DB	2	4	1	SB	6	2	1					220/132	100	2	200		17,340
Mkuranga	2025																					132/33	75	2	150		
Mkuranga	2030	DB		1		DB		1														400/220	500	1	500		2,975
Maneromango	2030									SB	2	2	1	SB	3	2	1					132/33	50	2	100		9,330
Mbweni	2025													SB	1	2		SB	3	1		33/11	15	1	15		2,500
Mbweni	2030													SB	1	1	1	SB	3	1	1	33/11	15	1	15		1,600

Source: JICA Study Team

Table 5-2.9 (3) Substation Facilities required in DSM and Coast Region until year 2030

Name of Substations	Year	**Bus Config.**: **1-1/2**; One & Half, **DB**; Double Bus, **SB**; Single Bus, **Line**; Transmission line Bay, **TR**; Transformer Bay, **BC**; Bus Coupler																				Transformer (in MVA)				Capa-citor	Cost (kUS$)
		400 kV				220 kV				132 kV				33 kV				11 kV				Voltage	Rating	Q'ty	Total MVA		
		Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	(kV)	(MVA)				
Jangwani Beach	2020													SB	1	1	1	SB	3	1	1	33/11	15	1	15		1,600
Mwananyamala	2025													SB	1	1	1	SB	3	1	1	33/11	15	1	15		1,600
Kunduchi	2030													SB	1	2		SB	3	1		33/11	30	1	30		2,890
New Msasani	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Ubungo	2020					DB		1		DB		1										220/132	300	1	300		18,150
Ubungo	2025													SB	1	1		SB		1		33/11	30	1	30		1,660
Ubungo	2030													SB	1												150
Tandale	2020													SB		1		SB		1		33/11	15	1	15		1,060
Mukongo	2030													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Mabibo	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Kijitonyama	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Kijitonyama	2030													SB	1	1	1	SB	3	1	1	33/11	30	1	30		1,990
Hananasifu	2030													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Muhimbili	2020													SB	1	1	1	SB	3	1	1	33/11	15	1	15		1,600
Jangwani	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Mburahati	2030													SB		1		SB		1		33/11	15	1	15		1,570
New Magomeni	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Ilala	2020													SB		1		SB		1		33/11	15	1	15		1,020
Ilala	2025													SB	3												450
Ilala	2030													SB	1												150
New Kariakoo	2030													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Mchafukoge	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Mchikichini	2025													SB	2	3	1	SB	6	2	1	33/11	30	2	60		4,750
FZ-I	2030													SB		1		SB		1		33/11	15	1	15		770
TOL	2025													SB	1	1		SB		1		33/11	15	1	15		1,270
Ukonga	2030													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Majohe	2025													SB	2	3	1	SB	6	2	1	33/11	30	2	60		4,750
Tandika	2020													SB	1	1		SB		1		33/11	15	1	15		1,340
Kiwalani	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Vingunguti	2025													SB	2	3	1	SB	6	2	1	33/11	30	2	60		4,750
Temeke	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Kijichi	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Yombo Vituka	2025													SB	2	3	1	SB	6	2	1	33/11	30	2	60		4,750
Mbagala II	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Mbagala II	2030													SB	1	1	1	SB	3	1	1	33/11	30	1	30		1,990
Kiburugwa	2025													SB	1	2		SB	3	1		33/11	15	1	15		2,500
Kiburugwa	2030													SB	1	1	1	SB	3	1	1	33/11	15	1	15		1,600
Charambe	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Charambe	2030													SB	1	1	1	SB	3	1	1	33/11	30	1	30		1,990
Chamazi	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
New Tumbi	2020													SB	1	2		SB	3	1		33/11	5	1	5		2,240
New Tumbi	2030													SB	1	1	1	SB	3	1	1	33/11	5	1	5		1,340
			2	0	1		8	11	1		80	62	20		178	157	36		184	73	22			139	9,700	545	570,720
		Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Voltage (kV)	Rating (MVA)	Q'ty	Total MVA	Capa-citor	Cost (kUS$)
		400 kV				220 kV				132 kV				33 kV				11 kV									
		Bus Config.: 1-1/2; One & Half, DB; Double Bus, SB; Single Bus, Line; Transmission line Bay, TR; Transformer Bay, BC; Bus Coupler																				Transformer (in MVA)					

Note; 1. The equipment colored in yellow background are included in PSMP2016 update and excluded in the total number of equipment.
2. The cost marked with *1 in Cost column has already been commited.

Source: JICA Study Team

(7) Counter measures in the short term in the master plan (Measures for year 2020)

As mentioned above, it's very difficult to reinforce the power system till 2020 due to very high demand as forecasted. We have to wait up to 2025 in which 220 kV new loop trunk line and their new substations are completed. Hence, as a necessary response in the short term with high urgency, the plans mainly for reinforcement of existing facilities in the Grid are extracted from the master plan for 2020 correspondence.

Since the demand grows day by day, some equipment may be overloaded at the time of peak demand in a day. In such a case, the operators should know the equipment ratings, such as the full ratings, permissible overload ratings, etc. and should operate the equipment or system carefully. (e.g., the rated current of transmission lines in TANESCO is 80% of the continuous permissible current rating, etc.)

1) Measures for Power Inlet Capacity at Dar es Salaam

In accordance with PSMP 2016 update, No: 1 & 4 units at Kinyerezi power plant and No: 1 & 2 units at Somanga Fungu power plant are on line by 2020 and the output of two power plants is delivered to Dar es Salaam through Kinyerezi power plant. However, the transmission line routes from Kinyerezi to Dar es Salaam as of 2017 are only two routes, one is 220 kV transmission line route to Ubungo Substation through 220 kV transmission line (cutting-in between Ubungo and Morogoro line) and another is 132 kV transmission line route to FZ-II through 220/132 kV, 50 MVA transformer

In order to receive the power from Kinyerezi to Dar es Salaam, provided that the power received should match the demand of Dar es Salaam in 2020 and the grid should have a reliability for N-1 condition, the system analysis requires the following measures.

a) Additional 220 kV transmission lines
   - Between Kinyerezi and Ubungo, 12 km, double circuits, Bluejay (564 mm^2) - single conductor

b) Additional 132 kV transmission lines
   - Between Kinyerezi and FZ-II, 5 km, double circuits, Hawk (242 mm^2) - double conductors

c) Additional 220/132 kV transformers at Ubungo substation
   - 2 sets of 300MVA auto-transformer or 3 sets of 150 MVA auto-transformer

     The existing substations, 220/132 kV, one set of 300 MVA transformer is going to install at Ubungo substation.

     [Note] Since the required capacity is total 600 MVA in case of N-1 condition, the case that one 300 MVA transformer is eliminated shows "Not satisfied". Hence, if 300 MVA unit is applied, 2 sets of 300 MVA transformers are necessary.

d) Additional 220/132 kV transformers at Kinyerezi substation
   - 2 sets of 200 MVA transformers (for delivery to FZ-II)

e) Additional 220/132 kV Switchgears at Kinyerezi substation

   220/132 kV Switchgears for the transmission lines and the transformers, listed above.

- 220 kV Switchgears for transmission lines (2 bays) and transformers (2 bays)
- 132 kV Switchgears for transformers (2 bays)

f) Additional 220/132 kV Switchgears at Ubungo substation

220/132 kV Switchgears for the transmission lines and the transformers, listed above.

- 220 kV Switchgears for transmission lines (2 bays) and transformers (2 bays)
- 132 kV Switchgears for transformers (2 bays)

[Note] At Ubungo 132 kV substation, the space for switchgears is limited. It seems that the site condition dose not admit to use air-insulated switchgears. The method of the expansion of the 132 kV bays should be well studied, such as the use of full gas-insulated switchgears, etc.

g) Additional 132 kV Switchgears at FZ II substation

- 132 kV Switchgears for transmission lines (2 bays) and 132 kV Bus expansion

2) Measures for 132/33 kV Transformer Overload

Since the demand increases steadily, it can be considered that some 132/ 33 kV transformers may be overloaded. As a measures of the overload transformers, in case of ONAN (self-cooling) transformers, approximately 20% of increased capacity can be obtained by adding cooling fans to their radiators. In substation with future transformer bays, the transformers should be installed together with associated switchgears.

From the view of distribution lines side, it is another measures that a part of the loads at the transformer with overloads would be shifted to the light loaded transformer in the other substation.

- Substations with future transformer bays;
  FZ-II substation (1 unit), Kurasini substation (1 unit), Mbagala substation (1 unit)
- Substations with ONAN Transformers
  Tegeta substation (2 units), Makumbusho substation (2 units), Kurasini substation (2 units including future unit), Mbagala substation (2 units including future unit)

3) Measures for 33/11 kV Transformer Overload

The same measures as 132/33 kV transformers can be applied. The following substations have future transformer bays.

- Substations with future transformer bays;
  Bahari Beach substation (2nd unit), Jangwani Beach substation (2nd unit), Tandale substation (2nd unit), Muhimbili substation (2nd unit), Ilala substation (4th unit), FZ-II (2nd & 3rd units) & Tandika substation (2nd unit)

4) Measures for Maintaining of Voltage

It is necessary for maintaining the system voltage within allowable range to install capacitors in the particular substations to compensate for the voltage drop caused by heavy load.

- Substations for application of additional capacitors

Tegeta (132 kV & 33 kV), Makumbusho (33 kV), FZ III (33 kV), Kurasini (33 kV) & Mbagala (33 kV)

5) Measures for 132 kV Ubungo - Tegeta Transmission Line Overload

According to PSMP 2016 update, the generated power from power plants around Tegeta substation are very small in 2020, especially none from IPTL (IPP). On the other hand, the high demand is expected in this area and Zanzibar Island. Consequently, the 132 kV Ubungo - Tegeta transmission lines becomes overload. Hence, the generation in Tegeta area should be operated until new transmission lines are installed, so that the existing transmission lines can avoid the overload.

6) Substation Renewal

a) Renewal of Substations with no monitoring, no control and no protections

- Kigamboni substation

  This substation should be renewed including replacement of old transformers (with increasing capacity). The remote terminal unit (RTU) for Distributed Control Center (DCC) has been already installed, however, it is impossible to monitor and control the existing facilities so that the renewal of the substation is required with proper functions which can be controlled by DCC remotely, by using the RTU. It should be noted that the substation should be planned as 132/33 kV substation, since the substation will be upgraded to 132 kV in 2025.

- Tumbi substation

  Since the substation has two different types of 33/11 kV transformers which cannot be synchronized at present, the substation is recommended to be renewed as soon as possible with proper functions as a 33/11 kV substation.

b) Renewal of Substation without Circuit Breakers (CBs) for 132 kV transmission line

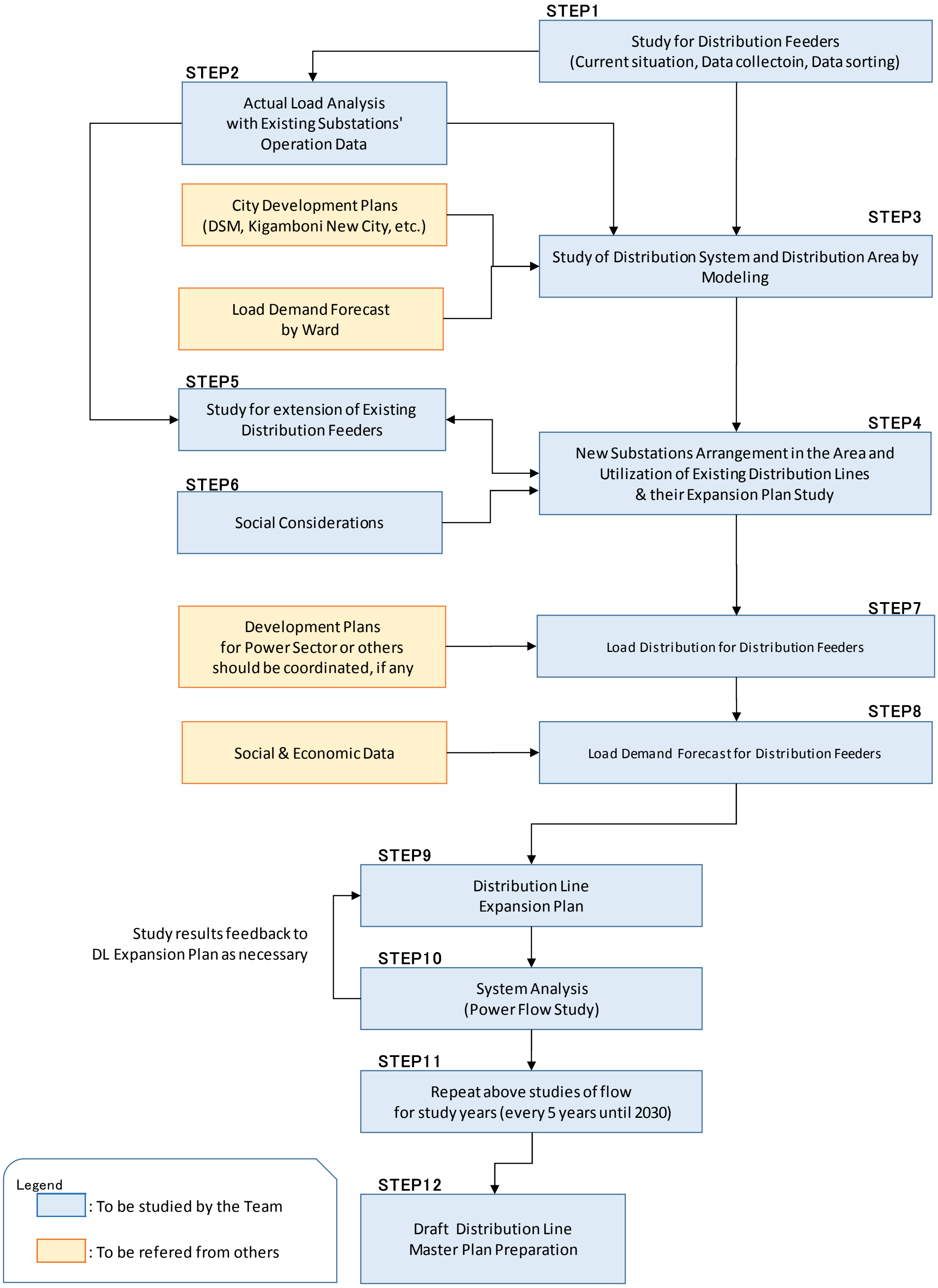
- Mlandizi substation

  Mlandizi substation located between Ubungo and Chalinze substations has no suitable protection function as a 132 kV substation, because there is no 132 kV CBs for 132 kV transmission lines. Hence, immediate substation renewal is required. Since the substation will be of 220 kV substation in 2030, the suitable design as a 132 kV substation should be implemented.

5-2-2 Distribution Facilities

(1) Methodology of Distribution Development Planning for DSMP

Figure 5-2.12 shows flow of methodology to formulate distribution development planning for Dar es Salaam and Coast Regions.



Source: JICA Study Team

Figure 5-2.12 Methodology of Distribution Development Planning for DSMP

In this Methodology of Distribution Development Planning, existing information such as urban planning, socio-economic data, and the regional demand forecasts and power generation development plans from the national power system master plan (hereinafter PSMP), are also utilized. The outline of the planning methodology is as follows.

- **STEP 1 Study For Distribution Feeders**
  Carry out a survey of existing substations in the project area and neighboring areas in order to confirm the deterioration of existing power distribution facilities, line data, and distribution methods to reflect them in the Development Planning.
  Details of the existing power distribution facilities confirmed by the survey are described in 5-1-2.

- **STEP 2 Actual Load Analysis With Existing Substations' Operation Data**
  Understand the electricity supply and demand situation in the project area.
  Specifically, summarize past power supply and demand results, current load records and overload conditions, and the details and causes for power outages in each region.
  Past power demand and supply results are described in Chapter 3. The number of planned outages as well as power failures, and the surrounding details, are as described in 5-1-2.

- **STEP 3 Study of distribution system and distribution area by modeling**
  Based on the power demand forecast formulated in Chapter 4, and from the confirmed status of the existing power distribution system, review the power distribution methods and distribution area and create a power distribution model within the project region.

- **STEP 4 New substations' arrangement in the area and utilization of existing distribution lines and their expansion plan study**
  Study the distribution area of the new substation and the utilization and renewal of existing distribution feeders, subject to the Distribution Development Planning.

- **STEP 5 Study for extension of existing distribution feeders**
  Study the necessity of increasing the existing distribution feeders against the future demand forecast.

- **STEP 6 Social Considerations**
  Consider the local community, for example, in selecting distribution methods (overhead and underground) that match the future plans of the region, and in choosing equipment, such as support structures, that can secure clearance in line with regulations.

- **STEP 7 Load distribution for distribution feeders**
  If there is an existing distribution development plan, consider the load distribution of the distribution feeders in accordance with the plan.

- **STEP 8 Load demand forecast for distribution feeders**
  Based on the socio-economic data, verify that the planned distribution feeder will meet the future demand forecast.

- **STEP 9 Distribution Line Expansion Plan**
  Compile the contents of the study up to Step 8 into a draft distribution line expansion plan.
  In case there are changes to the contents of the Distribution Development Planning in the system analysis check of STEP 10, the Distribution Line Expansion Plan is re-examined.

- **STEP 10 System Analysis**
  Feedback concerning amendments to the transmission/transformation plan is performed if considered necessary following flow analysis and accidental current calculation performed using a system analysis software (PSS@E), and subsequent technical verification.

- **STEP 11 Repeat Studies Every Study Year**
  In this DSMP, as the Planning is up until the year 2030, and reviewed every five years, the necessary steps described above are to be repeated in 2020, 2025 and 2030.

- **STEP 12 Draft Distribution Line Master Plan Preparation**
  Compile the contents of the study up to STEP 11 to formulate the Distribution Line Master Plan.

(2) Basic Concept of Distribution Line Expansion Plan

1) Utilization of different voltage classes at distribution facilities

There are two different voltage classes at the distribution facilities in Dar es Salaam and Coast regions; medium voltage 33kv and 11kV. According to interviews from TANESCO, 33kV was at first treated as a sub-transmission in urban areas, and 11kV was used for distribution. In regional areas 33kV was being reduced to direct low voltage and then supplied to consumers. Later the use of 33kV distribution began in urban areas as well and currently the two voltages are mixed.

As the demand increases and the area of demand grows, there is need to expand the distribution network while also considering improvements to the distribution system. This survey was conducted by examining the existing distribution facilities as much as possible. However, since opinions at TANESCO are not unified and the materials necessary for a discussion (plan drawings and data) are insufficient, the plan was created to take into account both a future unification of distribution voltage (33 kV) and the cost aspect (11 kV facilities are superior).

2) Utilization of existing distribution lines

It is necessary to develop distribution lines in accordance with increase of future load demand, however, existing distribution database is still under maintenance and there are lack of data and human error to input data. Moreover, distribution system is constantly changed for daily operation and maintenance. Thus assumed sample existing system is also necessary to consider distribution planning.

In the study, distribution areas in each section of the year 2020, 2025 and 2030 were set up in order to utilize existing distribution lines to find out necessity of reinforcement (re-use or re-connection to another substation) or replacement (renew after removal).

With regard to cost calculation, reinforcement was not considered in terms of utilization of existing facilities of system its self but replacement was considered.

3) Regional distribution expansion study to meet future power demand

In order to meet the demand forecast per ward, the distribution area, the range of the distribution line, and the capacity of the transformer are selected and inputted to distribution model sheet to confirm voltage drop at the distribution end point with maximum load using the distance covered from the distribution substation to the relevant ward as the basis.

There are voices within TANESCO calling for the unification of the distribution voltage at 33 kV, and apart from considering the effective utilization (reinforcement/conversion) of existing power distribution facilities, and sequential upgrading in view of a future unification of power distribution voltage, consideration should be given to extended power distribution lines.

Table 5-2.10 shows concept for distribution expansion planning in the cover area of 132kV substations.

Table 5-2.10 Concept for Distribution Expansion

No	District	132kV Substations	Existing /New	Concept for Distribution Expansion
1	Kinondoni	Tegeta SS	E	Currently 33kV medium voltage is adapted to supply power to a large consumer (Wazo cement factory) and Kinondoni north regions. In order to share loads with Bunju SS (N-DSM), N. Bahari Beach SS, N. Mbezi SS, Kawe SS and Goba SS to follow increase of future load demand, existing distribution facilities and system shall be utilized and replacement of small size conductor is recommended at the change of connection to other substations.
2	Kinondoni	Bunju SS (N-DSM)	N	In the city development master plan, new satellite center is planned and expected load demand increase enormously. New 33kV distribution lines should be expanded.
3	Kinondoni	N. Bahari Beach SS	N	In order to reduce loads at Tegeta SS, distribution system should be expanded with upgrade of the existing 33/11kV substation to 132kV substation.
4	Kinondoni	N. Mbezi SS	N	In order to reduce loads at Tegeta SS, distribution system should be expanded with upgrade of the existing 33/11kV substation to 132kV substation.
5	Kinondoni	Kawe SS	N	The rich area to be developed hotels and restaurants
6	Kinondoni	Goba SS	N	Existing distribution network is not enough for future new customers thus expected to expand 33kV distribution network.
7	Kinondoni	Ubungo SS	E	The main substation of Dar es Salaam to supply power to Cost, Kinondoni and Ilala regions widely. Load share with other primary substations is necessary. Thus expansion of distribution system is not expected but connection change to other substations or replacement of small size conductors would be effective.
8	Kinondoni	Makumbusho SS	E	In order to reduce loads at Ubungo SS, expansion of distribution system is not expected but reinforcement with the existing facilities will be considered.

No	District	132kV Substations	Existing /New	Concept for Distribution Expansion
9	Kinondoni	Drive Inn SS	N	In along with on-going regional development in Msasani, load demand will be highly grown and this substation will be main supply point for distribution lines.
10	Kinondoni	NCC SS	E	Construction of new substation supported by the Finnish government is about to commission. Because of this support and the support from AfDB, power distribution to consumers in the urban area will be improved. Some under distribution lines will be considered.
11	Kinondoni	Lugurni SS (W-DSM)	N	Planning is on-going located near Muhimbili University area. In the Dar es Salaam city master plan, new satellite center is planned in this area and distribution system should be ready to meet the load demand.
12	Kinondoni	N. Mburahati SS	N	33/11kV Mburahati SS is under construction by TEDAP. Magomeni area and Ndugumbi area seems like weak distribution network.
13	Ilala	Ilala SS	E	The Main primary substation to supply power to urban areas. Currently transmission, substation and distribution system are strengthening by JICA, Finnish government, TEDAP and AfDB supports. In the future load for Ilala substation should be reduced. Thus expansion of distribution system is not expected but power supply from secondary substation should be maintained.
14	Ilala	N. Ilala SS	N	In order to stabilize loads at Ilala substation, distribution system at Ilala area, Buguruni area and Vingunguti area should be reinforced.
15	Ilala	FZ II SS	E	Currently upgrading is on-going by TEDAP. Distribution network in the distribution cover area is weak and 33kV medium voltage network should be adapted in the area.
16	Ilala	Pugu SS	N	In the city development master plan, new industrial district is planned. In addition, New satellite center is also planned. In this area, large consumers are expected thus 33kV medium voltage for such customers and 11kV medium voltage will be planned for general consumers.
17	Ilala	FZ III SS	E	In order to relief current heavy load, load sharing with other primary substation will be expected thus existing distribution system is not expanded but utilization or replacement of small conductors to bigger capacity would be effective.
18	Ilala	Kimanga SS	N	In line with load demand increase and new connections to customers, 33kV medium voltage distribution system will be considered in un-development areas.
19	Ilala	Kivule SS (S-DSM)	N	In line with load demand increase and new connections to customers, 33kV medium voltage distribution system will be considered in south part of Dar es Salaam.
20	Temeke	Kurasini SS	E	Currently upgrading to 132kV system is on-going by TEDAP. This area is industrials and physical distribution area. Mainly 33kV distribution system will be considered to improve power supply.
21	Temeke	Mtoni SS	N	The heavy loads at Kurasini should be shared with Mtoni SS for stable power supply in the areas. 33kV medium voltage distribution system for large users and 11kV medium voltage distribution system for general used should be improved.
22	Temeke	Buza SS	N	In the existing distribution system, most of the network is 11kV,

No	District	132kV Substations	Existing /New	Concept for Distribution Expansion
				however in terms of future regional development, 33kV medium voltage system should be adapted.
23	Temeke	Somangila SS (SE-DSM)	N	In the area, one circuit 33kV distribution line is operated to supply power widely in low voltage system. This area has started developing and 33kV distribution expansion should be followed with the development properly.
24	Temeke	N. Kigamboni SS	N	This will be the main substation to supply developed area of city development master plan. In line with upgrading existing 33/11kV substation, distribution system in 33kV medium voltage should also be constructed to contribute to city development.
25	Temeke	Kibada SS	N	In the city master plan, new satellite center is planned in the area. Existing 33kV medium voltage line will be utilized to expand distribution network.
26	Temeke	Mbagala SS	E	Currently upgrading to 132kV is on-going by TEDAP. 33kV medium voltage should also be developed to meet the load demand in the future.
27	Temeke	Mianzini SS	N	This substation will be located in Temeke region and will be main distribution substation to supply power to Tambani, Mkuranga, Vikindu and Vianzi areas where rates of electrification and load demand growth are expected in the future. 33kV medium voltage system should be adapted.
28	Bagamoyo	Chalinze SS	E	Currently long distribution line on all sides is operated. In order to relief the existing line additional line should be considered to improve 33kV medium voltage system.
29	Kibaha	Mlandizi SS	E	Same as Chalinze SS. Currently long distribution line on all sides is operated. In order to relief the existing line additional line should be considered to improve 33kV medium voltage system.
30	Bagamoyo	Zinga SS	N	New development of the first Special Economic Zone (SEZ) is planned including new port development. In line with the development plan, 33kV medium voltage network in underground cable should be considered.
31	Mkuranga	Mkuranga SS	N	Currently one long distribution line is operated. In order to meet electricity access widely, 33kV medium voltage network should be expanded.
32	Kisarawe	Maneromango SS	N	Same as Mkuranga SS. Currently one long distribution line is operated. In order to meet electricity access widely, 33kV medium voltage network should be expanded.

Source: JICA Study Team

4) Distribution line expansion study with distribution models (33kV distribution line)

The system configuration is an always-on single-line supply tree system, but it is modeled after a three-sectionalized and three-connected system so that even if a failure occurs in a power distribution section, the failure section can be limited and a power interchange performed. For this purpose a load break switch is installed at the main branch point and the linkage point to limit the extent of the outage during the power failure, change the system configuration, and to operate the load current.

Based on results from TANESCO, the conductor of the overhead line shall be ACSR150mm^2, which is also the standard, and the rated capacity shall be 80% of the allowable continuous current.

Recently, TANESCO has increased its use of 33kV underground line. The utilization of underground lines is also considered for urban areas, and CuXLPE185mm^2, the standard of TANESCO, is used as a model.

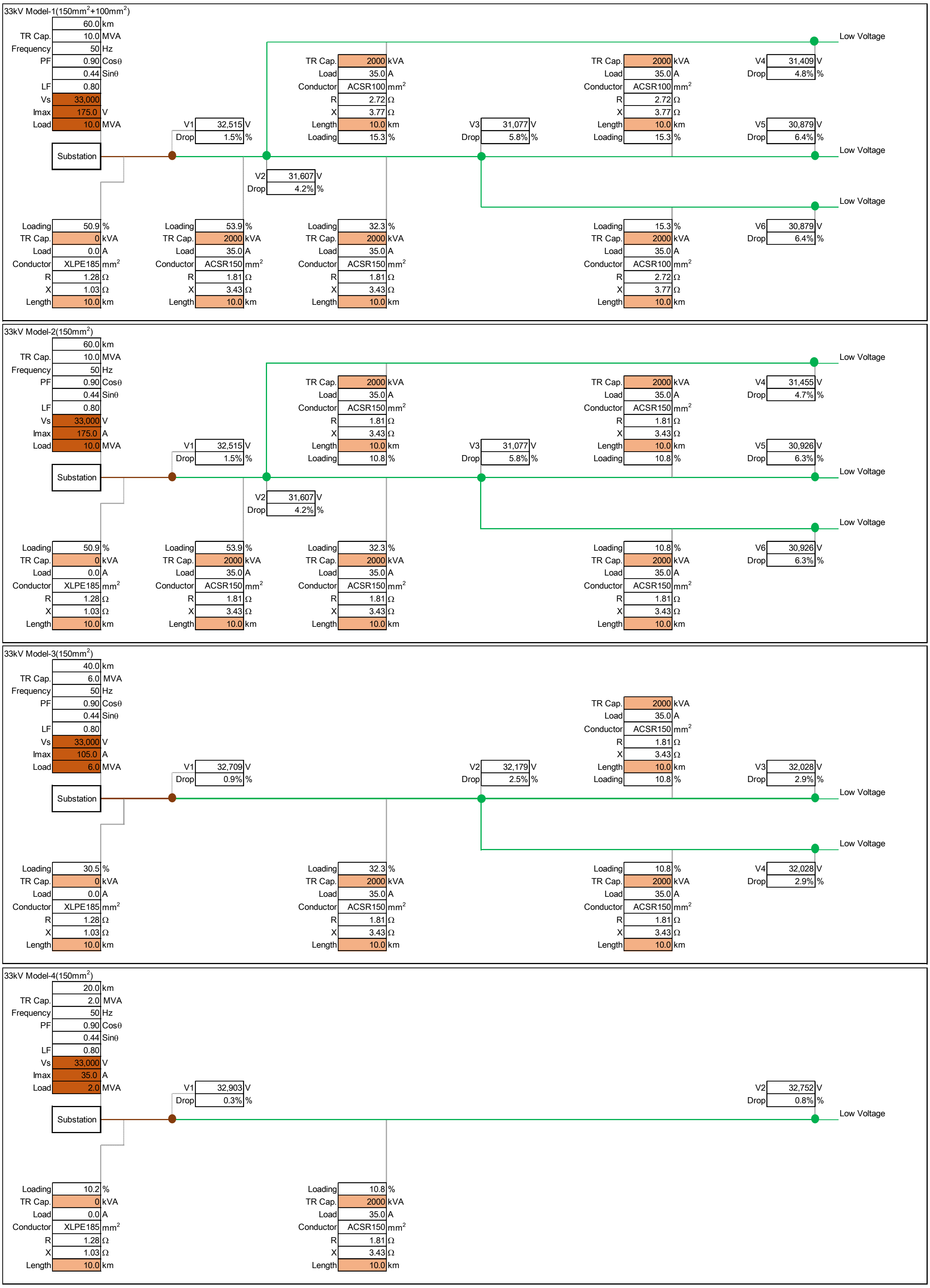
The support structures of overhead lines are modeled after wooden and steel pipe poles, and for long-distance distribution lines switches are installed at a span of about 10 km, in addition to main branch points. Furthermore, RMUs are installed in the underground distribution lines so that transformer protection and operation of system interconnection can be performed.

Existing distribution transformers operated by TANESCO have a wide range from 25 kVA to 2750 kVA. However, in this survey, we plan to use 100 kVA, 200 kVA, 315 kVA, and 500 kVA, which are TANESCO's standards, as the target models and establish a plan that forecasts future demand.

Although the service life of distribution facilities vary depending on the equipment used, it is generally estimated to be between 20 and 40 years, and in this survey, a facility plan that can withstand the demands of the master plans' final year is considered. The voltage drop of the distribution line should be within 5% at the end of the trunk line, and the distribution facility capacity within 10% at the end of the branch line.

In the study, maximum load per one distribution system was basically kept about 60% in view of inter connection with another distribution system. However, there were some cases to exceed 60% in high load density wards. Thus position of load break switches should be considered.

The sample models for the 33 kV distribution lines used in this study are shown below.



Source: JICA Study Team

Figure 5-2.13 Sample models for 33kV distribution lines

5) Distribution line expansion study with distribution models (11kV distribution line)

The system configuration is an always-on single-line supply tree system, the same as for the 33 kV power distribution line. However, it is modeled after a three-sectionalized and three-connected system so that even if a failure occurs in a power distribution section, the failure section can be limited and a power interchange performed. For this purpose a load break switch is installed at the main branch point and the linkage point to limit the extent of the outage during the power failure, change the system configuration, and to operate the load current.

Based on results from TANESCO, the conductor of the overhead line shall be ACSR100mm^2, which is also the standard, and the rated capacity shall be 80% of the allowable continuous current.

Recently, TANESCO has increased its use of 33kV underground line. The utilization of underground lines is also considered for urban areas, and CuXLPE95mm^2, the standard of TANESCO, is used as a model.

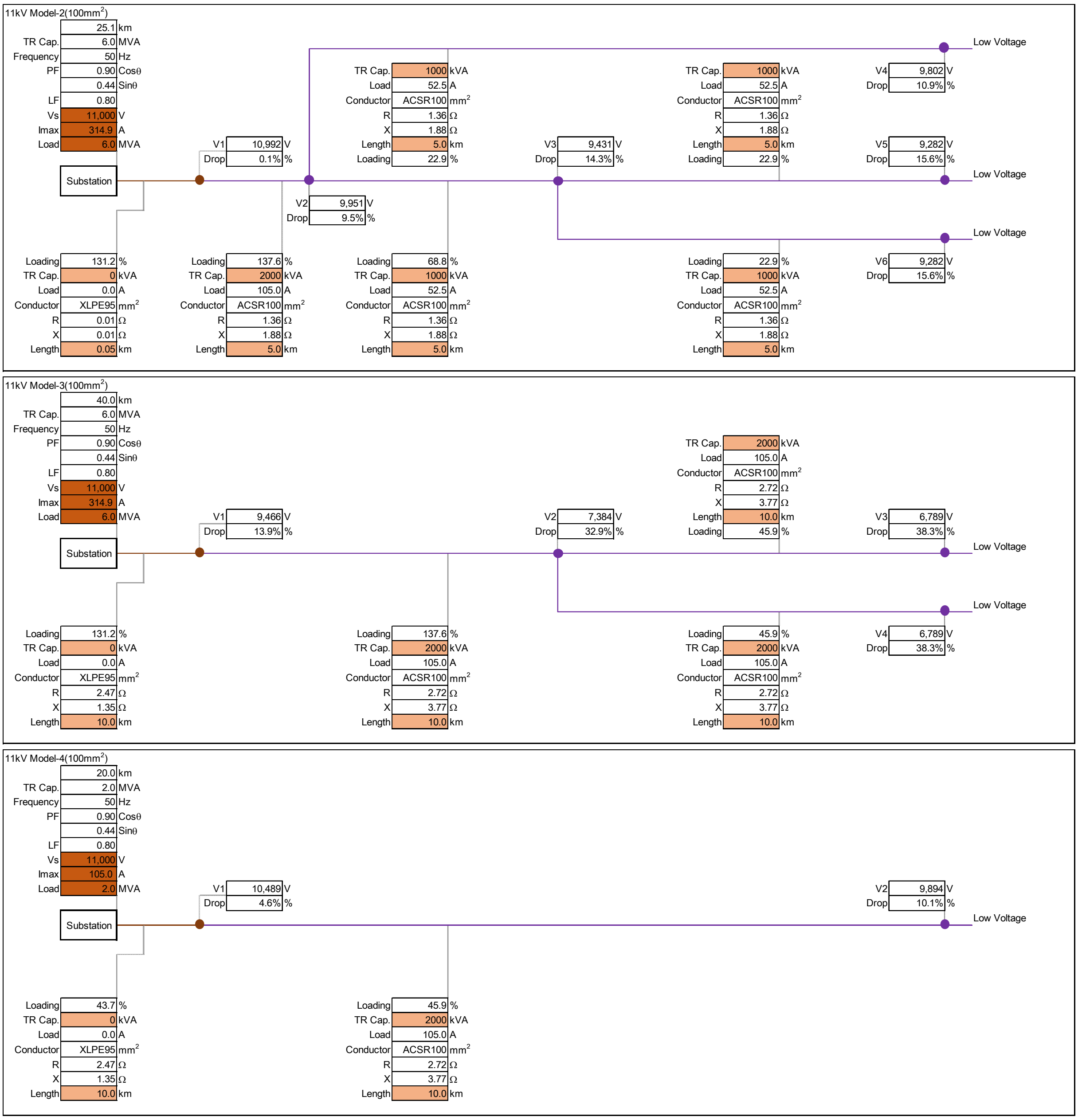
The support structures of overhead lines are modeled after wooden and steel pipe poles, and for long-distance distribution lines switches are installed at a span of about 10 km, in addition to main branch points. Furthermore, RMUs are installed in the underground distribution lines so that transformer protection and operation of system interconnection can be performed.

Existing distribution transformers operated by TANESCO have a wide range from 25 kVA to 2750 kVA. However, in this survey, we plan to use 100 kVA, 200 kVA, 315 kVA, and 500 kVA, which are TANESCO's standards, as the target models and establish a plan that forecasts future demand.

Although the service life of distribution facilities vary depending on the equipment used, it is generally estimated to be between 20 and 40 years, and in this survey, a facility plan that can withstand the demands of the master plans' final year is considered. The voltage drop of the distribution line should be within 5% at the end of the trunk line, and the distribution facility capacity within 10% at the end of the branch line.

In the study, maximum load per one distribution system was basically kept about 60% in view of inter connection with another distribution system. However, there were some cases to exceed 60% in high load density wards. Thus position of load break switches should be considered.

The sample models for the 11 kV distribution lines used in this study are shown below.



Source: JICA Study Team

Figure 5-2.14 Sample models for 11kV distribution lines

(3) Distribution Line Expansion Plan

1) Definition of distribution facilities

Followings are categories and definitions of distribution expansion plan on this masterplan.

A 132/33kV SS to 33/11kV SS : Distribution line from 132/33kV primary substations to 33/11kV secondary substations

B New / New (2cct) : New construction or extension of distribution lines

C Rep (Replacement) : : Replacement of existing distribution lines including removal, disconnection works

D Rein (Reinforcement) : Reinforcement of existing distribution lines by utilizing existing distribution lines including reconnection works (excluded from cost estimation

2) Summary of distribution line expansion plan

Table 8-3.1 summarizes the overall length of distribution lines per voltage type and the number of feeders required for new construction, reinforcement and renewal of substations, per regional office of TANESCO that control the distribution target areas.

In the short term, until 2020, increases in load will be covered by renewal of existing facilities, or connection changes at substations. In the medium term, until 2025, the distribution network will be expanded and by 2030 further expansion of the system will be carried out.

Table 5-2.11 Summary of distribution line expansion by region (Length and feeders)

Region	Unit	2020				2025				2030			
		New	New (2cct)	Rein	Rep	New	New (2cct)	Rein	Rep	New	New (2cct)	Rein	Rep
Kinondoni North Region													
Distance (33kV Feeder)	km	54.5	25.1	25.2	24.4	246.1	0.0	76.9	147.8	116.4	0.0	0.0	0.0
Distance (11kV Feeder)	km	22.4	0.0	5.3	9.2	43.5	72.0	0.0	30.8	80.6	74.7	0.0	0.0
Distance (Total)	km	76.9	25.1	30.5	33.6	289.6	72.0	76.9	178.5	197.0	74.7	0.0	0.0
Number of Feeder (33kV)	Nos.	5	1	2	1	21	0	5	2	11	0	0	0
Number of Feeder (33kV)	Nos.	4	0	1	1	5	10	0	2	9	7	0	0
Number of Feeder (Total)	Nos.	9	1	3	2	26	10	5	4	20	7	0	0
Kinondoni South Region													
Distance (33kV Feeder)	km	40.0	0.0	0.0	34.2	101.3	0.0	55.0	0.0	46.1	0.0	0.0	0.0
Distance (11kV Feeder)	km	70.5	0.0	0.0	0.0	24.4	21.2	0.0	0.0	20.4	21.2	0.0	0.0
Distance (Total)	km	110.5	0.0	0.0	34.2	125.7	21.2	55.0	0.0	66.5	21.2	0.0	0.0
Number of Feeder (33kV)	Nos.	4	0	0	2	8	0	3	0	3	0	0	0
Number of Feeder (33kV)	Nos.	5	0	0	0	4	2	0	0	4	2	0	0
Number of Feeder (Total)	Nos.	9	0	0	2	12	2	3	0	7	2	0	0
Ilala Region													
Distance (33kV Feeder)	km	6.0	18.1	0.0	0.0	74.0	50.5	0.0	0.0	92.7	10.6	0.0	0.0
Distance (11kV Feeder)	km	6.0	0.0	0.0	0.0	81.8	70.4	0.0	50.8	80.2	0.0	0.0	0.0
Distance (Total)	km	12.0	18.1	0.0	0.0	155.8	120.9	0.0	50.8	172.9	10.6	0.0	0.0
Number of Feeder (33kV)	Nos.	4	1	0	0	14	5	0	0	17	1	0	0
Number of Feeder (33kV)	Nos.	2	0	0	0	15	4	0	6	14	0	0	0
Number of Feeder (Total)	Nos.	6	1	0	0	29	9	0	6	31	1	0	0
Temeke Region													
Distance (33kV Feeder)	km	38.7	0.0	0.0	0.0	379.6	0.0	144.4	145.8	133.0	0.0	0.0	0.0
Distance (11kV Feeder)	km	3.5	0.0	0.0	0.0	128.1	0.0	73.2	82.9	23.7	0.0	0.0	0.0
Distance (Total)	km	42.2	0.0	0.0	0.0	507.7	0.0	217.6	228.8	156.7	0.0	0.0	0.0
Number of Feeder (33kV)	Nos.	4	0	0	0	34	0	4	10	12	0	0	0
Number of Feeder (33kV)	Nos.	1	0	0	0	17	0	12	2	3	0	0	0
Number of Feeder (Total)	Nos.	5	0	0	0	51	0	16	12	15	0	0	0
Coast Region													
Distance (33kV Feeder)	km	24.0	0.0	80.0	0.0	482.8	0.0	234.0	0.0	667.2	0.0	40.0	0.0
Distance (11kV Feeder)	km	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.2	0.0	0.0	0.0
Distance (Total)	km	24.0	0.0	80.0	0.0	482.8	0.0	234.0	0.0	687.4	0.0	40.0	0.0
Number of Feeder (33kV)	Nos.	3	0	3	0	10	0	4	0	14	0	1	0
Number of Feeder (33kV)	Nos.	0	0	0	0	0	0	0	0	2	0	0	0
Number of Feeder (Total)	Nos.	3	0	3	0	10	0	4	0	16	0	1	0

Source: JICA Study Team

3) Details of distribution line expansion plan

From Table 5-2.12 to Table 5-2.16 show distribution expansion plan of each substation located in targeted councils or regions in Dar es Salaam and Coast regions.

Furthermore, from Table 5-2.17 to Table 5-2.21 show assumed number of distribution transformer and switch.

Distribution areas of each section in the year 2020, 2025 and 2030 shows in Attachment S-4 for reference.

Table 5-2.12 Distribution Expansion Plan (Kinondoni North Region)

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)
Kinondoni North Region															
Tegeta															
Tegeta	33kV	TG1	Wazo II	Rep	24.4	24.3	0.1	Rein	24.4	24.3	0.1		24.4	24.3	0.1
		TG2	Mbeji		8.4	8.3	0.1	Rep	8.4	8.3	0.1		8.4	8.3	0.1
		TG3	Bagamoyo		139.3	139.0	0.3	Rep	139.3	139.0	0.3		139.3	139.0	0.3
		TG4	Bahari Beach		3.2	3.2	0.0	Rein	3.2	3.2	0.0		3.2	3.2	0.0
		TG5	Wazo-1	New	35.1	35.0	0.1	Rein	35.1	35.0	0.1		35.1	35.0	0.1
		TG6	Spare		7.7	7.7	0.0	Rein	7.7	7.7	0.0		7.7	7.7	0.0
		TG7	Jangwani Beach		6.5	6.4	0.1	Rein	6.5	6.4	0.1		6.5	6.4	0.1
			Wazo-3	New (2cct)	25.1	25.0	0.1		25.1	25.0	0.1		25.1	25.0	0.1
			Wazo-4		25.1	25.0	0.1		25.1	25.0	0.1		25.1	25.0	0.1
			Wazo-5									New	19.1	19.0	0.1
		New	Bahari Beach SS	New	3.2				3.2				3.2		
		New	Jangwani Beach SS	New	6.5				6.5				6.5		
Bahari Beach	33kV		Wazo area					N. Bahari				N. Bahari			
			Tegeta		3.2	3.2	0.0								
		New	Tegeta	New	3.2										
	11kV	BB1			12.2	12.0	0.2								
		BB2			59.7	59.5	0.2								
		BB5			41.4	40.6	0.7								
Jangwani Beach	33kV		Tegeta		6.5	6.4	0.1	N. Mbezi				N. Mbezi			
		New	Tegeta	New	6.5										
	11kV	F1	Kawe	New	5.1	5.0	0.1								
		F2	Kunduchi-1	New	5.1	5.0	0.1								
		F3	Kunduchi-2	New	5.1	5.0	0.1								
Mbezi	33kV		Tegeta	Ubungo				N. Mbezi				N. Mbezi			
	11kV		Kunduchi												
			Packers												
			Lugalo												
			Mwenge												
Bunju (N-DSM)															
Bunju (N-DSM)	33kV	New	Mbweni					New	16.0				16.0		
(New)		New	Mbweni									New	16.0		
		F1	Bunju-1					New	18.1	18.0	0.1		18.1	18.0	0.1
		F2	Bunju-2					New	18.1	18.0	0.1		18.1	18.0	0.1
		F3	Bunju-3									New	18.1	18.0	0.1
		F4	Mabwepande-1					New	24.1	24.0	0.1		24.1	24.0	0.1
		F5	Mabwepande-2									New	24.1	24.0	0.1
Mbeweni	33kV	New	Bunju (N-DSM)						16.0				16.0		
(New)		New	Bunju (N-DSM)										16.0		
	11kV	F1	Mbweni-1					New	12.1	12.0	0.1		12.1	12.0	0.1
		F2	Mbweni-2					New	12.1	12.0	0.1		12.1	12.0	0.1
		F3	Mbweni-3									New	12.1	12.0	0.1
		F4	Mbweni-4									New	12.1	12.0	0.1

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Voltage	Feeder No.	Feeder Name	2020 Rein Rep New	2020 Total (km)	2020 Overhead Line (km)	2020 Cable (km)	2025 Rein Rep New	2025 Total (km)	2025 Overhead Line (km)	2025 Cable (km)	2030 Rein Rep New	2030 Total (km)	2030 Overhead Line (km)	2030 Cable (km)
N. Bahari Beach															
N. Bahari Beach	33kV	New	Kunduchi									New	6.0		
(New)															
	11kV	F1	Kunduchi					New (2cct)	12.1	12.0	0.1		12.1	12.0	0.1
									12.1	12.0	0.1		12.1	12.0	0.1
		F2	Kunduchi					New (2cct)	12.1	12.0	0.1		12.1	12.0	0.1
									12.1	12.0	0.1		12.1	12.0	0.1
		F3	Kunduchi									New (2cct)	12.1	12.0	0.1
													12.1	12.0	0.1
		F4	Kunduchi									New (2cct)	12.1	12.0	0.1
													12.1	12.0	0.1
Bahari Beach	33kV		Wazo area	Tegeta											
			Tegeta						3.2	3.2	0.0		3.2	3.2	0.0
			Tegeta						3.2				3.2		
	11kV	BB1							12.2	12.0	0.2		12.2	12.0	0.2
		BB2							59.7	59.5	0.2		59.7	59.5	0.2
		BB5							41.4	40.6	0.7		41.4	40.6	0.7
Kunduchi	33kV	New	N. Bahari Beach									New	6.0		
(New)															
	11kV	F1	Kunduchi-1									New	12.1	12.0	0.1
		F2	Kunduchi-2									New	12.1	12.0	0.1
		F3	Kunduchi-3									New	12.1	12.0	0.1
N. Mbezi															
N. Mbezi	33kV		Jangwani Beach						6.5				6.5		
(New)		New	Jangwani Beach					New	9.0				9.0		
	11kV	F1	Kawe									New (2cct)	12.1	12.0	0.1
													12.1	12.0	0.1
		F2	Makongo									New (2cct)	12.1	12.0	0.1
													12.1	12.0	0.1
Mbezi	33kV		N. Mbezi	Ubungo					8.4	8.3	0.1		8.4	8.3	0.1
			Ubungo						14.0				14.0		
	11kV		Kunduchi						21.3	21.0	0.2		21.3	21.0	0.2
			Packers						22.8	22.3	0.6		22.8	22.3	0.6
			Lugalo						16.7	16.5	0.2		16.7	16.5	0.2
			Mwenge						17.9	17.6	0.3		17.9	17.6	0.3
Jangwani Beach	33kV		N. Mbezi	Tegeta					6.5	6.4	0.1		6.5	6.4	0.1
		New	N. Mbezi					New	9.0				9.0		
	11kV	F1							5.1	5.0	0.1		5.1	5.0	0.1
		F2							5.1	5.0	0.1		5.1	5.0	0.1
		F3							5.1	5.0	0.1		5.1	5.0	0.1
		F4	Kawe									New (2cct)	12.1	12.0	0.1
													12.1	12.0	0.1
Kawe															
Kawe	33kV	New	Mikocheni					New	4.0				4.0		
(New)															
	11kV	F1	Kijitonyama					New (2cct)	5.1	5.0	0.1		5.1	5.0	0.1
									5.1	5.0	0.1		5.1	5.0	0.1
		F2	Kijitonyama					New (2cct)	5.1	5.0	0.1		5.1	5.0	0.1
									5.1	5.0	0.1		5.1	5.0	0.1
		F3	Kijitonyama									New (2cct)	5.1	5.0	0.1
													5.1	5.0	0.1
Mikocheni	33kV	New	Kawe	Makumbusho				New	4.0				4.0		
			Mikocheni						3.2	3.1	0.1		3.2	3.1	0.1
	11kV								5.3	5.1	0.2		5.3	5.1	0.2
									12.9	12.4	0.5		12.9	12.4	0.5
									10.1	9.1	1.0		10.1	9.1	1.0
									8.7	8.5	0.2		8.7	8.5	0.2
									0.4	0.0	0.4		0.4	0.0	0.4
									11.6	11.2	0.4		11.6	11.2	0.4

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)
Goba															
Goba	33kV	F1	Goba-1					New	11.1	11.0	0.1		11.1	11.0	0.1
(New)		F2	Goba-2									New	11.1	11.0	0.1
		F3	Kimara					New	17.1	17.0	0.1		17.1	17.0	0.1
		F4	Mbezi-1					New	28.1	28.0	0.1		28.1	28.0	0.1
		F5	Mbezi-2					New	28.1	28.0	0.1		28.1	28.0	0.1
		F6	Saranga					New	21.6	21.5	0.1		21.6	21.5	0.1
		F7	Makongo					New	21.6	21.5	0.1		21.6	21.5	0.1
Makumbusho															
Makumbusho	33kV	H00	Msasani2		7.6	7.5	0.1		7.6	7.5	0.1		7.6	7.5	0.1
		H02	Msasani1		8.3	8.3	0.0		8.3	8.3	0.0		8.3	8.3	0.0
		H03	Oysterbay		1.6	1.6	0.0		1.6	1.6	0.0		1.6	1.6	0.0
		H09	Industry		5.6	5.5	0.2		5.6	5.5	0.2		5.6	5.5	0.2
		H10	Mikocheni		3.2	3.1	0.1		3.2	3.1	0.1		3.2	3.1	0.1
		H13	Mwananyamala		1.1	0.9	0.2		1.1	0.9	0.2		1.1	0.9	0.2
		J07	Mak3	Rein	11.8	10.9	0.9		11.8	10.9	0.9		11.8	10.9	0.9
		J08	Mak4	Rein	13.4	12.8	0.6		13.4	12.8	0.6		13.4	12.8	0.6
		New	Mwananyamala					New	1.1				1.1		
		New	Kijitonyama					New	3.0				3.0		
		New	Kijitonyama									New	3.0		
Oysterbay	33kV		Makumbusho		1.6	1.6	0.0	Drive Inn				Drive Inn			
	11kV				3.5	3.4	0.1								
					14.5	14.1	0.5								
					6.1	6.0	0.1								
				Rein	5.3	5.2	0.1								
Mikocheni	33kV		Makumbusho		3.2	3.1	0.1	Kawe				Kawe			
	11kV				5.3	5.1	0.2								
					12.9	12.4	0.5								
					10.1	9.1	1.0								
					8.7	8.5	0.2								
					0.4	0.0	0.4								
					11.6	11.2	0.4								
Msasani	33kV		Makumbusho1		8.3	8.3	0.0		8.3	8.3	0.0		8.3	8.3	0.0
			Makumbusho2		7.6	7.5	0.1		7.6	7.5	0.1		7.6	7.5	0.1
	11kV	F1		Rep	9.2	8.0	1.2		9.2	8.0	1.2		9.2	8.0	1.2
		F2			9.9	9.0	0.9		9.9	9.0	0.9		9.9	9.0	0.9
		F3			11.6	10.9	0.7		11.6	10.9	0.7		11.6	10.9	0.7
		F4	Msasani-1	New	7.1	7.0	0.1		7.1	7.0	0.1		7.1	7.0	0.1
		F5	Msasani-2					New	7.1	7.0	0.1		7.1	7.0	0.1
		F6	Msasani-3					New	7.1	7.0	0.1		7.1	7.0	0.1
Mwananyamala	33kV		Makumbusho		1.1	0.9	0.2		1.1	0.9	0.2		1.1	0.9	0.2
		New	Makumbusho					New	1.1				1.1		
	11kV	F1			16.2	15.0	1.2	Rep	16.2	15.0	1.2		16.2	15.0	1.2
		F2			9.9	9.0	0.9		9.9	9.0	0.9		9.9	9.0	0.9
		F3			11.6	10.9	0.7		11.6	10.9	0.7		11.6	10.9	0.7
		F4	Mwananyamala					New	5.1	5.0	0.1		5.1	5.0	0.1
Kijitonyama	33kV	New	Makumbusho					New	3.0				3.0		
(New)		New	Makumbusho									New	3.0		
	11kV	F1	Kijitonyama-1					New (2cct)	9.1	9.0	0.1		9.1	9.0	0.1
			Kijitonyama-2						9.1	9.0	0.1		9.1	9.0	0.1
		F2	Kijitonyama-3					New (2cct)	9.1	9.0	0.1		9.1	9.0	0.1
			Kijitonyama-4						9.1	9.0	0.1		9.1	9.0	0.1
		F3	Mikocheni									New (2cct)	9.1	9.0	0.1
													9.1	9.0	0.1

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)
Drive Inn															
Drive Inn	33kV	New	Oysterbay SS					New	2.0				2.0		
(New)		New	N. Msasani SS					New	4.0				4.0		
		New	Hananasifu SS									New	5.0		
	11kV	F1	Msasani-1					New (2cct)	6.1	6.0	0.1		9.1	9.0	0.1
			Msasani-2						6.1	6.0	0.1		9.1	9.0	0.1
		F2	Hananasifu-1					New (2cct)	6.1	6.0	0.1		9.1	9.0	0.1
			Hananasifu-2						6.1	6.0	0.1		9.1	9.0	0.1
		F3	Kinondoni									New	6.1	6.0	0.1
Oysterbay	33kV	New	Drive Inn	Makumbusho				New	2.0				2.0		
			Makumbusho												
	11kV								3.5	3.4	0.1		3.5	3.4	0.1
								Rep	14.5	14.1	0.5		14.5	14.1	0.5
									6.1	6.0	0.1		6.1	6.0	0.1
									5.3	5.2	0.1		5.3	5.2	0.1
N. Msasani	33kV	New	Makumbusho						4.0				4.0		
(New)															
	11kV	F1	Msasani-1					New (2cct)	3.6	3.5	0.1		3.6	3.5	0.1
			Msasani-2						3.6	3.5	0.1		3.6	3.5	0.1
		F2	Msasani-3					New (2cct)	3.6	3.5	0.1		3.6	3.5	0.1
			Msasani-4						3.6	3.5	0.1		3.6	3.5	0.1
		F3	Msasani-5									New	3.6	3.5	0.1
Hananasif	33kV	New	Makumbusho									New	5.0		
(New)															
	11kV	F1	Hananafasi-1									New	5.2	5.1	0.1
		F2	Hananafasi-2									New	5.2	5.1	0.1

Source: JICA Study Team

Table 5-2.13 Distribution Expansion Plan (Kinondoni South Region)

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)
Kinondoni South Region															
Ubungo															
Ubungo	33kV	New	Tandale	New	6.0				6.0				6.0		
		New	Mbezi	New	14.0				14.0				14.0		
		New	Makongo									New	9.0		
		New	Mabibo					New	5.0						
			Wazo2		22.0	21.9	0.1		22.0	21.9	0.1		22.0	21.9	0.1
			Nordic	Rep	17.1	17.0	0.1		17.1	17.0	0.1		17.1	17.0	0.1
			Tazara												
			FZ31		3.8	3.7	0.0		3.8	3.7	0.0		3.8	3.7	0.0
			Nordic	Rep	17.1	17.0	0.1		17.1	17.0	0.1		17.1	17.0	0.1
			FZ32		4.6	4.6			4.6	4.6			4.6	4.6	
			Magomeni/Mlimani City		9.5	8.9	0.6		9.5	8.9	0.6		9.5	8.9	0.6
			Wazo1		15.1	15.1			15.1	15.1			15.1	15.1	
			Tandale		1.5	1.5			1.5	1.5			1.5	1.5	
			Texile		1.5	1.5			1.5	1.5			1.5	1.5	
	11kV	U1	Mandela Road		14.4	14.1	0.4		14.4	14.1	0.4		14.4	14.1	0.4
		U2	Ubungo Terminal		7.1	7.0	0.2		7.1	7.0	0.2		7.1	7.0	0.2
		U7	NIT		7.8	7.6	0.2		7.8	7.6	0.2		7.8	7.6	0.2
		U8	Ubungo												
		U9	TANESCO		19.1	18.4	0.7		19.1	18.4	0.7		19.1	18.4	0.7
Mlimanicity	33kV		Ubungo/Mlimanicity		9.5	8.9	0.6		9.5	8.9	0.6		9.5	8.9	0.6
					22.2	21.2	1.0		22.2	21.2	1.0		22.2	21.2	1.0
	11kV	K1	Mlimanicity(Ring)												
		K2	Mlimanicity(Ring)												
		K7	University	New	21.1	21.0	0.1		21.1	21.0	0.1		21.1	21.0	0.1
Tandale	33kV	New	Ubungo	New	6.0				6.0				6.0		
			Ubungo		1.5	1.5			1.5	1.5			1.5	1.5	
			Ilala												
	11kV	Tan1			3.6	3.6			3.6	3.6			3.6	3.6	
		Tan2			3.9	3.9			3.9	3.9			3.9	3.9	
		Tan4			1.9	1.9			1.9	1.9			1.9	1.9	
		F1	Manzese-1	New	7.1	7.0	0.1		7.1	7.0	0.1		7.1	7.0	0.1
		F2	Manzese-2					New	7.1	7.0	0.1		7.1	7.0	0.1
		F3	Kinondoni					New	7.1	7.0	0.1		7.1	7.0	0.1
EPZ	33kV		Ubungo		4.6	4.6			4.6	4.6			4.6	4.6	
	11kV		Private												
Magomeni	33kV		Ubungo/Mlimanicity		9.5	8.9	0.6	N. Mburahati				N. Mburahati			
	11kV	MG1			5.4	5.4									
		MG2			2.6	2.6	0.1								
		MG3			7.3	7.3									
		MG4			2.7	2.7									
Mburahati	33kV		Ubungo					N. Mburahati				N. Mburahati			
	11kV	F1	Kigogo-1	New	14.1	14.0	0.1								
		F2	Kigogo-2	New	14.1	14.0	0.1								
		F3	Kigogo-3	New	14.1	14.0	0.1								
Mbezi	33kV		Tegeta		8.4	8.3	0.1	New Mbezi				New Mbezi			
		New	Ubungo	New	14.0										
	11kV		Kunduchi		21.3	21.0	0.2								
			Packers		22.8	22.3	0.6								
			Lugalo		16.7	16.5	0.2								
			Mwenge		17.9	17.6	0.3								

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Voltage	Feeder No.	Feeder Name	2020 Rein Rep New	2020 Total (km)	2020 Overhead Line (km)	2020 Cable (km)	2025 Rein Rep New	2025 Total (km)	2025 Overhead Line (km)	2025 Cable (km)	2030 Rein Rep New	2030 Total (km)	2030 Overhead Line (km)	2030 Cable (km)
Makongo	33kV	New	Ubungo									New	9.0		
(New)															
	11kV	F1	Makongo-1									New	5.1	5.0	0.1
		F2	Makongo-2									New	5.1	5.0	0.1
		F3	Makongo-3									New	5.1	5.0	0.1
Mabibo	33kV	New	Ubungo					New	5.0						
(New)															
	11kV	F1	Mabibo-1					New	5.1	5.0	0.1		5.1	5.0	0.1
		F2	Mabibo-2					New	5.1	5.0	0.1		5.1	5.0	0.1
		F3	Mabibo-3									New	5.1	5.0	0.1
Luguruni															
Luguruni	33kV	F1	Kiluvya					New	34.1	34.0	0.1		35.0	34.0	1.0
(New)		F2	Msigani-1					Rein	15.0	15.0	0.0		15.0	15.0	0.0
		F3	Msigani-2					New	20.1	20.0	0.1		20.1	20.0	0.1
		F4	Kwembe-1					Rein	20.0	20.0	0.0		20.0	20.0	0.0
		F5	Kwembe-2					New	28.1	28.0	0.1		28.1	28.0	0.1
		F6	Kwembe-3									New	28.1	28.0	0.1
		F7	Kibamba					Rein	20.0	20.0	0.0		20.0	20.0	0.0
								0.0							
N. Mburahati															
N. Mburahati	33kV	New	Magomeni					New	3.0				3.0		
(New)		New	N. Magomeni					New	3.0				3.0		
								0.0							
	11kV	F1	Mburahati					New (2cct)	10.6	10.5	0.1		10.6	10.5	0.1
		F2	Kigogo						10.6	10.5	0.1		10.6	10.5	0.1
		F3	mzimuni									New (2cct)	10.6	10.5	0.1
													10.6	10.5	0.1
Mburahati	33kV		Ubungo	Ubungo											
	11kV								14.1	14.0	0.1		14.1	14.0	0.1
									14.1	14.0	0.1		14.1	14.0	0.1
									14.1	14.0	0.1		14.1	14.0	0.1
Magomeni	33kV		Ubungo/Mlimanicity	Ubungo					3.0				3.0		
	11kV	MG1							5.4	5.4			5.4	5.4	
		MG2							2.6	2.6	0.1		2.6	2.6	0.1
		MG3							7.3	7.3			7.3	7.3	
		MG4							2.7	2.7			2.7	2.7	
N. Magomeni	33kV	New	N. Mburahati SS					New	3.0				3.0		
(New)															
	11kV	F1	Ndugumbi-1					New (2cct)	10.6	10.5	0.1		10.6	10.5	0.1
		F2	Ndugumbi-2						10.6	10.5	0.1		10.6	10.5	0.1
		F3	Ndugumbi-3									New (2cct)	10.6	10.5	0.1
													10.6	10.5	0.1

Source: JICA Study Team

Table 5-2.14 Distribution Expansion Plan (Ilala Region)

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Voltage	Feeder No.	Feeder Name	2020 Rein Rep New	2020 Total (km)	2020 Overhead Line (km)	2020 Cable (km)	2025 Rein Rep New	2025 Total (km)	2025 Overhead Line (km)	2025 Cable (km)	2030 Rein Rep New	2030 Total (km)	2030 Overhead Line (km)	2030 Cable (km)
Ilala Region															
New City Center															
New City Center	33kV		New City Center												
			Ilala		4.0	3.7	0.3		4.0	3.7	0.3		4.0	3.7	0.3
			Sokoine		5.0	2.7	2.4		5.0	2.7	2.4		5.0	2.7	2.4
			RMU												
			Muhimbili		2.1	1.7	0.4		2.1	1.7	0.4		2.1	1.7	0.4
			Kariakoo												
		New	Muhimbili SS	New	2.0				2.0				2.0		
		New	Sokoine SS									New	2.0		
		New	Jangwani SS					New	3.0				3.0		
		New	Mchafukoge SS									New	4.0		
City Center	33kV		New City Center												
	11kV	F1													
		F2			5.6	5.0	0.6		12.2	5.6	5.0		12.2	5.6	5.0
		F3			1.6	1.1	0.5		5.6	1.6	1.1		5.6	1.6	1.1
		F4			2.6	1.6	0.9		12.9	2.6	1.6		12.9	2.6	1.6
		F5			2.0	1.0	1.0		5.3	2.0	1.0		5.3	2.0	1.0
		F6			8.9	7.9	1.0	Rep	24.0	8.9	7.9		24.0	8.9	7.9
		F7	Upanga Mashariki									New	3.5	0.0	3.5
		F8			2.8	2.0	0.8		5.8	2.8	2.0		5.8	2.8	2.0
Muhimbili	33kV		New City Center		2.1	1.7	0.4		2.1	1.7	0.4		2.1	1.7	0.4
		New	New City Center	New	2.0										
	11kV	F1	Upanga Magharibi-1	New	3.0	0.0	3.0		3.0	0.0	3.0		3.0	0.0	3.0
		F2	Upanga Magharibi-2	New	3.0	0.0	3.0		3.0	0.0	3.0		3.0	0.0	3.0
		New	Upanga Mashariki-1					New	3.5	0.0	3.5		3.5	0.0	3.5
		New	Upanga Mashariki-2									New	3.5	0.0	3.5
Sokoine	33kV	1.0	Sokoine SP1	Ilala				Ilala							
		3.0	SokoineRailway												
		4.0	RMU												
		6.0	New City Center										5.0	2.7	2.4
		8.0	Kempinski Hotel												
		10.0	Sokoine SP-2										8.8	6.2	2.6
		New	New City Center									New	2.0		
	11kV	PL01	Sokoine-1										0.9	0.5	0.4
		PL02	Sokoine-2												
		PL04	Sokoine-3										4.4	2.0	2.4
		PL05	Sokoine-4										1.9	1.3	0.6
		PL08	Sokoine-5										0.8	0.8	0.0
Railway	33kV		Kariakoo, Ilala	Ilala				Ilala					3.5	2.1	1.4
			Sokoine										0.0	0.0	0.0
	11kV	F01	Water Front										7.4	6.3	1.2
		F02	Clock Tower										0.0	0.0	0.0
		F03	Sokoine Ohio										2.5	1.7	0.8
Jangwani (New)	33kV	New	New City Center					New	3.0				3.0		
	11kV	F1	Jangwani-1					New	3.5	0.0	3.5		3.5	0.0	3.5
		F2	Jangwani-2					New	3.5	0.0	3.5		3.5	0.0	3.5
		F3	Kisutu					New	3.5	0.0	3.5		3.5	0.0	3.5
Mchafukoge (New)	33kV		New City Center					Ilala					4.0		
	11kV	F1	Mchafukoge-1										3.5	3.5	0.0
		F2	Mchafukoge-2										3.5	3.5	0.0
		F3	Gerezeni										3.5	3.5	0.0

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)
Ilala															
Ilala	33kV	H02	Kariakoo UG1												
		H05	Kurasini(KR)		7.0	7.0			7.0	7.0			7.0	7.0	
		H06	Tanzania Oxigen(TOL)		3.0	2.9	0.1		3.0	2.9	0.1		3.0	2.9	0.1
		H07	Factory Zone1												
		H09	Factory Zone2												
		H17	City Center2		3.5	2.1	1.4		3.5	2.1	1.4		3.5	2.1	1.4
		H18	City Center1		3.7	3.5	0.3		3.7	3.5	0.3		3.7	3.5	0.3
		H20	Sokoine												
		H21	Kariakoo		3.5	2.1	1.4		3.5	2.1	1.4		3.5	2.1	1.4
		H23	Kariakoo UG2												
		New	N. Kariakoo									New	2.0		
		New	Mchafukoge SS					New	4.0						
		New	Mchikichini SS					New	2.0						
		New	TOL SS					New	5.0						
	11kV	K02	Kariakoo												
		K05	Muhimbili		7.0	5.6	1.4	Rep	7.0	5.6	1.4		7.0	5.6	1.4
		K06	Buguruni Sokoni		9.4	9.1	0.2		9.4	9.1	0.2		9.4	9.1	0.2
		K10	Uhuru Road		4.7	3.9	0.8		4.7	3.9	0.8		4.7	3.9	0.8
		K13	Nyerere Road/Shaurimoyo		1.5	1.4	0.2	Rep	1.5	1.4	0.2		1.5	1.4	0.2
		K14	Buguruni Reline		6.4	5.7	0.6		6.4	5.7	0.6		6.4	5.7	0.6
		K17	Kariakoo												
		K18	Breweries												
		K21	Magomeni												
Kariakoo	33kV		Ilalla, Railway		3.5	2.1	1.4		3.5	2.1	1.4		3.5	2.1	1.4
			New City Center												
	11kV	KAR1			4.8	4.8	0.0		4.8	4.8	0.0		4.8	4.8	0.0
		KAR2			2.4	1.7	0.6		2.4	1.7	0.6		2.4	1.7	0.6
		KAR3						New	3.5	3.5	0.0		3.5	3.5	0.0
		KAR4			3.7	2.6	1.1		3.7	2.6	1.1		3.7	2.6	1.1
N. Kariakoo (New)	33kV	New	Ilala									New	2.0		
	11kV	F1	Kariakoo-1									New	3.5	3.5	0.0
		F2	Kariakoo-2									New	3.5	3.5	0.0
		F3	Gerezani									New	3.5	3.5	0.0
FZI(Buguruni)	33kV		Kipawa		7.4	7.4	0.0		7.4	7.4	0.0	N. Ilala			
			Ilala												
			FZ II												
			Tazara												
			ALAF		8.5	8.4	0.0		8.5	8.4	0.0				
	11kV				11.5	11.0	0.5		11.5	11.0	0.5				
					9.9	9.5	0.4		9.9	9.5	0.4				
					6.8	6.0	0.8		6.8	6.0	0.8				
Sokoine	33kV	1.0	Sokoine SP1									NCC			
		3.0	SokoineRailway												
		4.0	RMU												
		6.0	New City Center		5.0	2.7	2.4		5.0	2.7	2.4				
		8.0	Kempinski Hotel												
		10.0	Sokoine SP-2		8.8	6.2	2.6		8.8	6.2	2.6				
	11kV	PL01	Sokoine-1		0.9	0.5	0.4		0.9	0.5	0.4				
		PL02	Sokoine-2												
		PL04	Sokoine-3		4.4	2.0	2.4		4.4	2.0	2.4				
		PL05	Sokoine-4		1.9	1.3	0.6		1.9	1.3	0.6				
		PL08	Sokoine-5		0.8	0.8			0.8	0.8					
Railway	33kV		Kariakoo, Ilala		3.5	2.1	1.4		3.5	2.1	1.4	NCC			
			Sokoine		0.0	0.0	0.0		0.0	0.0	0.0				
	11kV	F01	Water Front		7.4	6.3	1.2		7.4	6.3	1.2				
		F02	Clock Tower		0.0	0.0			0.0	0.0					
		F03	Sokoine Ohio		2.5	1.7	0.8		2.5	1.7	0.8				

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)
Mchafukoge	33kV	New	Ilala					New	4.0			NCC			
(New)															
	11kV	F1	Mchafukoge-1					New	3.5	0.0	3.5				
		F2	Mchafukoge-2					New	3.5	0.0	3.5				
		F3	Mchafukoge-3					New	3.5	0.0	3.5				
Mchikichini	33kV	New	Ilala					New	2.0			New	4.0		
(New)															
	11kV	F1	Mchikichini-1					New	3.5	0.0	3.5		3.5	0.0	3.5
		F2	Mchikichini-2					New	3.5	0.0	3.5		3.5	0.0	3.5
		F3	Mchikichini-3					New	3.5	0.0	3.5		3.5	0.0	3.5
		F4	Mchikichini-4									New	3.5	0.0	3.5
		F5	Mchikichini-5									New	3.5	0.0	3.5
TOL	33kV		Ilala		2.2	2.1	0.1		2.2	2.1	0.1	N. Ilala			
		New	Ilala					New	5.0						
	11kV	TOL1			9.7	9.4	0.3		9.7	9.4	0.3				
		TOL2			7.8	7.6	0.2		7.8	7.6	0.2				
		TOL3			2.0	1.5	0.5		2.0	1.5	0.5				
		TOL4			0.4	0.2	0.2		0.4	0.2	0.2				
		TOL5			5.5	5.2	0.4		5.5	5.2	0.4				
N. Ilala															
N. Ilala	33kV	New	FZI(Buguruni)									New	3.0		
(New)		New	TOL									New	3.0		
		New	Ilala-1									New	4.5	0.0	4.5
		New	Ilala-2									New	4.5	0.0	4.5
		New	Buguruni									New	4.5	0.0	4.5
	11kV	F1	Ilala-1									New	3.5	0.0	3.5
		F2	Ilala-2									New	3.5	0.0	3.5
		F3	Buguruni									New	3.5	0.0	3.5
FZI(Buguruni)	33kV		Kipawa	Ilala				Ilala					7.4	7.4	0.0
			Ilala												
			FZ II												
			Tazara												
			ALAF										8.5	8.4	0.0
		New	N. Ilala									New	3.0		
	11kV		Vingunguti-1									New	3.5	0.0	3.5
			Vingunguti-2									New	3.5	0.0	3.5
TOL	33kV		Ilala	Ilala				Ilala					2.2	2.1	0.1
			Ilala										5.0		
		New	N. Ilala									New	3.0		
	11kV	TOL1											9.7	9.4	0.3
		TOL2											7.8	7.6	0.2
		TOL3											2.0	1.5	0.5
		TOL4											0.4	0.2	0.2
		TOL5											5.5	5.2	0.4
FZII(Gongo'boto)															
FZII(Gongo'boto)	33kV		Kipawa		99.3	99.3			99.3	99.3			99.3	99.3	
			Gongo'boto	New (2cct)	18.1	18.0	0.1		18.1	18.0	0.1		18.1	18.0	0.1
					18.1	18.0	0.1		18.1	18.0	0.1		18.1	18.0	0.1
		New	Ukonga									New	4.0		
	11kV	F22			14.9	14.8	0.1		14.9	14.8	0.1		14.9	14.8	0.1
		F23			17.0	16.9	0.1		17.0	16.9	0.1		17.0	16.9	0.1
		F24			101.2	101.1	0.1		101.2	101.1	0.1		101.2	101.1	0.1
		F25			0.5	0.0	0.5		0.5	0.0	0.5		0.5	0.0	0.5
Ukonga	33kV	New	FZII(Gongo'boto)									New	4.0		
(New)															
	11kV	F1	Ukonga-1									New	19.1	19.0	0.1
		F2	Ukonga-2									New	19.1	19.0	0.1

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)
Pugu															
Pugu	33kV	New	Majohe					New	10.0				10.0		
(New)			Pugu-1					New (2cct)	9.1	9.0	0.1		9.1	9.0	0.1
			Pugu-2						9.1	9.0	0.1		9.1	9.0	0.1
			Majohe-3					New (2cct)	9.1	9.0	0.1		9.1	9.0	0.1
			Majohe-4						9.1	9.0	0.1		9.1	9.0	0.1
			Msongola									New	32.1	32.0	0.1
	11kV	F1	Pugu-1					New	10.1	10.0	0.1		10.1	10.0	0.1
		F2	Pugu-2					New	10.1	10.0	0.1		10.1	10.0	0.1
Majohe	33kV	New	Pugu					New	10.0				10.0		
(New)															
	11kV	F1	Majohe-1					New (2cct)	19.1	19.0	0.1		19.1	19.0	0.1
		F2	Majohe-2						19.1	19.0	0.1		19.1	19.0	0.1
		F3	Pugu-1					New (2cct)	19.1	19.0	0.1		19.1	19.0	0.1
		F4	Pugu-2						19.1	19.0	0.1		19.1	19.0	0.1
FZIII(Kipawa)															
FZIII(Kipawa)	33kV		Ubungo		30.7	30.6	0.1		30.7	30.6	0.1		30.7	30.6	0.1
			FZ I		9.9	9.4	0.5		9.9	9.4	0.5		9.9	9.4	0.5
			FZ II		99.3	99.3			99.3	99.3			99.3	99.3	
			Buguruni		7.4	7.4	0.0		7.4	7.4	0.0		7.4	7.4	0.0
			Tandika		10.4	10.4			10.4	10.4			10.4	10.4	
			Segerea		57.3	57.3			57.3	57.3			57.3	57.3	
			Chamgombe												
					44.5	44.5			44.5	44.5			44.5	44.5	
			Kilawi									New	11.1	11.0	0.1
		New	Tandika	New	1.0				1.0				1.0		
		New	Kiwalani					New	5.0				5.0		
	11kV		F32		0.0	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0
			F33		8.3	7.7	0.7	Rep	8.3	7.7	0.7		8.3	7.7	0.7
			F34		6.3	6.2	0.2		6.3	6.2	0.2		6.3	6.2	0.2
Tandika	33kV		Kipawa (FZ-III)		9.0	9.0		Mtoni				Mtoni			
		New	Kipawa (FZ-III)	New	1.0										
	11kV	TD2			11.5	11.4	0.1								
		TD3			22.9	22.8	0.0								
		TD4			16.4	16.4	0.0								
		TD5			10.3	10.1	0.2								
Kiwalani	33kV	New	FZIII(Kipawa)					New	5.0				5.0		
(New)															
	11kV	F1	Kiwalani (Existing line)					Rep	5.0	5.0	0.0		5.0	5.0	0.0
		F2	Kiwalani (Existing line)					Rep	5.0	5.0	0.0		5.0	5.0	0.0
		F3	Kiwalani (New)					New	16.1	16.0	0.1		16.1	16.0	0.1
Chamgombe	33kV		Kurasini		13.6	13.5	0.1	Kurasini				Kurasini			
			Kipawa (FZ-III)		3.4	3.4									
	11kV	CG1			2.5	2.4	0.1								
		CG2			1.3	1.1	0.1								
		CG3			0.4	0.3	0.1								
		CG4			4.3	4.2	0.0								
		CG5			2.2	2.0	0.2								
Kimanga															
Kimanga	33kV	New	Vingunguti SS					New	8.0				8.0		
(New)			Kimanga Feeder1					New (2cct)	16.1	16.0	0.1		16.1	16.0	0.1
			Kimanga Feeder2						16.1	16.0	0.1		16.1	16.0	0.1
			Vigunguti1									New (2cct)	10.6	10.5	0.1
			Vigunguti2										10.6	10.5	0.1
	11kV	F1	Kimanga-1					New (2cct)	16.1	16.0	0.1		16.1	16.0	0.1
		F2	Kimanga-2						16.1	16.0	0.1		16.1	16.0	0.1
		F3	Kimanga-3					New (2cct)	16.1	16.0	0.1		16.1	16.0	0.1
		F4	Kimanga-4						16.1	16.0	0.1		16.1	16.0	0.1
		New	Kurasini					New	7.0				7.0		

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)
Kivule (S-DSM)															
Kivule (S-DSM)	33kV		Kivule-1					New (2cct)	8.1	8.0	0.1		8.1	8.0	0.1
(New)			Kivule-2						8.1	8.0	0.1		8.1	8.0	0.1
			Kitunda-1					New (2cct)	8.1	8.0	0.1		8.1	8.0	0.1
			Kitunda-2						8.1	8.0	0.1		8.1	8.0	0.1
		New	Kimanga					New	8.0				8.0		

Source: JICA Study Team

Table 5-2.15 Distribution Expansion Plan (Temeke Region)

Regend= New : New / Extension   Rein : Reinforcement / Improvement   Rep : Replacement / Renew   New : New Line from 132/33kV substation   Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)
Temeke Region															
kurasini															
Kurasini	33kV		Ilala-Kurasini		7.1	7.1			7.1	7.1			7.1	7.1	
			Ilala		1.5	1.5			1.5	1.5			1.5	1.5	
			Kigamboni		8.7	8.5	0.2		8.7	8.5	0.2		8.7	8.5	0.2
			Chango'mbe		13.6	13.5	0.1		13.6	13.5	0.1		13.6	13.5	0.1
			Mbagala		8.9	8.9			8.9	8.9			8.9	8.9	
			Miburani					New	5.5	0.0	5.5		5.5	0.0	5.5
			Keko					New	5.5	0.0	5.5		5.5	0.0	5.5
			Kurasini	New	5.5	0.0	5.5		5.5	0.0	5.5		5.5	0.0	5.5
			Chango'mbe-2									New	5.5	0.0	5.5
		New	Kimanga						7.0				7.0		
		New	N. Kigamboni SS		9.0				9.0				9.0		
	11kV	KR1	Mtoni, Azizi		7.8	7.5	0.3		7.8	7.5	0.3		7.8	7.5	0.3
		KR2	Kurasini		14.2	14.0	0.2		14.2	14.0	0.2		14.2	14.0	0.2
		KR3	Tandika, Sabasaba		13.5	13.4	0.1		13.5	13.4	0.1		13.5	13.4	0.1
		KR4	DSM Port Area		7.7	7.5	0.2		7.7	7.5	0.2		7.7	7.5	0.2
			Kurasini-2	New	3.5	0.0	3.5		3.5	0.0	3.5		3.5	0.0	3.5
			Keko					New	3.5	0.0	3.5		3.5	0.0	3.5
			Miburani									New	3.5	0.0	3.5
Chamgombe	33kV		Kurasini	FZ III					13.6	13.5	0.1		13.6	13.5	0.1
			Kipawa (FZ-III)						3.4	3.4			3.4	3.4	
									17.0	**16.9**	**0.1**		**17.0**	**16.9**	**0.1**
	11kV	CG1							2.5	2.4	0.1		2.5	2.4	0.1
		CG2							1.3	1.1	0.1		1.3	1.1	0.1
		CG3							0.4	0.3	0.1		0.4	0.3	0.1
		CG4							4.3	4.2	0.0		4.3	4.2	0.0
		CG5							2.2	2.0	0.2		2.2	2.0	0.2
Kigamboni	33kV		Kurasini	N. Kigamboni				N. Kigamboni				N. Kigamboni			
			Feeder												
	11kV		Feeder												
N. Kigamboni (New)	33kV		Kurasini		8.7	8.5	0.2	N. Kigamboni				N. Kigamboni			
			Feeder		136.7	136.6	0.1								
		New	Kurasini	New	9.0										
	11kV		Feeder		16.7	16.5	0.2								
Mtoni															
Motni (New)	33kV	New	Tandika					New	4.0				4.0		
		New	Temeke					New	5.0				5.0		
		New	Kijichi					New	7.0				7.0		
		F1	Mtoni					New	10.1	10.0	0.1		10.1	10.0	0.1
		F2	Azimio					New	10.1	10.0	0.1		10.1	10.0	0.1
		F3	Kijichi					New	10.1	10.0	0.1		10.1	10.0	0.1
	11kV	F1	Mtoni-1					New	10.1	10.0	0.1		10.1	10.0	0.1
		F2	Mtoni-2					New	10.1	10.0	0.1		10.1	10.0	0.1
		F3	Azimio-1					New	8.1	8.0	0.1		8.1	8.0	0.1
		F4	Azimio-2					New	8.1	8.0	0.1		8.1	8.0	0.1
		F5	Sadali-1					New	11.6	11.5	0.1		11.6	11.5	0.1
		F6	Sadali-2					New	11.6	11.5	0.1		11.6	11.5	0.1
Tandika	33kV		Kipawa (FZ-III)	FZ III					9.0	9.0			9.0	9.0	
			Kipawa (FZ-III)						1.0				1.0		
		New	Motni					New	4.0				4.0		
	11kV	TD2							11.5	11.4	0.1		11.5	11.4	0.1
		TD3							22.9	22.8	0.0		22.9	22.8	0.0
		TD4							16.4	16.4	0.0		16.4	16.4	0.0
		TD5							10.3	10.1	0.2		10.3	10.1	0.2

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)
Temeke	33kV	New	Motni					New	5.0				5.0		
(New)															
	11kV	F1	Temeke-1					New	5.1	5.0	0.1		5.1	5.0	0.1
		F2	Temeke-2					New	5.1	5.0	0.1		5.1	5.0	0.1
		F3	Temeke-3					New	5.1	5.0	0.1		5.1	5.0	0.1
Kijichi	33kV	New	Motni					New	7.0				7.0		
(New)															
	11kV	F1	Kijichi-1					New	5.1	5.0	0.1		5.1	5.0	0.1
		F2	Kijichi-2					New	5.1	5.0	0.1		6.0	5.0	1.0
		F3	Kijichi-3					New	5.1	5.0	0.1		6.0	5.0	1.0
Buza															
Buza	33kV	New	Yombo Vituka					New	4.0				4.0		
(New)			Buza (Existing line)					Rein	5.1	5.0	0.1		5.1	5.0	0.1
			New Buza					New	10.1	10.0	0.1		10.1	10.0	0.1
			Makangarawe(Existing line)					Rein	5.1	5.0	0.1		5.1	5.0	0.1
			New Makangarawe					New	10.1	10.0	0.1		10.1	10.0	0.1
			Yombo Vituka					New	15.1	15.0	0.1		15.1	15.0	0.1
			Kilakala									New	12.1	12.0	0.1
	11kV	F1	Buza-1					Rein	4.1	4.0	0.1		4.1	4.0	0.1
		F2	Buza-2					Rein	6.1	6.0	0.1		6.1	6.0	0.1
		F3	Buza-3					New	10.1	10.0	0.1		10.1	10.0	0.1
		F4	Makangarawe-1					Rein	6.1	6.0	0.1		6.1	6.0	0.1
		F5	Makangarawe-2					New	10.1	10.0	0.1		10.1	10.0	0.1
		F6	Kilakala-1									New	10.1	10.0	0.1
		F7	Kilakala-2									New	10.1	10.0	0.1
Yombo Vituka	33kV	New	Buza					New	4.0				4.0		
(New)															
	11kV	F1	Yombo Vituka-1					Rein	4.1	4.0	0.1		4.1	4.0	0.1
		F2	Yombo Vituka-2					Rein	6.1	6.0	0.1		6.1	6.0	0.1
		F3	Yombo Vituka-3						10.1	10.0	0.1		10.1	10.0	0.1
Somangila (SE-DSM)															
Somangila (SE-DSM)	33kV		Somangila (Existing line)					Rep	11.1	11.0	0.1		11.1	11.0	0.1
(New)			Somangila (Existing line)					Rep	24.1	24.0	0.1		24.1	24.0	0.1
			Kimbiji (Existing line)					Rep	11.1	11.0	0.1		11.1	11.0	0.1
			Somangila-1									New	18.1	18.0	0.1
			Kisarawe II					New	26.1	26.0	0.1		26.1	26.0	0.1
			Pembamna					New	51.1	51.0	0.1		51.1	51.0	0.1
N. Kigamboni															
N. Kigamboni	33kV		Kurasini	Kurasini				Rein	8.7	8.5	0.2		8.7	8.5	0.2
(New)			Vijibweni (Existing)					Rep	18.1	18.0	0.1		18.1	18.0	0.1
			Kigamboni-1					New	17.1	17.0	0.1		17.1	17.0	0.1
			Kigamboni-2					New	17.1	17.0	0.1		17.1	17.0	0.1
			Kigamboni-3									New	17.1	17.0	0.1
			Tungi					New	17.1	17.0	0.1		17.1	17.0	0.1
			Kurasini						9.0				9.0		
	11kV		Kigamboni (Existing)					Rein	16.7	16.5	0.2		16.7	16.5	0.2
			Tungi-1						10.1	10.0	0.1		10.1	10.0	0.1
			Tungi-2						10.1	10.0	0.1		10.1	10.0	0.1
Kibada															
Kibada	33kV		Kibada (Existing)					Rep	8.1	8.0	0.1		8.1	8.0	0.1
(New)			Toangoma (Existing)					Rep	22.1	22.0	0.1		22.1	22.0	0.1
			Mjimwema (Existing)					Rep	20.1	20.0	0.1		20.1	20.0	0.1

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Voltage	Feeder No.	Feeder Name	2020 Rein Rep New	2020 Total (km)	2020 Overhead Line (km)	2020 Cable (km)	2025 Rein Rep New	2025 Total (km)	2025 Overhead Line (km)	2025 Cable (km)	2030 Rein Rep New	2030 Total (km)	2030 Overhead Line (km)	2030 Cable (km)
Mbagala															
Mbagala	33kV	1	Mkuranga		8.9	8.9		Rep	8.9	8.9			8.9	8.9	
		2			21.4	21.2	0.2		21.4	21.2	0.2		21.4	21.2	0.2
		3			13.2	13.2		Rep	13.2	13.2			13.2	13.2	
		4			125.5	125.4	0.1	Rein	125.5	8.0	0.1		125.5	8.0	0.1
		5			8.9	8.9		Rep	8.9	8.9			8.9	8.9	
			Mbagala Kuu-1	New	13.1	13.0	0.1		13.1	13.0	0.1		13.1	13.0	0.1
			Toangoma						11.1	17.0	0.1		11.1	17.0	0.1
			Kiburugwa	New	11.1	11.0	0.1		11.1	11.0	0.1		11.1	11.0	0.1
		New	Mbagala II SS					New	4.0				4.0		
		New	Mbagala II SS									New	4.0		
		New	Kiburugwa SS					New	4.0				4.0		
		New	Kiburugwa SS									New	4.0		
	11kV	MBF1			46.6	46.5	0.1	Rep	46.6	46.5	0.1		46.6	46.5	0.1
		MBF2			17.9	17.8	0.1		17.9	17.8	0.1		17.9	17.8	0.1
		MBF3			18.2	18.0	0.1		18.2	18.0	0.1		18.2	18.0	0.1
		MBF4			36.4	36.1	0.2	Rep	36.4	36.1	0.2		36.4	36.1	0.2
Mbagala II	33kV	New	Mbagala					New	4.0				4.0		
		New	Mbagala									New	4.0		
(New)															
	11kV	F1	Mbagala Kuu					New	7.1	7.0	0.1		7.1	7.0	0.1
Kiburungwa	33kV	Inter	Mbagala					New	4.0				4.0		
		Inter	Mbagala									New	4.0		
(New)															
	11kV	F1	Kiburungwa					New	7.1	7.0	0.1		7.1	7.0	0.1
Mianzini															
Mianzini	33kV	New	Charambe					New	5.0				5.0		
		New	Charambe									New	5.0		
		New	Chamazi					New	10.0				10.0		
			Chamazi					New	11.1	11.0	0.1		11.1	11.0	0.1
			Charambe					New	7.1	7.0	0.1		7.1	7.0	0.1
			Mianzini					New	5.1	5.0	0.1		5.1	5.0	0.1
			Mkuranga					New	40.1	40.0	0.1		40.1	40.0	0.1
			Tambani					New	25.1	25.0	0.1		25.1	25.0	0.1
			Vikindu									New	29.1	29.0	0.1
			Vianzi									New	25.1	25.0	0.1
	11kV	F1	Mianzini-1					Rein	5.0	5.0			5.0	5.0	
		F2	Mianzi-2					Rein	5.0	5.0			5.0	5.0	
		F3													
Charambe	33kV	New	Mianzini					New	5.0				5.0		
(New)		New	Mianzini									New	5.0		
	11kV	F1	Charambe-1					Rein	5.0	5.0			5.0	5.0	
		F2	Charambe-2					Rein	5.0	5.0			5.0	5.0	
Chamazi	33kV	New	Mianzini					New	10.0						
(New)															
	11kV	F1	Chamazi-1					Rein	5.0	5.0			5.0	5.0	
		F2	Chamazi-2					Rein	5.0	5.0			5.0	5.0	

Source: JICA Study Team

Table 5-2.16 Distribution Expansion Plan (Coast Region)

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)
Coast Region															
Chalinze															
Chalinze	33kV		Ngerengere		71.1	71.1			71.1	71.1			71.1	71.1	
			Lugoba		169.7	169.2	0.5								
			Ruvu		81.3	81.3			81.3	81.3			81.3	81.3	
			Bagamoyo		322.1	321.6	0.5								
			Lugoba (Existing)					Rein	80.0	80.0	0.5		80.0	80.0	0.5
			Lugoba (New)						80.0	80.0	0.5		80.0	80.0	0.5
			Kimange, Msata						66.1	66.0	0.1		66.1	66.0	0.1
			Kiwangwe, Tarawanda									New	66.1	66.0	0.1
			Magindu									New	27.1	27.0	0.1
Mlandizi															
Mlandizi	33kV	H0	Upper Luvu		0.5	0.3	0.2		0.5	0.3	0.2		0.5	0.3	0.2
		H1	Lower Luvu 1		29.9	29.9	0.0		29.9	29.9	0.0		29.9	29.9	0.0
		H3	Chalinze		135.0	135.0	0.0								
		H5	Kibaha		133.2	132.6	0.6								
		H7	Lower Luvu 2		27.7	27.7	0.0		27.7	27.7	0.0		27.7	27.7	0.0
		H8	Zegereni		11.1	0.0	11.1		11.1	0.0	11.1		11.1	0.0	11.1
		H9	Kiluwa		0.0	0.0			0.0	0.0			0.0	0.0	
			Chalinze (Existing)					Rein	68.0	0.0	0.0		68.0	0.0	0.0
			Chalinze (ENew)					New	68.1	68.0	0.1		68.1	68.0	0.1
			Kibaha (Existing)					Rein	66.0	0.0	0.6		66.0	0.0	0.6
			Kibaha (New)					New	68.1	68.0	0.1		68.1	68.0	0.1
			Vigwaza, Dutumi					New	70.1	70.0	0.1		70.1	70.0	0.1
			Soga, Mzenga									New	42.1	42.0	0.1
			Bokomnemela									New	26.1	26.0	0.1
		New	N. Tumbi SS					New	31.0				31.0		
		New	N. Tumbi SS									New	31.0		
Tumbi(Kibaha)	33kV	H5	Mlandizi, Kibaha	N. Tumbi				N. Tumbi				N. Tumbi			
			Kibaha												
		H3	Chalinze												
	11kV		Picha Ya Ndege												
N. Tumbi (New)	33kV	H5	Mlandizi, Kibaha		133.2	132.6	0.6		133.2	132.6	0.6				
			Kibaha		0.0	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0
		H3	Chalinze		0.0	0.0			0.0	0.0			0.0	0.0	
					133.2	132.6	0.6		133.2	132.6	0.6				
		New	Mlandizi					New	31.0				31.0		
		New	Mlandizi									New	31.0		
	11kV		Picha Ya Ndege		9.6	9.6	0.0		9.6	9.6	0.0		9.6	9.6	0.0
					8.8	8.8	0.0		8.8	8.8	0.0		8.8	8.8	0.0
			Tumbi-1									New	10.1	10.0	0.1
			Tumbi-2									New	10.1	10.0	0.1
Zinga															
Zinga (New)	33kV		Kerege (Existing line)	Rein	20.0	20.0	0.0		20.0	20.0	0.0		20.0	20.0	0.0
			Yombo, Kiromo (Ex. line)	Rein	20.0	20.0	0.0		20.0	20.0	0.0		20.0	20.0	0.0
			Fukayosi, Magomeni (Ex. Line)	Rein	40.0	40.0	0.0		40.0	40.0	0.0		40.0	40.0	0.0
			Zinga-1	New	8.0	0.0	8.0		8.0	0.0	8.0		8.0	0.0	8.0
			Zinga-2	New	8.0	0.0	8.0		8.0	0.0	8.0		8.0	0.0	8.0
			Zinga-3	New	8.0	0.0	8.0		8.0	0.0	8.0		8.0	0.0	8.0
			Yombo, Kiromo (New)					New	23.1	23.0	0.1		23.1	23.0	0.1
			Fukayosi, Magomeni (New)					New	26.1	26.0	0.1		26.1	26.0	0.1

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)	Rein Rep New	Total (km)	Overhead Line (km)	Cable (km)
Mkuranga															
Mkuranga (New)	33kV		Kiparanganda (Existing line)					Rein	20.0	20.0	0.0		20.0	20.0	0.0
			Mbezi					New	55.1	55.0	0.1		55.1	55.0	0.1
			Shungubweni					New	68.1	68.0	0.1		68.1	68.0	0.1
			Myagawa, Myamato					New	42.1	42.0	0.1		42.1	42.0	0.1
			Panzuo, Mkamba									New	42.1	41.0	0.1
			Bupu									New	42.1	15.0	0.1
Maneromango															
Maneromango (New)	33kV		Masaki (Existing line)									Rein	40.0	40.0	0.0
			Kurui									New	45.1	45.0	0.1
			Mafizi									New	70.1	70.0	0.1
			Cholesamvula									New	61.1	61.0	0.1
			Vikumbulu									New	67.1	67.0	0.1
			Marui									New	61.1	61.0	0.1
			Msimbu									New	55.1	55.0	0.1

Source: JICA Study Team

Table 5-2.17 Assumption of distribution transformers and switch (Kinondoni North Region)

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation

Substation	Feeder			2020					2025					2030					2020		2025		2030	
	Voltage	Feeder No.	Feeder Name	TR				Total	TR				Total	TR				Total	Switch		Switch		Switch	
				100	200	315	500	Nos.	100	200	315	500	Nos.	100	200	315	500	Nos.	LBS	RMU	LBS	RMU	LBS	RMU
Kinondoni North Region			**33/0.4kV**	**50**	**72**	**39**	**17**	**178**	**141**	**180**	**102**	**64**	**487**	**59**	**94**	**48**	**22**	**223**	**20**		**16**		**16**	
			11/0.4kV	**32**	**36**	**11**		**79**	**130**	**300**	**65**		**495**	**143**	**276**	**52**		**471**	**20**		**100**		**92**	
Tegeta				**78**	**96**	**47**	**17**	**238**	**0**	**0**	**0**	**0**	**0**	**18**	**38**	**16**	**2**	**74**	**36**	**0**	**0**	**0**	**8**	**0**
Tegeta	33kV	TG1	Wazo II	5	5	1	1	**12**											4					
		TG2	Mbeji											4	16	6		**26**					4	
		TG3	Bagamoyo																					
		TG4	Bahari Beach																					
		TG5	Wazo-1	9	9	4	4	**26**											4					
		TG6	Spare																					
		TG7	Jangwani Beach																					
			Wazo-3	11	18	12	5	**46**											4					
			Wazo-4	11	18	12	5	**46**											4					
			Wazo-5	14	22	10	2	**48**						14	22	10	2	**48**	4				4	
		New	Bahari Beach SS																					
		New	Jangwani Beach SS																					
			Total	**50**	**72**	**39**	**17**	**178**						**18**	**38**	**16**	**2**	**74**	**20**		**0**		**8**	
Bahari Beach	33kV		Wazo area																					
			Tegeta																					
		New	Tegeta																					
			Total																					
	11kV	BB1																						
		BB2																						
		BB5																						
			Total																					
Jangwani Beach	33kV		Tegeta																					
		New	Tegeta																					
			Total																					
	11kV	F1	Kawe	7	6	2		**15**											4					
		F2	Kunduchi-1	7	6	2		**15**											4					
		F3	Kunduchi-2	7	6	2		**15**											4					
				7	6	2		**15**											4					
			Total	**28**	**24**	**8**		**60**											**16**					
Mbezi	33kV		Tegeta																					
			Total																					
	11kV		Kunduchi																					
			Packers																					
			Lugalo																					
			Mwenge																					
			Total																					
Bunju (N-DSM)				**0**	**0**	**0**	**0**	**0**	**50**	**78**	**34**	**18**	**180**	**38**	**60**	**24**	**12**	**167**	**0**	**0**	**20**	**0**	**16**	**0**
Bunju (N-DSM) (New)	33kV	New	Mbweni																					
		New	Mbweni																					
		F1	Bunju-1						12	18	10	6	**46**					**11**			4			
		F2	Bunju-2						12	18	10	6	**46**					**11**			4			
		F3	Bunju-3											12	18	10	6	**46**					4	
		F4	Mabwepande-1						12	18	10	6	**46**					**11**			4			
		F5	Mabwepande-2											12	18	10	6	**46**					4	
			Total						**36**	**54**	**30**	**18**	**138**	**24**	**36**	**20**	**12**	**125**	**0**		**12**		**8**	
Mbeweni (New)	33kV	New	Bunju (N-DSM)																					
		New	Bunju (N-DSM)																					
			Total																					
	11kV	F1	Mbweni-1						7	12	2		**21**								4			
		F2	Mbweni-2						7	12	2		**21**								4			
		F3	Mbweni-3											7	12	2		**21**					4	
		F4	Mbweni-4											7	12	2		**21**					4	
			Total						**14**	**24**	**4**		**42**	**14**	**24**	**4**		**42**	**0**		**8**		**8**	

Regend= New : New / Extension   Rein : Reinforcement / Improvement   Rep : Replacement / Renew   New : New Line from 132/33kV substation

Substation	Feeder			2020					2025					2030					2020		2025		2030	
	Voltage	Feeder No.	Feeder Name	TR				Total	TR				Total	TR				Total	Switch		Switch		Switch	
				100	200	315	500	Nos.	100	200	315	500	Nos.	100	200	315	500	Nos.	LBS	RMU	LBS	RMU	LBS	RMU
N. Bahari Beach				0	0	0	0	0	28	48	8	0	84	49	84	14	0	147	0	0	16	0	28	0
N. Bahari Beach	33kV	New	Kunduchi																					
(New)			**Total**																					
	11kV	F1	Kunduchi						7	12	2		21								4			
									7	12	2		21								4			
		F2	Kunduchi						7	12	2		21								4			
									7	12	2		21								4			
		F3	Kunduchi											7	12	2		21					4	
														7	12	2		21					4	
		F4	Kunduchi											7	12	2		21					4	
														7	12	2		21					4	
			Total						28	48	8		84	28	48	8		84			16		16	
Bahari Beach	33kV		Wazo area																					
			Tegeta																					
			Tegeta																					
			Total																					
	11kV	BB1																						
		BB2																						
		BB5																						
			Total																					
Kunduchi	33kV	New	N. Bahari Beach																					
(New)			**Total**																					
	11kV	F1	Kunduchi-1											7	12	2		21					4	
		F2	Kunduchi-2											7	12	2		21					4	
		F3	Kunduchi-3											7	12	2		21					4	
			Total											21	36	6		63					12	
N. Mbezi				0	0	0	0	0	0	0	0	0	0	42	72	12	0	126	0	0	0	0	24	0
N. Mbezi	33kV		Jangwani Beach																					
(New)		New	Jangwani Beach																					
			Total																					
	11kV	F1	Kawe											7	12	2		21					4	
														7	12	2		21					4	
		F2	Makongo											7	12	2		21					4	
														7	12	2		21					4	
			Total											28	48	8		84					16	
Mbezi	33kV		N. Mbezi																					
			Ubungo																					
			Total																					
	11kV		Kunduchi																					
			Packers																					
			Lugalo																					
			Mwenge																					
			Total																					
Jangwani Beach	33kV		N. Mbezi																					
		New	N. Mbezi																					
			Total																					
	11kV	F1																						
		F2																						
		F3																						
		F4	Kawe											7	12	2		21					4	
														7	12	2		21					4	
			Total											14	24	4		42					8	
Kawe				0	0	0	0	0	28	48	8	0	84	14	24	4	0	42	0	0	16	0	8	0
Kawe	33kV	New	Mikocheni																					
(New)			**Total**																					
	11kV	F1	Kijitonyama						7	12	2		21								4			
									7	12	2		21								4			
		F2	Kijitonyama						7	12	2		21								4			
									7	12	2		21								4			
		F3	Kijitonyama											7	12	2		21					4	
														7	12	2		21					4	
			Total						28	48	8		84	14	24	4		42			16		8	
Mikocheni	33kV	New	Kawe																					
			Mikocheni																					
			Total																0					
	11kV																							
			Total																0					

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation

Substation	Feeder			2020					2025					2030					2020		2025		2030	
	Voltage	Feeder No.	Feeder Name	TR				Total	TR				Total	TR				Total	Switch		Switch		Switch	
				100	200	315	500	Nos.	100	200	315	500	Nos.	100	200	315	500	Nos.	LBS	RMU	LBS	RMU	LBS	RMU
Goba				**0**	**0**	**0**	**0**	**0**	**105**	**126**	**72**	**46**	**349**	**17**	**20**	**12**	**8**	**57**	**0**	**0**	**4**	**0**	**0**	**0**
Goba	33kV	F1	Goba-1						17	20	12	8	**57**								4			
(New)		F2	Goba-2											17	20	12	8	**57**					4	
		F3	Kimara						17	20	12	8	**57**								4			
		F4	Mbezi-1						18	22	12	8	**60**								4			
		F5	Mbezi-2						18	22	12	8	**60**								4			
		F6	Saranga						18	22	12	8	**60**								4			
		F7	Makongo						17	20	12	6	**55**								4			
			Total						**105**	**126**	**72**	**46**	**349**	**17**	**20**	**12**	**8**	**57**			**4**			
Makumbusho				**4**	**12**	**3**	**0**	**19**	**28**	**84**	**21**	**0**	**133**	**8**	**24**	**6**	**0**	**38**	**4**	**0**	**28**	**0**	**8**	**0**
Makumbusho	33kV	H00	Msasani2																					
		H02	Msasani1																					
		H03	Oysterbay																					
		H09	Industry																					
		H10	Mikocheni																					
		H13	Mwananyamala																					
		J07	Mak3																					
		J08	Mak4																					
		New	Mwananyamala																					
		New	Kijitonyama																					
		New	Kijitonyama																					
			Total																					
Oysterbay	33kV		Makumbusho																					
			Total																					
	11kV																							
			Total																					
Mikocheni	33kV		Makumbusho																					
			Total																					
	11kV																							
			Total																					
Msasani	33kV		Makumbusho1																					
			Makumbusho2																					
			Total																					
	11kV	F1																						
		F2																						
		F3																						
		F4	Msasani-1	4	12	3		**19**											4					
		F5	Msasani-2						4	12	3		**19**								4			
		F6	Msasani-3						4	12	3		**19**								4			
			Total	**4**	**12**	**3**		**19**	**8**	**24**	**6**		**38**						**4**		**8**			
Mwananyamala	33kV		Makumbusho																					
		New	Makumbusho																					
			Total																					
	11kV	F1																						
		F2																						
		F3																						
		F4	Mwananyamala						4	12	3		**19**								4			
			Total						**4**	**12**	**3**		**19**								**4**			
Kijitonyama	33kV	New	Makumbusho																					
(New)		New	Makumbusho																					
			Total																					
	11kV	F1	Kijitonyama-1						4	12	3		**19**								4			
			Kijitonyama-2						4	12	3		**19**								4			
		F2	Kijitonyama-3						4	12	3		**19**								4			
			Kijitonyama-4						4	12	3		**19**								4			
		F3	Mikocheni											4	12	3		**19**					4	
														4	12	3		**19**					4	
			Total						**16**	**48**	**12**		**76**	**8**	**24**	**6**		**38**			**16**		**8**	

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation

Substation	Feeder			2020					2025					2030					2020		2025		2030	
	Voltage	Feeder No.	Feeder Name	TR				Total	TR				Total	TR				Total	Switch		Switch		Switch	
				100	200	315	500	Nos.	100	200	315	500	Nos.	100	200	315	500	Nos.	LBS	RMU	LBS	RMU	LBS	RMU
Drive Inn				**0**	**0**	**0**	**0**	**0**	**32**	**96**	**24**	**0**	**152**	**16**	**48**	**12**	**0**	**76**	**0**	**0**	**32**	**0**	**16**	**0**
Drive Inn	33kV	New	Oysterbay SS																					
(New)		New	N. Msasani SS																					
		New	Hananasifu SS																					
			Total																					
	11kV	F1	Msasani-1						4	12	3		19								4			
			Msasani-2						4	12	3		19								4			
		F2	Hananasifu-1						4	12	3		19								4			
			Hananasifu-2						4	12	3		19								4			
		F3	Kinondoni											4	12	3		19					4	
			Total						**16**	**48**	**12**		**76**	**4**	**12**	**3**		**19**			**16**		**4**	
Oysterbay	33kV	New	Drive Inn																					
			Makumbusho																					
			Total																					
	11kV																							
			Total																					
N. Msasani	33kV	New	Makumbusho																					
(New)			**Total**																					
	11kV	F1	Msasani-1						4	12	3		19								4			
			Msasani-2						4	12	3		19								4			
		F2	Msasani-3						4	12	3		19								4			
			Msasani-4						4	12	3		19								4			
		F3	Msasani-5											4	12	3		19					4	
			Total						**16**	**48**	**12**		**76**	**4**	**12**	**3**		**19**			**16**		**4**	
Hananasif	33kV	New	Makumbusho																					
(New)			**Total**																					
	11kV	F1	Hananafasi-1											4	12	3		19					4	
		F2	Hananafasi-2											4	12	3		19					4	
			Total											**8**	**24**	**6**		**38**					**8**	

Source: JICA Study Team

Table 5-2.18 Assumption of distribution transformers and switch (Kinondoni South Region)

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation

Substation	Feeder			2020					2025					2030					2020		2025		2030	
	Voltage	Feeder No.	Feeder Name	TR				Total	TR				Total	TR				Total	Switch		Switch		Switch	
				100	200	315	500	Nos.	100	200	315	500	Nos.	100	200	315	500	Nos.	LBS	RMU	LBS	RMU	LBS	RMU
Kinondoni South Region			**33/0.4kV**						**9**	**42**	**46**	**19**	**116**	**3**	**14**	**16**	**7**	**40**			**12**		**4**	
			11/0.4kV	**4**	**52**	**11**		**67**	**40**	**84**	**28**		**152**	**40**	**84**	**28**		**152**	**19**		**24**		**24**	
Ubungo				**4**	**52**	**11**	**0**	**67**	**16**	**48**	**12**	**0**	**76**	**16**	**48**	**12**	**0**	**76**	**19**	**0**	**16**	**0**	**16**	**0**
Ubungo	33kV	New	Tandale																					
		New	Mbezi																					
		New	Makongo																					
		New	Mabibo																					
			Wazo2																					
			Nordic																					
			Tazara																					
			FZ31																					
			Nordic																					
			FZ32																					
			Magomeni/Mlimani City																					
			Wazo1																					
			Tandale																					
			Texile																					
			Total																					
	11kV	U1	Mandela Road																					
		U2	Ubungo Terminal																					
		U7	NIT																					
		U8	Ubungo																					
		U9	TANESCO																					
			Total																					
Mlimanicity	33kV		Ubungo/Mlimanicity																					
			Total																					
	11kV	K1	Mlimanicity(Ring)																					
		K2	Mlimanicity(Ring)																					
		K7	University		10	2		12											4					
			Total		**10**	**2**		**12**											**4**					
Tandale	33kV	New	Ubungo																					
			Ubungo																					
			Ilala																					
			Total																					
	11kV	Tan1																						
		Tan2																						
		Tan4																						
		F1	Manzese-1	4	12	3		19											4					
		F2	Manzese-2						4	12	3		19								4			
		F3	Kinondoni						4	12	3		19								4			
			Total	**4**	**12**	**3**		**19**	**8**	**24**	**6**		**38**						**3**		**8**			
EPZ	33kV		Ubungo																					
			Total																					
	11kV		Private																					
			Total																					
Magomeni	33kV		Ubungo/Mlimanicity																					
			Total																					
	11kV	MG1																						
		MG2																						
		MG3																						
		MG4																						
			Total																					
Mburahati	33kV		Ubungo																					
			Total																					
	11kV	F1	Kigogo-1		10	2		12											4					
		F2	Kigogo-2		10	2		12											4					
		F3	Kigogo-3		10	2		12											4					
			Total		**30**	**6**		**36**											**12**					
Mbezi	33kV		Tegeta																					
		New	Ubungo																					
			Total																					
	11kV		Kunduchi																					
			Packers																					
			Lugalo																					
			Mwenge																					
			Total																					

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation

Substation	Feeder			2020					2025					2030					2020		2025		2030	
	Voltage	Feeder No.	Feeder Name	TR				Total	TR				Total	TR				Total	Switch		Switch		Switch	
				100	200	315	500	Nos.	100	200	315	500	Nos.	100	200	315	500	Nos.	LBS	RMU	LBS	RMU	LBS	RMU
Makongo	33kV	New	Ubungo																					
(New)			Total																					
	11kV	F1	Makongo-1											4	12	3		19					4	
		F2	Makongo-2											4	12	3		19					4	
		F3	Makongo-3											4	12	3		19					4	
			Total											12	36	9		57					12	
Mabibo	33kV	New	Ubungo																					
(New)			Total																					
	11kV	F1	Mabibo-1						4	12	3		19								4			
		F2	Mabibo-2						4	12	3		19								4			
		F3	Mabibo-3											4	12	3		19					4	
			Total						8	24	6		38	4	12	3		19			8		4	
Luguruni				**0**	**0**	**0**	**0**	**0**	**9**	**42**	**46**	**19**	**116**	**3**	**14**	**16**	**7**	**40**	**0**	**0**	**12**	**0**	**4**	**0**
Luguruni	33kV	F1	Kiluvya						3	14	14	5	36								4			
(New)		F2	Msigani-1																					
		F3	Msigani-2						3	14	16	7	40								4			
		F4	Kwembe-1																					
		F5	Kwembe-2						3	14	16	7	40								4			
		F6	Kwembe-3											3	14	16	7	40					4	
		F7	Kibamba																					
			Total						9	42	46	19	116	3	14	16	7	40			12		4	
N. Mburahati				**0**	**0**	**0**	**0**	**0**	**24**	**36**	**16**	**0**	**76**	**24**	**36**	**16**	**0**	**76**	**0**	**0**	**8**	**0**	**8**	**0**
N. Mburahati	33kV	New	Magomeni																					
(New)		New	N. Magomeni																					
			Total																					
	11kV	F1	Mburahati						6	9	4		19								4			
		F2	Kigogo						6	9	4		19								4			
		F3	mzimuni											6	9	4		19					4	
														6	9	4		19					4	
			Total						12	18	8		38	12	18	8		38			8		8	
Mburahati	33kV		Ubungo																					
			Total																					
	11kV																							
			Total																					
Magomeni	33kV		Ubungo/Mlimanicity																					
			Total																					
	11kV	MG1																						
		MG2																						
		MG3																						
		MG4																						
			Total																					
N. Magomeni	33kV	New	N. Mburahati SS																					
(New)			Total																					
	11kV	F1	Ndugumbi-1						6	9	4		19								4			
		F2	Ndugumbi-2						6	9	4		19								4			
		F3	Ndugumbi-3											6	9	4		19						
														6	9	4		19						
			Total						12	18	8		38	12	18	8		38						

Source: JICA Study Team

Table 5-2.19 Assumption of distribution transformers and switch (Ilala Region)

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation

Substation	Voltage	Feeder No.	Feeder Name	2020					2025					2030					2020		2025		2030	
				TR				Total	TR				Total	TR				Total	Switch		Switch		Switch	
				100	200	315	500	Nos.	100	200	315	500	Nos.	100	200	315	500	Nos.	LBS	RMU	LBS	RMU	LBS	RMU
Ilala Region			**33/0.4kV**	**16**	**48**	**28**	**12**	**104**	**84**	**220**	**140**	**60**	**504**	**38**	**107**	**84**	**41**	**270**			**24**		**28**	
			11/0.4kV		**14**	**4**	**4**	**22**	**102**	**157**	**82**	**11**	**352**	**70**	**127**	**58**	**15**	**270**		**6**	**60**	**13**	**60**	**7**
New City Center				**0**	**14**	**4**	**4**	**22**	**0**	**28**	**8**	**11**	**47**	**0**	**35**	**10**	**15**	**60**	**0**	**6**	**0**	**13**	**12**	**7**
New City Center	33kV		New City Center																					
			Ilala																					
			Sokoine																					
			RMU																					
			Muhimbili																					
			Kariakoo																					
		New	Muhimbili SS																					
		New	Sokoine SS																					
		New	Jangwani SS																					
		New	Mchafukoge SS																					
			Total																					
City Center	33kV		New City Center																					
			Total																					
	11kV	F1																						
		F2																						
		F3																						
		F4																						
		F5																						
		F6																						
		F7	Upanga Mashariki												7	2	3	**12**						4
		F8																						
			Total												**7**	**2**	**3**	**12**						**4**
Muhimbili	33kV		New City Center																					
		New	New City Center																					
			Total																					
	11kV	F1	Upanga Magharibi-1		7	2	2	**11**												3				
		F2	Upanga Magharibi-2		7	2	2	**11**												3				
		New	Upanga Mashariki-1							7	2	2	**11**									3		
		New	Upanga Mashariki-2												7	2	3	**12**						3
			Total		**14**	**4**	**4**	**22**		**7**	**2**	**2**	**11**		**7**	**2**	**3**	**12**		**6**		**3**		**3**
Sokoine	33kV	1.0	Sokoine SP1																					
		3.0	SokoineRailway																					
		4.0	RMU																					
		6.0	New City Center																					
		8.0	Kempinski Hotel																					
		10.0	Sokoine SP-2																					
		New	New City Center																					
			Total																					
	11kV	PL01	Sokoine-1																					
		PL02	Sokoine-2																					
		PL04	Sokoine-3																					
		PL05	Sokoine-4																					
		PL08	Sokoine-5																					
			Total																					
Railway	33kV		Kariakoo, Ilala																					
			Sokoine																					
			Total																					
	11kV	F01	Water Front																					
		F02	Clock Tower																					
		F03	Sokoine Ohio																					
			Total																					
Jangwani (New)	33kV	New	New City Center																					
			Total																					
	11kV	F1	Jangwani-1							7	2	3	**12**									3		
		F2	Jangwani-2							7	2	3	**12**									3		
		F3	Kisutu							7	2	3	**12**									4		
			Total							**21**	**6**	**9**	**36**									**10**		
Mchafukoge (New)	33kV		New City Center																					
			Total																					
	11kV	F1	Mchafukoge-1												7	2	3	**12**					4	
		F2	Mchafukoge-2												7	2	3	**12**					4	
		F3	Gerezeni												7	2	3	**12**					4	
			Total												**21**	**6**	**9**	**36**					12	

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation

Substation	Feeder			2020					2025					2030					2020		2025		2030	
	Voltage	Feeder No.	Feeder Name	TR				Total	TR				Total	TR				Total	Switch		Switch		Switch	
				100	200	315	500	Nos.	100	200	315	500	Nos.	100	200	315	500	Nos.	LBS	RMU	LBS	RMU	LBS	RMU
Ilala				**0**	**0**	**0**	**0**	**0**	**47**	**63**	**30**	**0**	**140**	**30**	**40**	**20**	**0**	**90**	**0**	**0**	**32**	**0**	**20**	**0**
Ilala	33kV	H02	Kariakoo UG1																					
		H05	Kurasini(KR)																					
		H06	Tanzania Oxigen(TOL)																					
		H07	Factory Zone1																					
		H09	Factory Zone2																					
		H17	City Center2																					
		H18	City Center1																					
		H20	Sokoine																					
		H21	Kariakoo																					
		H23	Kariakoo UG2																					
		New	N. Kariakoo																					
		New	Mchafukoge SS																					
		New	Mchikichini SS																					
		New	TOL SS																					
			Total																					
	11kV	K02	Kariakoo																					
		K05	Muhimbili																					
		K06	Buguruni Sokoni																					
		K10	Uhuru Road																					
		K13	Nyerere Road/Shaurimoyo						5	7	2		14								4			
		K14	Buguruni Reline																					
		K17	Kariakoo																					
		K18	Breweries																					
		K21	Magomeni																					
			Total						**5**	**7**	**2**		**14**								**4**			
Kariakoo	33kV		Ilalla, Railway																					
			New City Center																					
			Total																					
	11kV	KAR1																						
		KAR2																						
		KAR3							6	8	4		18								4			
		KAR4																						
			Total						**6**	**8**	**4**		**18**								**4**			
N. Kariakoo	33kV	New	Ilala																					
(New)			**Total**																					
	11kV	F1	Kariakoo-1											6	8	4		18					4	
		F2	Kariakoo-2											6	8	4		18					4	
		F3	Gerezani											6	8	4		18					4	
			Total											**18**	**24**	**12**		**54**					**12**	
FZI(Buguruni)	33kV		Kipawa																					
			Ilala																					
			FZ II																					
			Tazara																					
			ALAF																					
			Total																					
	11kV																							
			Total																					
Sokoine	33kV	1.0	Sokoine SP1																					
		3.0	SokoineRailway																					
		4.0	RMU																					
		6.0	New City Center																					
		8.0	Kempinski Hotel																					
		10.0	Sokoine SP-2																					
			Total																					
	11kV	PL01	Sokoine-1																					
		PL02	Sokoine-2																					
		PL04	Sokoine-3																					
		PL05	Sokoine-4																					
		PL08	Sokoine-5																					
			Total																					
Railway	33kV		Kariakoo, Ilala																					
			Sokoine																					
			Total																					
	11kV	F01	Water Front																					
		F02	Clock Tower																					
		F03	Sokoine Ohio																					
			Total																					

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation

Substation	Voltage	Feeder No.	Feeder Name	2020 TR 100	2020 TR 200	2020 TR 315	2020 TR 500	2020 Total Nos.	2025 TR 100	2025 TR 200	2025 TR 315	2025 TR 500	2025 Total Nos.	2030 TR 100	2030 TR 200	2030 TR 315	2030 TR 500	2030 Total Nos.	2020 Switch LBS	2020 Switch RMU	2025 Switch LBS	2025 Switch RMU	2030 Switch LBS	2030 Switch RMU
Mchafukoge	33kV	New	Ilala																					
(New)			**Total**																					
	11kV	F1	Mchafukoge-1						6	8	4		**18**								4			
		F2	Mchafukoge-2						6	8	4		**18**								4			
		F3	Mchafukoge-3						6	8	4		**18**								4			
			Total						**18**	**24**	**12**		**54**								**12**			
Mchikichini	33kV	New	Ilala																					
(New)			**Total**																					
	11kV	F1	Mchikichini-1						6	8	4		**18**								4			
		F2	Mchikichini-2						6	8	4		**18**								4			
		F3	Mchikichini-3						6	8	4		**18**								4			
		F4	Mchikichini-4											6	8	4		**18**					4	
		F5	Mchikichini-5											6	8	4		**18**					4	
			Total						**18**	**24**	**12**		**54**	**12**	**16**	**8**		**36**			**12**		**8**	
TOL	33kV		Ilala																					
		New	Ilala																					
			Total																					
	11kV	TOL1																						
		TOL2																						
		TOL3																						
		TOL4																						
		TOL5																						
			Total																					
N. Ilala				**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**39**	**82**	**68**	**21**	**210**	**0**	**0**	**0**	**0**	**32**	**0**
N. Ilala	33kV	New	FZI(Buguruni)																					
(New)		New	TOL																					
		New	Ilala-1											3	14	16	7	**40**					4	
		New	Ilala-2											3	14	16	7	**40**					4	
		New	Buguruni											3	14	16	7	**40**					4	
			Total											**9**	**42**	**48**	**21**	**120**					**12**	
	11kV	F1	Ilala-1											6	8	4		**18**					4	
		F2	Ilala-2											6	8	4		**18**					4	
		F3	Buguruni											6	8	4		**18**					4	
			Total											**18**	**24**	**12**		**54**					**12**	
FZI(Buguruni)	33kV		Kipawa																					
			Ilala																					
			FZ II																					
			Tazara																					
			ALAF																					
		New	N. Ilala																					
			Total																					
	11kV		Vingunguti-1											6	8	4		**18**					4	
			Vingunguti-2											6	8	4		**18**					4	
			Total											**12**	**16**	**8**		**36**					**8**	
TOL	33kV		Ilala																					
			Ilala																					
		New	N. Ilala																					
			Total																					
	11kV	TOL1																						
		TOL2																						
		TOL3																						
		TOL4																						
		TOL5																						
			Total																					
FZII(Gongo'boto)				**16**	**48**	**28**	**12**	**104**	**0**	**0**	**0**	**0**	**0**	**10**	**12**	**8**	**0**	**30**	**0**	**0**	**0**	**0**	**8**	**0**
FZII(Gongo'boto)	33kV		Kipawa																					
			Gongo'boto	8	24	14	6	**52**																
				8	24	14	6	**52**																
		New	Ukonga																					
			Total	**16**	**48**	**28**	**12**	**104**																
	11kV	F22																						
		F23																						
		F24																						
		F25																						
			Total																					
Ukonga	33kV	New	FZII(Gongo'boto)																					
(New)			**Total**																					
	11kV	F1	Ukonga-1											5	6	4		**15**					4	
		F2	Ukonga-2											5	6	4		**15**					4	
			Total											**10**	**12**	**8**		**30**					**8**	

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation

Substation	Feeder			2020					2025					2030					2020		2025		2030	
	Voltage	Feeder No.	Feeder Name	TR				Total	TR				Total	TR				Total	Switch		Switch		Switch	
				100	200	315	500	Nos.	100	200	315	500	Nos.	100	200	315	500	Nos.	LBS	RMU	LBS	RMU	LBS	RMU
Pugu				**0**	**0**	**0**	**0**	**0**	**62**	**132**	**80**	**24**	**298**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**40**	**0**	**4**	**0**
Pugu	33kV	New	Majohe																					
(New)			Pugu-1						8	24	14	6	**52**								4			
			Pugu-2						8	24	14	6	**52**								4			
			Majohe-3						8	24	14	6	**52**								4			
			Majohe-4						8	24	14	6	**52**								4			
			Msongola											**6**	**23**	**10**	**6**	**45**					4	
			Total						**32**	**96**	**56**	**24**	**208**								**16**		**4**	
	11kV	F1	Pugu-1						5	6	4		**15**								4			
		F2	Pugu-2						5	6	4		**15**								4			
			Total						**10**	**12**	**8**		**30**								**8**			
Majohe	33kV	New	Pugu																					
(New)			**Total**																					
	11kV	F1	Majohe-1						5	6	4		**15**								4			
		F2	Majohe-2						5	6	4		**15**								4			
		F3	Pugu-1						5	6	4		**15**								4			
		F4	Pugu-2						5	6	4		**15**								4			
			Total						**20**	**24**	**16**		**60**								**16**			
FZIII(Kipawa)				**0**	**0**	**0**	**0**	**0**	**5**	**6**	**4**	**0**	**15**	**11**	**23**	**8**	**8**	**50**	**0**	**0**	**4**	**0**	**4**	**0**
FZIII(Kipawa)	33kV		Ubungo																					
			FZ I																					
			FZ II																					
			Buguruni																					
			Tandika																					
			Segerea																					
			Chamgombe																					
			Kilawi											11	23	8	8	**50**					4	
		New	Tandika																					
		New	Kiwalani																					
			Total											**11**	**23**	**8**	**8**	**50**					**4**	
	11kV		F32																					
			F33																					
			F34																					
			Total																					
Tandika	33kV		Kipawa (FZ-III)																					
		New	Kipawa (FZ-III)																					
			Total																					
	11kV	TD2																						
		TD3																						
		TD4																						
		TD5																						
			Total																					
Kiwalani	33kV	New	FZIII(Kipawa)																					
(New)			**Total**																					
	11kV	F1	Kiwalani (Existing line)																					
		F2	Kiwalani (Existing line)																					
		F3	Kiwalani (New)						5	6	4		**15**								4			
			Total						**5**	**6**	**4**		**15**								**4**			
Chamgombe	33kV		Kurasini																					
			Kipawa (FZ-III)																					
			Total																					
	11kV	CG1																						
		CG2																						
		CG3																						
		CG4																						
		CG5																						
			Total																					
Kimanga				**0**	**0**	**0**	**0**	**0**	**36**	**64**	**44**	**12**	**156**	**18**	**42**	**28**	**12**	**100**	**0**	**0**	**8**	**0**	**8**	**0**
Kimanga	33kV	New	Vingunguti SS																					
(New)			Kimanga Feeder1						8	20	14	6	**48**								4			
			Kimanga Feeder2						8	20	14	6	**48**								4			
			Vigunguti1											9	21	14	6	**50**					4	
			Vigunguti2											9	21	14	6	**50**					4	
			Total						**16**	**40**	**28**	**12**	**96**	**18**	**42**	**28**	**12**	**100**			**8**		**8**	
	11kV	F1	Kimanga-1						5	6	4		**15**											
		F2	Kimanga-2						5	6	4		**15**											
		F3	Kimanga-3						5	6	4		**15**											
		F4	Kimanga-4						5	6	4		**15**											
		New	Kurasini																					
			Total						**20**	**24**	**16**		**60**											

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation

Substation	Feeder			2020					2025					2030					2020		2025		2030	
	Voltage	Feeder No.	Feeder Name	TR				Total	TR				Total	TR				Total	Switch		Switch		Switch	
				100	200	315	500	Nos.	100	200	315	500	Nos.	100	200	315	500	Nos.	LBS	RMU	LBS	RMU	LBS	RMU
Kivule (S-DSM)				**0**	**0**	**0**	**0**	**0**	**36**	**84**	**56**	**24**	**200**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Kivule (S-DSM)	33kV		Kivule-1						9	21	14	6	**50**											
(New)			Kivule-2						9	21	14	6	**50**											
			Kitunda-1						9	21	14	6	**50**											
			Kitunda-2						9	21	14	6	**50**											
		New	Kimanga																					
			Total						**36**	**84**	**56**	**24**	**200**											

Source: JICA Study Team

Table 5-2.20 Assumption of distribution transformers and switch (Temeke Region)

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation

Substation	Voltage	Feeder No.	Feeder Name	2020 TR 100	2020 TR 200	2020 TR 315	2020 TR 500	2020 Total Nos.	2025 TR 100	2025 TR 200	2025 TR 315	2025 TR 500	2025 Total Nos.	2030 TR 100	2030 TR 200	2030 TR 315	2030 TR 500	2030 Total Nos.	2020 Switch LBS	2020 Switch RMU	2025 Switch LBS	2025 Switch RMU	2030 Switch LBS	2030 Switch RMU
Temeke Region			33/0.4kV	12	63	42	20	137	108	588	392	194	1282	23	125	84	39	271	12		100		24	
			11/0.4kV	3	8	5		16	135	158	59		352	19	26	11		56	4		68		12	
kurasini				7	29	19	6	61	11	50	33	12	106	7	29	19	6	61	8	0	12	0	8	0
Kurasini	33kV		Ilala-Kurasini																					
			Ilala																					
			Kigamboni																					
			Chango'mbe																					
			Mbagala																					
			Miburani						4	21	14	6	45								4			
			Keko						4	21	14	6	45								4			
			Kurasini	4	21	14	6	45											4					
			Chango'mbe-2											4	21	14	6	45					4	
		New	Kimanga																					
		New	N. Kigamboni SS																					
			Total	4	21	14	6	45	8	42	28	12	90	4	21	14	6	45	4		8		4	
	11kV	KR1	Mtoni, Azizi																					
		KR2	Kurasini																					
		KR3	Tandika, Sabasaba																					
		KR4	DSM Port Area																					
			Kurasini-2	3	8	5		16											4					
			Keko						3	8	5		16								4			
			Miburani											3	8	5		16					4	
			Total	3	8	5		16	3	8	5		16	3	8	5		16	4		4		4	
Chamgombe	33kV		Kurasini																					
			Kipawa (FZ-III)																					
			Total																					
	11kV	CG1																						
		CG2																						
		CG3																						
		CG4																						
		CG5																						
			Total																					
Kigamboni	33kV		Kurasini																					
			Feeder																					
			Total																					
	11kV		Feeder																					
			Total																					
N. Kigamboni (New)	33kV		Kurasini																					
			Feeder																					
		New	Kurasini																					
			Total																					
	11kV		Feeder																					
			Total																					
Mtoni				0	0	0	0	0	96	159	78	21	354	0	0	0	0	0	0	0	60	0	0	0
Motni (New)	33kV	New	Tandika																					
		New	Temeke																					
		New	Kijichi																					
		F1	Mtoni						4	21	14	7	46								4			
		F2	Azimio						4	21	14	7	46								4			
		F3	Kijichi						4	21	14	7	46								4			
			Total						12	63	42	21	138								12			
	11kV	F1	Mtoni-1						7	8	3		18								4			
		F2	Mtoni-2						7	8	3		18								4			
		F3	Azimio-1						7	8	3		18								4			
		F4	Azimio-2						7	8	3		18								4			
		F5	Sadali-1						7	8	3		18								4			
		F6	Sadali-2						7	8	3		18								4			
			Total						42	48	18		108								24			
Tandika	33kV		Kipawa (FZ-III)																					
			Kipawa (FZ-III)																					
		New	Motni																					
			Total																					
	11kV	TD2																						
		TD3																						
		TD4																						
		TD5																						
			Total																					

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation

Substation	Voltage	Feeder No.	Feeder Name	2020 TR 100	2020 TR 200	2020 TR 315	2020 TR 500	2020 Total Nos.	2025 TR 100	2025 TR 200	2025 TR 315	2025 TR 500	2025 Total Nos.	2030 TR 100	2030 TR 200	2030 TR 315	2030 TR 500	2030 Total Nos.	2020 Switch LBS	2020 Switch RMU	2025 Switch LBS	2025 Switch RMU	2030 Switch LBS	2030 Switch RMU
Temeke	33kV	New	Motni																					
(New)			**Total**																					
	11kV	F1	Temeke-1						7	8	3		18								4			
		F2	Temeke-2						7	8	3		18								4			
		F3	Temeke-3						7	8	3		18								4			
			Total						**21**	**24**	**9**		**54**								**12**			
Kijichi	33kV	New	Motni																					
(New)			**Total**																					
	11kV	F1	Kijichi-1						7	8	3		18								4			
		F2	Kijichi-2						7	8	3		18								4			
		F3	Kijichi-3						7	8	3		18								4			
			Total						**21**	**24**	**9**		**54**								**12**			
Buza				**0**	**0**	**0**	**0**	**0**	**28**	**81**	**48**	**21**	**178**	**20**	**39**	**20**	**7**	**86**	**0**	**0**	**20**	**0**	**12**	**0**
Buza	33kV	New	Yombo Vituka																					
(New)			Buza (Existing line)																					
			New Buza						4	21	14	7	46								4			
			Makangarawe(Existing line)																					
			New Makangarawe						4	21	14	7	46								4			
			Yombo Vituka						4	21	14	7	46								4			
			Kilakala											4	21	14	7	46					4	
			Total						**12**	**63**	**42**	**21**	**138**	**4**	**21**	**14**	**7**	**46**			**12**		**4**	
	11kV	F1	Buza-1																					
		F2	Buza-2																					
		F3	Buza-3						8	9	3		20								4			
		F4	Makangarawe-1																					
		F5	Makangarawe-2						8	9	3		20								4			
		F6	Kilakala-1											8	9	3		20					4	
		F7	Kilakala-2											8	9	3		20					4	
			Total						**16**	**18**	**6**		**40**	**16**	**18**	**6**		**40**			**8**		**8**	
Yombo Vituka	33kV	New	Buza																					
(New)			**Total**																					
	11kV	F1	Yombo Vituka-1																					
		F2	Yombo Vituka-2																					
		F3	Yombo Vituka-3																					
			Total																					
Somangila (SE-DSM)				**0**	**0**	**0**	**0**	**0**	**16**	**105**	**70**	**35**	**226**	**4**	**21**	**14**	**7**	**46**	**0**	**0**	**20**	**0**	**4**	**0**
Somangila (SE-DSM)	33kV		Somangila (Existing line)						4	21	14	7	46								4			
(New)			Somangila (Existing line)						4	21	14	7	46								4			
			Kimbiji (Existing line)						4	21	14	7	46								4			
			Somangila-1											4	21	14	7	46					4	
			Kisarawe II						2	21	14	7	44								4			
			Pembamna						2	21	14	7	44								4			
			Total						**16**	**105**	**70**	**35**	**226**	**4**	**21**	**14**	**7**	**46**			**20**		**4**	
N. Kigamboni				**0**	**0**	**0**	**0**	**0**	**28**	**81**	**48**	**21**	**178**	**4**	**21**	**14**	**7**	**46**	**0**	**0**	**12**	**0**	**4**	**0**
N. Kigamboni	33kV		Kurasini																					
(New)			Vijibweni (Existing)																					
			Kigamboni-1						4	21	14	7	46								4			
			Kigamboni-2						4	21	14	7	46								4			
			Kigamboni-3											4	21	14	7	46					4	
			Tungi						4	21	14	7	46								4			
			Kurasini																					
			Total						**12**	**63**	**42**	**21**	**138**	**4**	**21**	**14**	**7**	**46**			**12**		**4**	
	11kV		Kigamboni (Existing)																					
			Tungi-1						8	9	3		20											
			Tungi-2						8	9	3		20											
			Total						**16**	**18**	**6**		**40**											
Kibada				**0**	**0**	**0**	**0**	**0**	**12**	**63**	**42**	**21**	**138**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Kibada	33kV		Kibada (Existing)						4	21	14	7	46											
(New)			Toangoma (Existing)						4	21	14	7	46											
			Mjimwema (Existing)						4	21	14	7	46											
			Total						**12**	**63**	**42**	**21**	**138**											

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation

Substation	Feeder			2020					2025					2030					2020		2025		2030	
	Voltage	Feeder No.	Feeder Name	TR				Total	TR				Total	TR				Total	Switch		Switch		Switch	
				100	200	315	500	Nos.	100	200	315	500	Nos.	100	200	315	500	Nos.	LBS	RMU	LBS	RMU	LBS	RMU
Mbagala				**8**	**42**	**28**	**14**	**92**	**32**	**102**	**62**	**28**	**249**	**0**	**0**	**0**	**0**	**0**	**8**	**0**	**24**	**0**	**0**	**0**
Mbagala	33kV	1	Mkuranga						4	21	14	7	**46**								4			
		2																						
		3							4	21	14	7	**46**								4			
		4																						
		5							4	21	14	7	**46**								4			
			Mbagala Kuu-1	4	21	14	7	**46**											4					
			Toangoma						4	21	14	7	**46**								4			
			Kiburugwa	4	21	14	7	**46**											4					
		New	Mbagala II SS																					
		New	Mbagala II SS																					
		New	Kiburugwa SS																					
		New	Kiburugwa SS																					
			Total	**8**	**42**	**28**	**14**	**92**	**16**	**84**	**56**	**28**	**209**						**8**		**16**			
	11kV	MBF1																						
		MBF2																						
		MBF3																						
		MBF4																						
			Total																					
Mbagala II	33kV	New	Mbagala																					
		New	Mbagala																					
(New)			**Total**																					
	11kV	F1	Mbagala Kuu						8	9	3		**20**								4			
			Total						**8**	**9**	**3**		**20**								**4**			
Kiburungwa	33kV	Inter	Mbagala																					
		Inter	Mbagala																					
(New)			**Total**																					
	11kV	F1	Kiburungwa						8	9	3		**20**								4			
			Total						**8**	**9**	**3**		**20**								**4**			
Mianzini				**0**	**0**	**0**	**0**	**0**	**20**	**105**	**70**	**35**	**230**	**7**	**41**	**28**	**12**	**88**	**0**	**0**	**20**	**0**	**8**	**0**
Mianzini	33kV	New	Charambe																					
		New	Charambe																					
		New	Chamazi						4	21	14	7	**46**								4			
			Chamazi						4	21	14	7	**46**								4			
			Charambe						4	21	14	7	**46**								4			
			Mianzini						4	21	14	7	**46**								4			
			Mkuranga						4	21	14	7	**46**								4			
			Tambani																					
			Vikindu											4	21	14	7	**46**					4	
			Vianzi											3	20	14	5	**42**					4	
			Total						**20**	**105**	**70**	**35**	**230**	**7**	**41**	**28**	**12**	**88**			**20**		**8**	
	11kV	F1	Mianzini-1																					
		F2	Mianzi-2																					
		F3																						
			Total																					
Charambe	33kV	New	Mianzini																					
(New)		New	Mianzini																					
			Total																					
	11kV	F1	Charambe-1																					
		F2	Charambe-2																					
			Total																					
Chamazi	33kV	New	Mianzini																					
(New)			**Total**																					
	11kV	F1	Chamazi-1																					
		F2	Chamazi-2																					
			Total																					

Source: JICA Study Team

Table 5-2.21 Assumption of distribution transformers and switch (Coast Region)

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation

Feeder				2020					2025					2030					2020		2025		2030	
Substation	Voltage	Feeder No.	Feeder Name	TR				Total	TR				Total	TR				Total	Switch		Switch		Switch	
				100	200	315	500	Nos.	100	200	315	500	Nos.	100	200	315	500	Nos.	LBS	RMU	LBS	RMU	LBS	RMU
Coast Region			**33/0.4kV**		**39**	**42**	**48**	**129**	**10**	**96**	**73**	**50**	**229**	**53**	**109**	**105**	**80**	**347**	**12**		**87**		**88**	
			11/0.4kV												**8**	**14**		**22**					**8**	
Chalinze				**0**	**0**	**0**	**0**	**0**	**0**	**16**	**14**	**8**	**38**	**0**	**10**	**13**	**8**	**31**	**0**	**0**	**16**	**0**	**12**	**0**
Chalinze	33kV		Ngerengere																					
			Lugoba																					
			Ruvu																					
			Bagamoyo																					
			Lugoba (Existing)																					
			Lugoba (New)							8	6	3	**17**								8			
			Kimange, Msata							8	8	5	**21**								8			
			Kiwangwe, Tarawanda												8	8	5	**21**					8	
			Magindu												2	5	3	**10**					4	
			Total							**16**	**14**	**8**	**38**		**10**	**13**	**8**	**31**			**16**		**12**	
Mlandizi				**0**	**0**	**0**	**0**	**0**	**0**	**27**	**21**	**12**	**60**	**0**	**29**	**36**	**8**	**73**	**0**	**0**	**24**	**0**	**20**	**0**
Mlandizi	33kV	H0	Upper Luvu																					
		H1	Lower Luvu 1																					
		H3	Chalinze																					
		H5	Kibaha																					
		H7	Lower Luvu 2																					
		H8	Zegereni																					
		H9	Kiluwa																					
			Chalinze (Existing)																					
			Chalinze (ENew)							9	7	4	**20**								8			
			Kibaha (Existing)																					
			Kibaha (New)							9	7	4	**20**								8			
			Vigwaza, Dutumi							9	7	4	**20**								8			
			Soga, Mzenga												12	13	4	**29**					8	
			Bokomnemela												9	9	4	**22**					4	
		New	N. Tumbi SS																					
		New	N. Tumbi SS																					
			Total							**27**	**21**	**12**	**60**		**21**	**22**	**8**	**51**			**24**		**12**	
Tumbi(Kibaha)	33kV	H5	Mlandizi, Kibaha																					
			Kibaha																					
		H3	Chalinze																					
			Total																					
	11kV		Picha Ya Ndege																					
			Total																					
N. Tumbi (New)	33kV	H5	Mlandizi, Kibaha																					
			Kibaha																					
		H3	Chalinze																					
		New	Mlandizi																					
		New	Mlandizi																					
			Total																					
	11kV		Picha Ya Ndege																					
			Tumbi-1												4	7		**11**					4	
			Tumbi-2												4	7		**11**					4	
			Total												**8**	**14**		**22**					**8**	
Zinga				**0**	**39**	**42**	**48**	**129**	**0**	**20**	**16**	**8**	**44**	**0**	**0**	**0**	**0**	**0**	**12**	**0**	**23**	**0**	**0**	**0**
Zinga (New)	33kV		Kerege (Existing line)																					
			Yombo, Kiromo (Ex. line)																					
			Fukayosi, Magomeni (Ex. Line)																					
			Zinga-1		13	14	16	**43**											4					
			Zinga-2		13	14	16	**43**											4					
			Zinga-3		13	14	16	**43**											4					
			Yombo, Kiromo (New)							10	8	4	**22**								4			
			Fukayosi, Magomeni (New)							10	8	4	**22**								4			
			Total		**39**	**42**	**48**	**129**		**20**	**16**	**8**	**44**						**12**		**23**			

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation

Substation	Feeder			2020					2025					2030					2020		2025		2030	
	Voltage	Feeder No.	Feeder Name	TR				Total	TR				Total	TR				Total	Switch		Switch		Switch	
				100	200	315	500	Nos.	100	200	315	500	Nos.	100	200	315	500	Nos.	LBS	RMU	LBS	RMU	LBS	RMU
Mkuranga				**0**	**0**	**0**	**0**	**0**	**10**	**33**	**22**	**22**	**87**	**12**	**22**	**20**	**16**	**70**	**0**	**0**	**24**	**0**	**16**	**0**
Mkuranga	33kV		Kiparanganda (Existing line)																					
(New)			Mbezi						3	11	8	8	**30**								8			
			Shungubweni						4	11	6	6	**27**								8			
			Myagawa, Myamato						3	11	8	8	**30**								8			
			Panzuo, Mkamba											6	11	10	8	**35**					8	
			Bupu											6	11	10	8	**35**					8	
			Total						**10**	**33**	**22**	**22**	**87**	**12**	**22**	**20**	**16**	**70**			**24**		**16**	
Maneromango				**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**41**	**56**	**50**	**48**	**195**	**0**	**0**	**0**	**0**	**48**	**0**
Maneromango	33kV		Masaki (Existing line)																					
(New)			Kurui											6	11	10	8	**35**					8	
			Mafizi											7	9	8	8	**32**					8	
			Cholesamvula											7	9	8	8	**32**					8	
			Vikumbulu											7	9	8	8	**32**					8	
			Marui											7	9	8	8	**32**					8	
			Msimbu											7	9	8	8	**32**					8	
			Total											**41**	**56**	**50**	**48**	**195**					**48**	

Source: JICA Study Team

5-3 System Analysis

System analysis is carried out using Siemens PSS®E33 and considers the operation of a power system under two possible situations, that is:

Normal operating conditions (N-0): the transmission infrastructure is entirely available (no equipment has been forced out of service).

Contingency operating conditions (N-1): one piece of transmission equipment (line or transformer) is out of service.

5-3-1 System Voltage Criteria

The acceptable voltage range for operating the system based on the factors such as equipment limitations and motor operation under normal and contingency conditions is shown in Table 5-3.1.

Table 5-3.1 System Voltage Criteria

Condition	Acceptable Voltage Range
Normal System Conditions	95% - 105%
Contingency Conditions	90% - 110%

5-3-2 Equipment Thermal Loading Criteria

The transmission system shall be planned and designed to allow all transmission lines and equipment to operate within the limits for the defined conditions as shown in Table 5-3.2.

Table 5-3.2 Equipment Thermal Loading Criteria

Condition	Thermal Loading Limit
Normal System Conditions	Defined Normal Load Capacity
Contingency Conditions	Defined Emergency Load Capacity (120% of normal rating)

5-3-3 System analysis result

The system analysis result is shown regarding the system in year-2020, Year-2025, and Year-2030. In system analysis, although the Dar es Salaam system is dealt with as a part of national system, the result of only the Dar es Salaam system is shown here.

Three study cases were considered:

- Y-2020 peak load case;
- Y-2025 peak load case; and
- Y-2030 peak load case.

Each case has been analyzed under both normal (N-0) and contingency (N-1) conditions.

The load flow diagram of each case is shown in Figure 5-3.1 up to Figure 5-3.3.

(1) Year-2020 case

1) Year-2020 (N-0)

The results of analysis show that under normal conditions (N-0), all bus voltages are within the limits (0.95 -1.05 pu), as defined in the planning criteria. No voltage violation is recorded in the system. Transmission line power flows are also below the line normal capacity. The overloading at Tegeta-132kV Substation is only observed. A summary of (N-0) results is given in Table 5-3.3.

Table 5-3.3 Year-2020 system: Overloading under normal conditions

Overloaded Line/Tr	Percent [%]	Flow [MVA]	Nominal Rate [MVA]
Tegeta 132/33kV 1stTr	114.2	74.2	65
Tegeta 132/33kV 2ndTr	114.1	74.2	65

2) Year‐2020 (N-1)

Contingency analysis (N-1) for this case was performed. Under contingency conditions, voltage violations and overloading are observed. A summary of (N-1) results is given in Table 5-3.4 and 5-3.5.

Table 5-3.4 Year-2020 system: Voltage violations under Contingency Conditions

Open Line	Bus	Violation [p.u.]	Voltage Magnitude [p.u.]
Mbagala 132/33kV 1stTr	Mbagala 132kV Bus	0.0319	0.8681
	Kurasini 33kV 2nd Bus	0.0082	0.8918
Mbagala 132/33kV 2ndTr	Mbagala 132kV Bus	0.0319	0.8681
	Kurasini 33kV 2nd Bus	0.0082	0.8918
Ubungo - Kurasini 132kV line	Kurasini 33kV 2nd Bus	0.0956	0.8044
	Kurasini 33kV 1st Bus	0.0871	0.8129
	Kurasini 132kV Bus	0.0552	0.8448
	Mbagala 33kV 2nd Bus	0.035	0.865
	Mbagala 132kV Bus	0.0195	0.8805

Table 5-3.5 Year-2020 system: Over Loadings under Contingency Conditions

Open Line/Tr	Over Loaded Line/Tr	Percent [%]	Flow [MVA]	Emergency Rate [MVA]
Mbagala 132/33kV 1stTr	Mbagala 132/33kV 2ndTr	340.19	265.35	78
Mbagala 132/33kV 2ndTr	Mbagala 132/33kV 1stTr	340.19	265.35	78
Ubungo - Kurasini 132kV line	FZ-II - Mbagala 132kV line	145.61	279.51	218
FZ-III - FZ-II 132kV line	FZ-III - Ubungo 132kV line	145.02	232.64	178
FZ-II - Mbagala 132kV line	Ubungo - Kurasini 132kV line	126.6	263.3	218
FZ-II 132/33kV 1stTr	FZ-II 132/33kV 2ndTr	125.11	75.06	60
FZ-II 132/33kV 2ndTr	FZ-II 132/33kV 1stTr	125.11	75.06	60
Tegeta-IPTL 132/11kV Tr	Tegeta - Ubungo 132kV 1st line	124.94	106.43	88.9
	Tegeta - Ubungo 132kV 2nd line	124.94	106.43	88.9
Tegeta-Ubungo(1)	Tegeta - Ubungo 132kV 2nd line	115.01	99.93	88.9
Tegeta-Ubungo(2)	Tegeta - Ubungo 132kV 1st line	115.01	99.93	88.9
Mlandizi 132/33kV 1stTr (10MVA)	Mlandizi 132/33kV 2ndTr (10MVA)	114.5	13.74	12

Open Line/Tr	Over Loaded Line/Tr	Percent [%]	Flow [MVA]	Emergency Rate [MVA]
Mlandizi 132/33kV 2ndTr (10MVA)	Mlandizi 132/33kV 1stTr (10MVA)	114.5	13.74	12
FZ-III - Ubungo 132kV line	FZ-III - FZ-II 132kV line	109.46	228.11	218
Ilala 132/33kV 1stTr	Ilala 132/33kV 2ndTr	108.09	77.82	72
Ilala 132/33kV 2ndTr	Ilala 132/33kV 1stTr	108.09	77.82	72
Ilala 132/33kV 3rdTr	Ilala 132/33kV 4thTr	107.93	77.71	72
Ilala 132/33kV 4thTr	Ilala 132/33kV 3rdTr	107.89	77.68	72

(2) Year-2025 case

1) Year-2025 (N-0)

The results of analysis show that under normal conditions (N-0), all bus voltages are within the limits (0.95 -1.05 pu), as defined in the planning criteria. No voltage violation is recorded in the system. Transmission line power flows are also below the line normal capacity.

2) Year-2025 (N-1)

Contingency analysis (N-1) for this case was performed and no voltage problem was encountered but some over loadings were observed in the system. A summary of (N-1) results is given in Table 5-3.6.

Table 5-3.6 Year-2025 system: Over Loadings under Contingency Conditions

Open Line/Tr	Over Loaded Line/Tr	Percent [%]	Flow [MVA]	Emergency Rate [MVA]
Ilala 132/33kV Tr (1)	Ilala 132/33kV Tr (7)	143.85	103.57	72
Ilala 132/33kV Tr (7)	Ilala 132/33kV Tr (1)	143.85	103.57	72
Ilala 132/33kV Tr (5)	Ilala 132/33kV Tr (2)	143.48	103.31	72
Ilala 132/33kV Tr (2)	Ilala 132/33kV Tr (5)	143.39	103.24	72
Tegeta - Ubungo 132kV 1st line	Tegeta - Ubungo 132kV 2nd line	119.87	105.33	88.9
Tegeta - Ubungo 132kV 2nd line	Tegeta - Ubungo 132kV 1st line	119.87	105.33	88.9
Kawe-Drive Inn 132kV Overhead line	Ilala - NCC 132kV Overhead line	114.45	169.8	150
	Ilala - NCC 132kV Cable	102.19	169.49	168
Kawe-Goba 132kV line	Ilala - NCC 132kV Overhead line	112.08	166.6	150
	Ilala - NCC 132kV Cable	100.07	166.4	168
Mbagala 132/33kV 1stTr	Mbagala 132/33kV 2stTr	106.21	82.85	78
Mbagala 132/33kV 2stTr	Mbagala 132/33kV 1stTr	106.21	82.85	78

(3) Year-2030 case

1) Year-2030(N-0)

The results of analysis show that under normal conditions (N-0), all bus voltages are within the limits (0.95 -1.05 pu), as defined in the planning criteria. No voltage violation is recorded in the system. Transmission line power flows are also below the line normal capacity.

2) Year-2030(N-1)

Contingency analyses (N-1) for this case were performed. When Kivule-Buza 132kV Line was opened, voltage violations at some buses were observed in the system. And some over loadings were observed. Summary of (N-1) results are given in Table5-3.7 and 5-3.8.

Table 5-3.7 Year-2030 system: Voltage violations under Contingency Conditions

Open Line/Tr	Bus	Violation [p.u.]	Voltage Magnitude [p.u.]
Kivule-Buza 132kV Line	Buza 132kV Bus	0.0816	0.8184
	Buza 33kV 1st Bus	0.0719	0.8281
	Buza 33kV 2nd Bus	0.0719	0.8281
	Buza 33kV 3rd Bus	0.0719	0.8281
	Kibada 132kV Bus	0.0475	0.8525
	Kibada 33kV 1st Bus	0.0247	0.8753
	Kibada 33kV 2nd Bus	0.0247	0.8753
	New Kigamboni 132kV Bus	0.0231	0.8769
	New Kigamboni 33kV 1st Bus	0.0014	0.8986
	New Kigamboni 33kV 2nd Bus	0.0014	0.8986

Table 5-3.8 Year-2030 system: Over Loadings under Contingency Conditions

Open Line/Tr	Over Loaded Line/Tr	Percent [%]	Flow [MVA]	Emergency Rate [MVA]
Ubungo-Makumbusho 132kV line	Ilala-NCC 132kV Overhead	153.77	225.38	150
	Ilala - NCC 132kV Cable	137.47	225.37	168
Ilala 132/33kV 1stTr	Ilala 132/33kV 2ndTr	122.46	88.17	72
Ilala 132/33kV 2ndTr	Ilala 132/33kV 1stTr	122.46	88.17	72
Ilala 132/33kV 3rdTr	Ilala 132/33kV 4thTr	122.23	88.01	72
Ilala 132/33kV 4thTr	Ilala 132/33kV 3rdTr	122.18	87.97	72
Kawe - Drive Inn 132kV Overhead line	Ilala - NCC 132kV Overhead	119.28	175.18	150
	Ilala - NCC 132kV Cable	106.63	175.24	168
Tegeta - Ubungo 132kV 1st line	Tegeta - Ubungo 132kV 2nd line	115.86	103.98	88.9
Tegeta - Ubungo 132kV 2nd line	Tegeta - Ubungo 132kV 1st line	115.86	103.98	88.9
Tegeta-New Bahari Beach 132kV line	Tegeta - Ubungo 132kV 1st line	113.06	101.53	88.9
	Tegeta - Ubungo 132kV 2nd line	113.06	101.53	88.9
Mbagala 132/33kV 1stTr	Mbagala 132/33kV 2ndTr	112.89	88.06	78
Mbagala 132/33kV 2ndTr	Mbagala 132/33kV 1stTr	112.89	88.06	78
Kawe-Goba 132kV line	Ilala - NCC 132kV Overhead	110.53	163.49	150
FZ-III-FZ-II 132kV line	FZ-II - Kivule 132kV line	104.49	227.31	218
NCC-Makumbusho 132kV line	Ilala - NCC 132kV Overhead	102.67	151.3	150
FZ-II 132/33kV 1stTr	FZ-II 132/33kV 2ndTr	100.97	60.58	60
FZ-II 132/33kV 2ndTr	FZ-II 132/33kV 1stTr	100.97	60.58	60
New Bahari Beach-New Mbezi 132kV Overhead line	Ilala - NCC 132kV Overhead	100.61	147.55	150
Bunju 220/132kV 1stTr	Tegeta - Ubungo 132kV 1st line	100	89.72	88.9
	Tegeta - Ubungo 132kV 2nd line	100	89.72	88.9
Bunju 220/132kV 2ndTr	Tegeta - Ubungo 132kV 1st line	100	89.72	88.9
	Tegeta - Ubungo 132kV 2nd line	100	89.72	88.9

3) Short circuit study of Year-2030 system

A Short circuit study was performed on the year 2030 system and results are given in Table 5-3.9.

A typical equivalent machine reactance of 15% for turbine generators and 20% for hydro generators was assumed for short circuit current calculations. Pre-fault conditions were set to the load flow solution.

All fault currents for 400kV, 220kV, 132kV and 33kV buses are well below the practical switchgear ratings for these levels. The minimum switchgear short circuit rating is in the range of 63 kA for 400kV level, 40kA for 220kV level, 40kA (31.5kA) for 132kV level and 16kA for 33kV level. Therefore, the year 2030 system does not experience any switchgear short circuit rating problems.

Table 5-3.9 Year 2030 short circuit results

Bus			3-ph Short circuit Currents		
No.	Name	kV	kA	in MVA	X/R Ratio
33kV Buses					
10112	FZ-III	33	11.83	676	7.4
10113	FZ-III	33	10.70	612	7.1
10233	Tegeta	33	6.53	373	7.5
10234	Tegeta	33	6.58	376	7.6
10333	Ubungo	33	9.84	562	4.9
10343	Ubungo	33	10.27	587	5.1
10413	Chalinze	33	6.02	344	8.3
10512	Ilala	33	13.29	760	6.0
10513	Ilala	33	13.49	771	6.1
10613	Mlandizi	33	6.61	378	8.8
10614	Mlandizi	33	6.61	378	8.8
10615	Mlandizi	33	3.10	177	12.3
10616	Mlandizi	33	4.55	260	13.9
11002	FZ-II	33	10.73	613	8.9
11102	Mbagala	33	9.50	543	5.1
11202	Kurasini	33	5.37	307	6.1
11203	Kurasini	33	5.37	307	6.1
11303	NCC	33	8.19	468	7.9
11304	NCC	33	8.19	468	7.9
11306	NCC	33	7.75	443	7.7
11404	Zinga	33	15.07	861	16.1
11405	Zinga	33	15.07	861	16.1
12003	Bunju (North Dar es Salaam)	33	14.16	810	10.5
12004	Bunju (North Dar es Salaam)	33	14.16	810	10.5
12103	Somangila (Southeast Dar es Salaam)	33	7.52	430	13.0

Bus			3-ph Short circuit Currents		
No.	Name	kV	kA	in MVA	X/R Ratio
12104	Somangila (Southeast Dar es Salaam)	33	7.52	430	13.0
12203	Kivule (South Dar es Salaam)	33	11.44	654	12.3
12204	Kivule (South Dar es Salaam)	33	11.44	654	12.3
12303	Luguruni (West Dar es Salaam)	33	13.99	800	13.1
12304	Luguruni (West Dar es Salaam)	33	13.99	800	13.1
14002	Makumbusho	33	7.33	419	7.5
14003	Makumbusho	33	7.40	423	7.6
14006	Makumbusho	33	8.68	496	7.6
Bus			3-ph Short circuit Currents		
No.	Name	kV	kA	in MVA	X/R Ratio
14102	New Bahari Beach	33	14.11	806	8.8
14103	New Bahari Beach	33	14.11	806	8.8
16702	New Mbezi	33	10.78	616	10.7
16703	New Mbezi	33	10.78	616	10.7
16802	Kawe	33	10.93	625	11.7
16803	Kawe	33	10.93	625	11.7
16902	Goba	33	13.30	760	9.0
16903	Goba	33	13.30	760	9.0
17002	Drive Inn	33	14.00	800	9.4
17003	Drive Inn	33	14.00	800	9.4
17102	New Mubrahati	33	13.57	776	9.1
17103	New Mubrahati	33	13.57	776	9.1
17202	New Ilala	33	13.02	744	8.2
17203	New Ilala	33	13.02	744	8.2
17302	Pugu	33	13.13	750	10.1
17303	Pugu	33	13.13	750	10.1
17402	Kimanga	33	13.17	753	9.0
17403	Kimanga	33	13.17	753	9.0
17502	Mtoni	33	13.41	766	8.6
17503	Mtoni	33	13.41	766	8.6
17504	Mtoni	33	13.41	766	8.6
17602	Buza	33	12.79	731	8.6
17603	Buza	33	12.79	731	8.6
17604	Buza	33	12.79	731	8.6
17702	New Kigamboni	33	11.58	662	7.5
17703	New Kigamboni	33	11.58	662	7.5
17802	Kibada	33	6.79	388	12.9
17803	Kibada	33	6.79	388	12.9

Bus			3-ph Short circuit Currents		
No.	Name	kV	kA	in MVA	X/R Ratio
17902	Mianzini	33	12.53	716	7.4
17903	Mianzini	33	12.53	716	7.4
17904	Mianzini	33	12.53	716	7.4
18002	Maneromango	33	5.43	310	10.1
18003	Maneromango	33	5.43	310	10.1
20404	Mkuranga	33	8.91	510	14.8
20405	Mkuranga	33	8.91	510	14.8
50233	Hale	33	5.64	322	11.3
132kV Buses					
10111	FZ-III	132	21.31	4,871	2.8
10211	Tegeta	132	16.73	3,824	2.4
10311	Ubungo	132	27.63	6,316	2.6
10411	400kV Chalinze	132	6.65	1,520	3.7
10412	Chalinze	132	6.32	1,445	3.4
10511	Ilala	132	20.24	4,628	2.5
Bus			3-ph Short circuit Currents		
No.	Name	kV	kA	in MVA	X/R Ratio
10611	Mlandizi	132	8.24	1,885	4.4
11001	FZ-II	132	24.04	5,497	3.3
11101	Mbagala	132	13.86	3,168	3.8
11201	Kurasini	132	13.99	3,198	3.6
11301	NCC	132	21.37	4,886	2.4
11803	Kinyerezi	132	22.31	5,100	3.7
11804	Kinyerezi(50MVA)	132	17.98	4,110	3.0
12002	Bunju (North Dar es Salaam)	132	20.52	4,691	3.7
12102	Somangila (Southeast Dar es Salaam)	132	16.83	3,849	4.1
12202	Kivule (South Dar es Salaam)	132	27.74	6,341	3.0
12302	Luguruni (West Dar es Salaam)	132	20.40	4,664	4.6
14001	Makumbusho	132	19.40	4,435	2.4
14101	New Bahari Beach	132	19.28	4,408	2.8
16701	New Mbezi	132	17.43	3,985	3.0
16801	Kawe	132	19.85	4,539	2.8
16901	Goba	132	16.48	3,769	3.9
17001	Drive Inn	132	21.37	4,887	2.5
17101	New Mubrahati	132	19.28	4,407	2.7
17201	New Ilala	132	16.37	3,743	2.8
17301	Pugu	132	15.34	3,507	3.8
17401	Kimanga	132	16.67	3,811	3.2
17501	Mtoni	132	18.04	4,124	3.2
17601	Buza	132	14.68	3,356	3.8

Bus			3-ph Short circuit Currents		
No.	Name	kV	kA	in MVA	X/R Ratio
17701	New Kigamboni	132	10.36	2,369	4.2
17801	Kibada	132	10.40	2,377	4.3
17901	Mianzini	132	13.88	3,174	3.6
18001	Maneromango	132	3.39	775	5.0
20403	Mkuranga	132	6.48	1,480	12.6
50211	Hale	132	4.45	1,017	3.7
80111	Morogoro	132	6.68	1,528	3.1
220kV Buses					
10312	Ubungo	220	22.27	8,485	3.3
10402	400kV Chalinze	220	5.59	2,131	11.0
10601	Mlandizi	220	8.30	3,164	4.9
11402	Bagamoyo	220	17.89	6,815	4.1
11501	Zinga	220	11.51	4,386	6.5
11802	Kinyerezi	220	27.42	10,450	3.2
12001	Bunju (North Dar es Salaam)	220	17.57	6,695	3.7
12101	Somangila (Southeast Dar es Salaam)	220	13.56	5,165	4.7
Bus			3-ph Short circuit Currents		
No.	Name	kV	kA	in MVA	X/R Ratio
12201	Kivule (South Dar es Salaam)	220	21.83	8,318	3.4
12301	Luguruni (West Dar es Salaam)	220	20.75	7,908	3.6
20402	Mkuranga	220	13.19	5,027	6.9
80112	Morogoro	220	6.04	2,302	3.8
400kV Buses					
10401	Chalinze	400	10.40	7,207	4.9
10701	Somanga Fungu-Kinyerezi SwS1	400	15.85	10,982	6.2
11401	Bagamoyo	400	9.10	6,308	5.3
11801	Kinyerezi	400	18.05	12,507	4.6
20101	Mkuranga	400	12.57	8,706	6.1

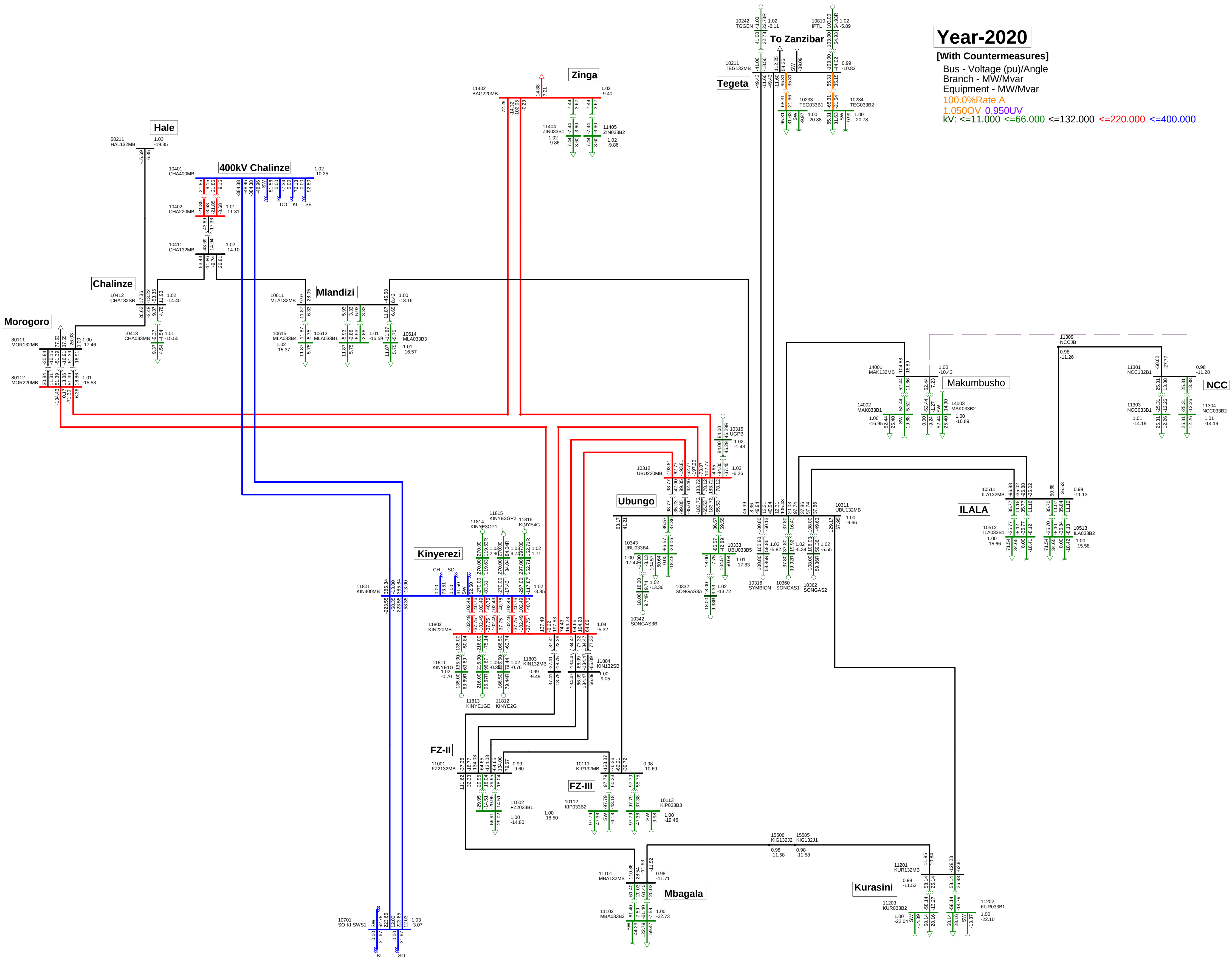


Figure 5-3.1 Power Flow of Year-2020 System

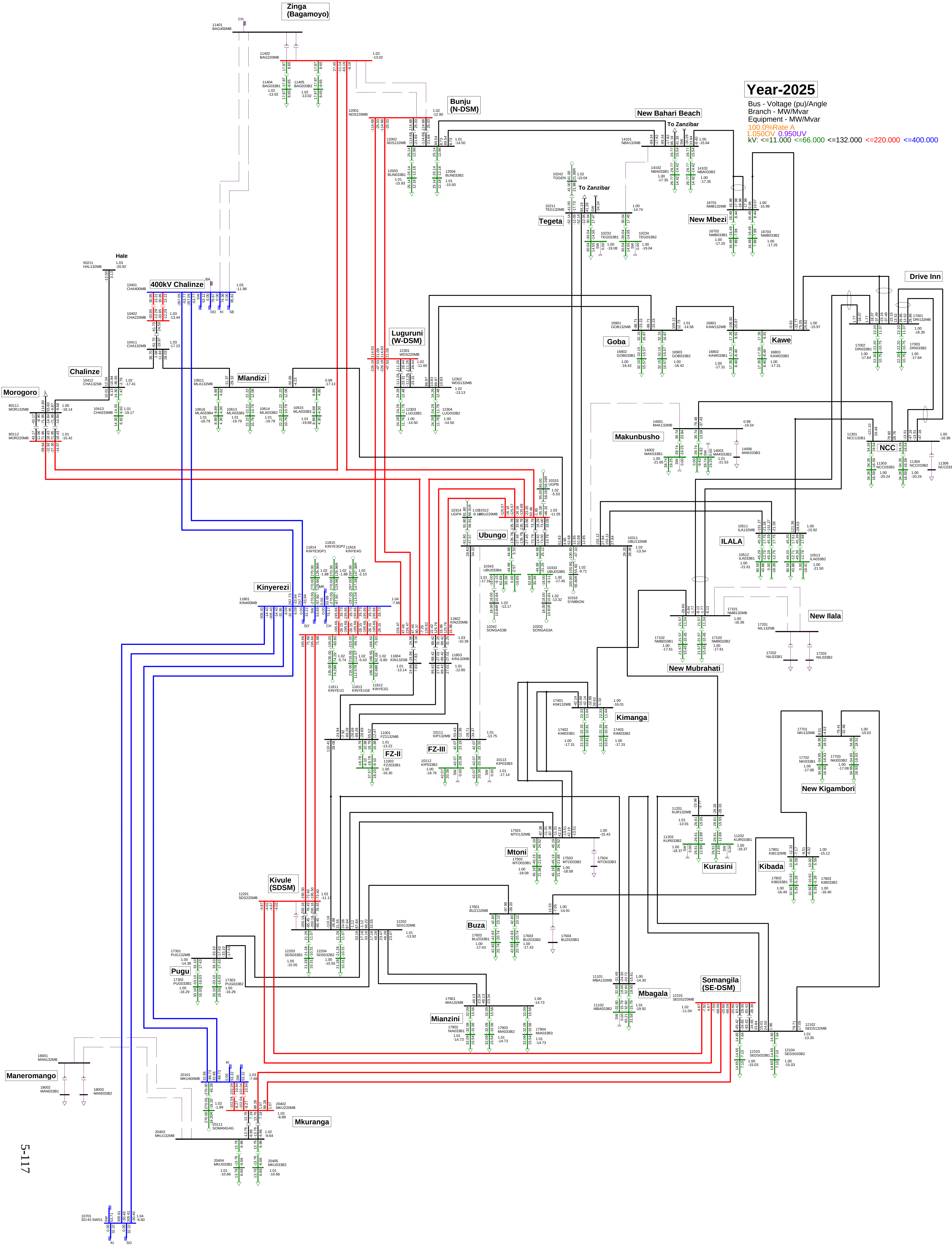


Figure 5-3.2 Power Flow of Year-2025 System

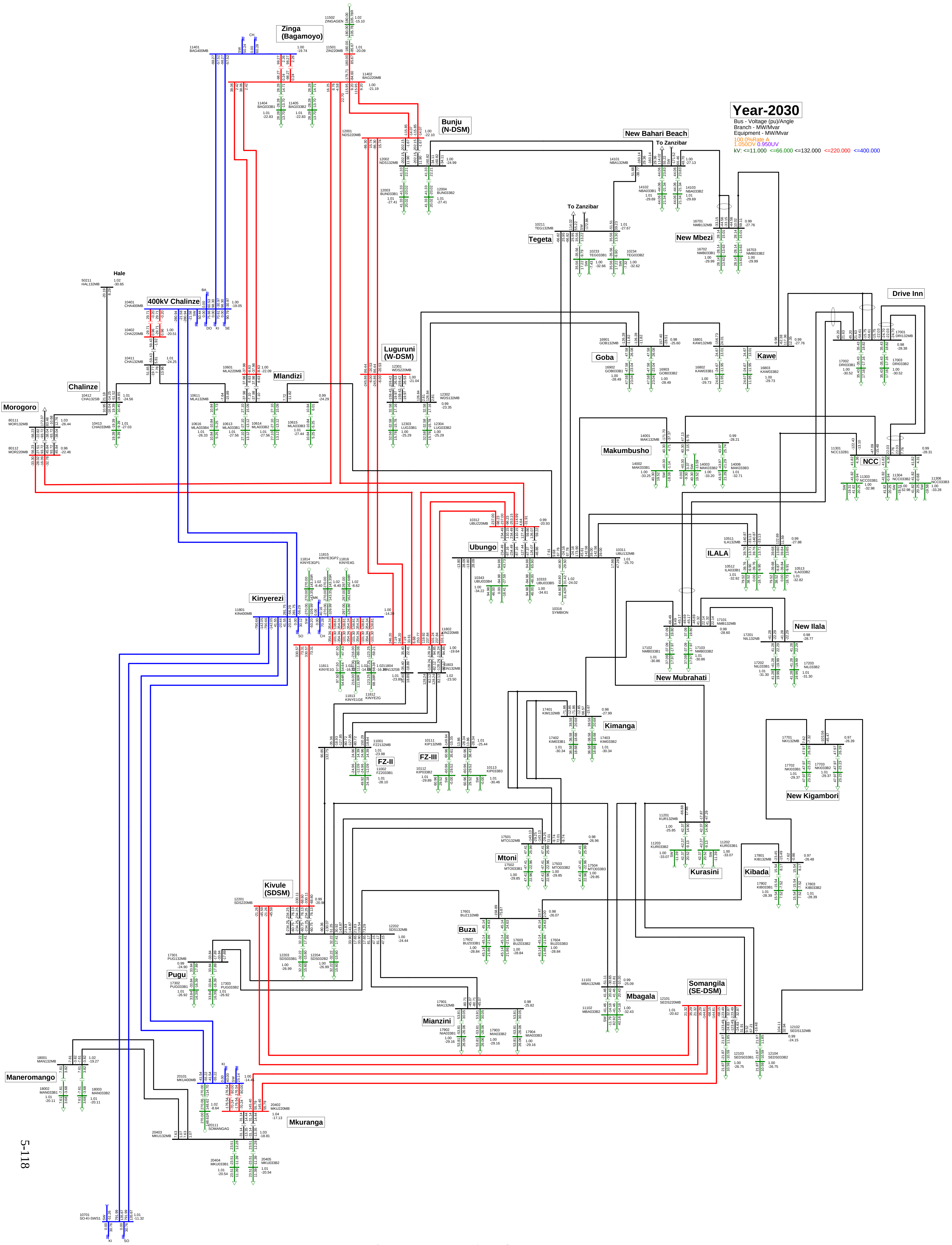


Figure 5-3.3 Power Flow of Year-2030 System

Chapter 6 Environmental Social Consideration

6-1 Environmental Legal framework in Tanzania

6-1-1 Legal framework

The Environmental Management Act (EMA, 2004) is a framework environmental law which provides for legal and institutional framework for sustainable management of the environmental and natural resources in the country. It includes provisions for institutional roles and responsibilities with regard to environmental management; Environmental Impact Assessments (EIA); Strategic Environmental Assessments (SEA); pollution prevention and control; waste management; environmental standards. Between 2005 and 2016, a total of 21 regulations have been developed to facilitate implementation of the Act. Some of them are as follows.

Table 6-1.1 List of Environmental Management Regulation

Category	Environmental Management Regulation
Environmental management framework	・ Environmental Impact Assessment and Audit Regulations (2005) ・ Environmental Management (Fee and Charges) (Amendment) Regulations, 2016 ・ Strategic Environmental Assessment Regulations (2009) ・ Environmental Inspectors Regulations (2011) ・ Registration of Environmental Experts Regulations (2005)
Air quality and Noise	・ Air Quality Standards Regulations (2007) ・ Noise and Vibrations Standards Regulations (2009)
Water quality	・ Water Quality Standards Regulations (2007)
Soil quality	・ The Soil Quality Standards Regulations (2007)
Waste management	・ Hazardous Waste Management Regulations (2009) ・ Solid Waste Management Regulations (2009)

<u>Relation to the DSCMP</u>: In implementing the identified projects under DSCMP, all necessary Acts and related regulations have to be taken into consideration.

Land Act, 1999: It provides for the basic law in relation to land other than the village land, the management of land, settlement of disputes and related matters. The Land Act relates to land-use planning processes and land-use management and guidance to land ownership in Tanzania. The projects identified under DSCMP are expected to involve the land acquisition and it needs to be in line with this Act.

Village Land Act, 1999: The Village Land Act was enacted specifically for the administration and management of land in villages. Under the provisions of this Act, the village council is responsible for the management of the village land. DSCMP implementation is expected to involve the rural land acquisition and it needs to be in compliance with this Act.

Land Acquisition Act 1967: Any land acquisition that shall be done shall be guided by this law. Under the Land Acquisition Act, 1967, the President may, subject to the provisions of this Act, acquire any land for any estate or term where such land is required for any public purpose.

The implementation of DSCMP involves the rural and urban land acquisition and it needs to be in compliance with this Act.

Forest Act, 2002: It provides for the management of forests, to repeal certain laws relating to forests and for related matters. Forest reserves and Mangrove forest reserves are established based on this act. Forest reserves are also considered in siting the DSCMP components including transmission lines.

Wildlife Conservation Act, 2013: It provides for the conservation of wildlife and ensures protection, management and sustainable utilization of wildlife resources, habitats, ecosystems and the non-living environment supporting such resources, habitats or ecosystems. Game Reserves, Game controlled areas, corridor areas, buffer zones are established based on this Act. It is necessary to consider wildlife habitat in locating the identified projects under DSCMP.

Marine Park/Reserve Act, 1994: It provides for management of marine and coastal areas so as to promote sustainability of existing resource use, and the recovery of areas and resources. Marine parks and reserves are established based on this Act. Some transmission lines are expected to be located along the coastal area and if the components are expected to have impact on Marine Parks and reserves, it is subjected to this Act.

Water Resources Management Act, 2009: This is a new legislation that has repealed the Water Utilization (Control and Regulation) Act (1974). The Act provides for institutional and legal framework for sustainable management and development of water resources; outlines principles for water resources management; for prevention and control of water pollution; and provides for participation of stakeholders and general public in implementation of the National Water Policy.

Electricity Act, 2008: It provides for the facilitation and regulation of generation, transmission, transformation, distribution, supply and use of electric energy to provide for cross-border trade in electricity and the planning and regulation of rural electrification and related matters. The Act stipulates obligations of the licensee and it is required to take into account a need to preserve natural beauty, flora and fauna, buildings and sites of geological, archaeological or cultural significance. It also stipulates the access to land for installations, acquisition of wayleaves and land and related compensation.

Antiquities Act, 1964 (Amended in 1979): It includes the principle that no archaeological research can be undertaken without the permission of the Director of Antiquities. According to this Act, local government authorities can pass by-laws for the preservation of archaeological heritage in their area of jurisdiction. If there is any archaeological heritage found during the construction, it is subject to this Act.

Ratified International Conventions and Treaties

Convention on Biological Diversity: It aims to promote conservation of biological diversity; sustainable use of its components; and fair and equitable sharing of benefits arising out of the utilization of genetic resources.

Ramsar Convention on Wetlands: It provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

United Nations Convention on Climate Change (UNFCCC): It aims to mitigate and adapt to climate change to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

Convention for the Protection of the World Cultural and Natural Heritage: It aims at encouraging the identification, protection, and preservation of earth's cultural and natural heritage. It recognizes that the nature and culture are complementary and that cultural identity is strongly related to the natural environment in which it develops. The Convention provides for the protection of those cultural and natural 'properties' deemed to be of the greatest value to humanity. In the course of implementing DSCMP, cultural and heritage objects may be discovered. Recommendations will be made according to the Tanzanian legislation and policies and international best practices on how to handle these objects at the project level.

6-1-2 Institutional Framework

EMA 2004 sets up the institutional framework for environmental management in Tanzania. It confers the tasks of overall coordination of environmental management and provision of the central support functions to the Ministry Responsible for Environment, which is the Vice President's Office (VPO). Other related organizations are as follows:

- **National Environmental Advisory Committee (NEAC):** The committee is created to advise the Minister responsible for environment or any sector ministry on any environmental matter which may be referred to it.
- **Minister Responsible for Environment:** The Minister can articulate policy guidelines, make regulations, guidelines, can designate any institution to perform any function. The Minister can make rules for preparation of periodic environmental plans at sector level, can make regulations prescribing the procedure and manner in which Environmental Action Plans may be prepared, adopted and implemented.
- **Director of Environment, Vice President's office:** The Director of Environment coordinates environmental activities, advices the government on the law and international environmental agreements on the environment, monitor and assess activities of relevant agencies, prepares and issue State of Environment Report.
- **National Environmental Management Council (NEMC):** The function of the Council among others include carries out environmental audits, surveys, researches; reviews and recommend for approval of Environmental Impact Assessment; enforce compliance of the National Environmental Quality Standards; initiates procedure for the prevention of accidents which may cause environmental degradation; undertakes programs to enhance environmental education; publishes and disseminate manuals relating to environmental management; renders advise and technical support to entities engaged in natural resources and environmental management; and performs any

other functions assigned to it by the Minister responsible for environment.

- **Sector Ministries:** Each sector ministry carries out its functions and duties in connection with the environment according to EMA and any other law provided that such law does not conflict with EMA. Involvement of Sector Ministries in environmental management is through a sector environment sections (SEs) which have been established in each ministry to ensure that ministries comply with the EMA.
- **Regional Secretariat:** The Regional Secretariat is composed of a Regional Environmental Management Expert (REME) charged with the responsibility to advise the Local Government Authorities of that particular administrative region on matters relating to implementation and enforcement of EMA. The REME links the region with the Director of Environment.
- **Local Government:** EMA has vested to the Local Government Authorities the function of environmental management. It has created officers and has also designated to some committees certain environmental functions.

The Institutional Arrangement under Environmental Management Act is shown in the Figure 6-1.1.

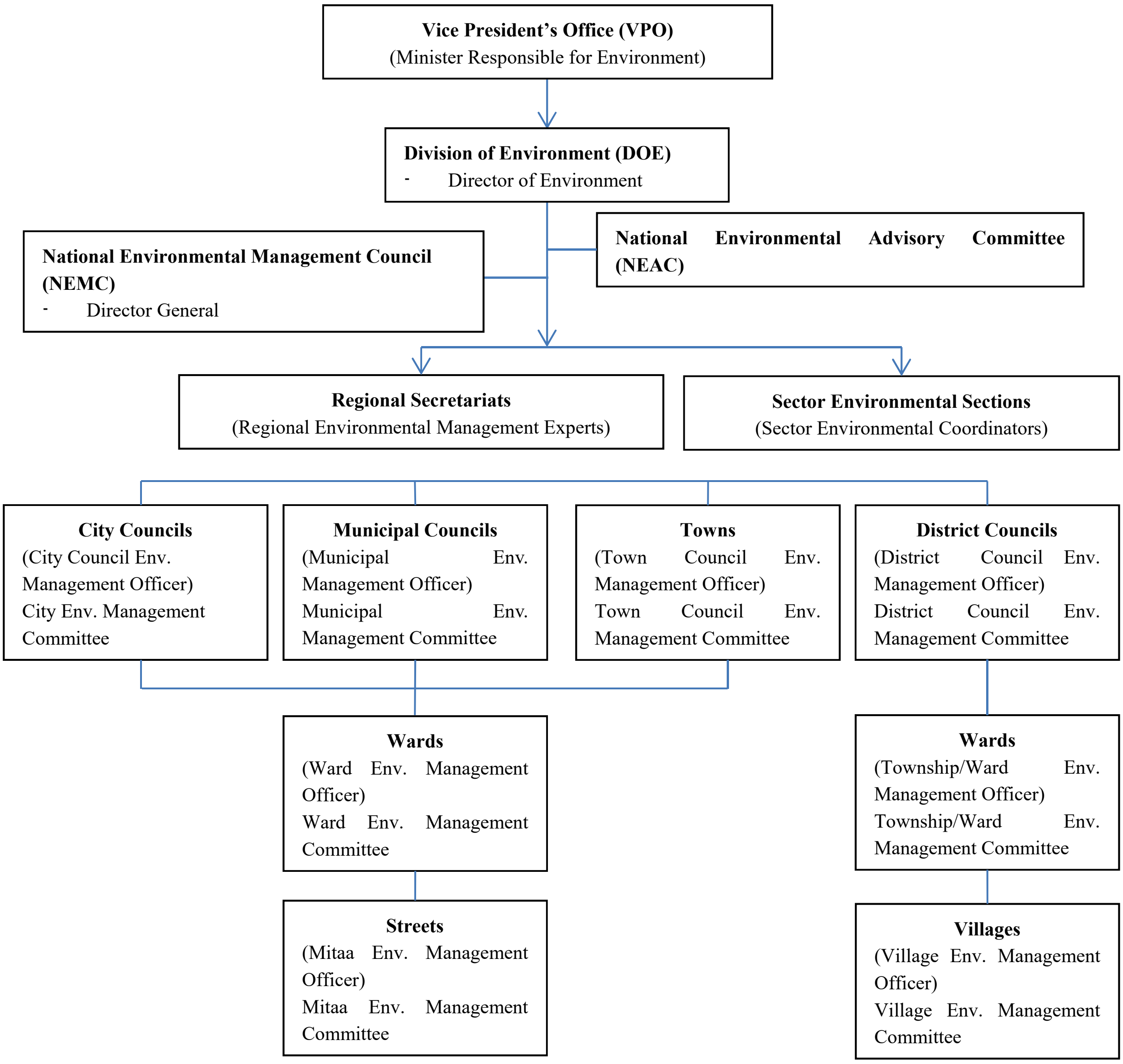


Figure 6-1.1 Institutional framework on Environmental Management in Tanzania (DOE-VPO, 2012)

6-1-3 Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA)

(1) Requirements and procedures of EIA

EIA in Tanzania is guided by the National Environmental Policy (1997) and Environmental Management Act (EMA) 2004. The EMA 2004 specifies detailed measures for protecting ecological process, the sustainable utilization of ecosystems, and environmental protection, and is organized into following parts:

Part I: Preliminary provisions

Part II: general principles

Part III: Administrative and institutional arrangements

Part IV: Environmental Planning

Part V: Environmental Management

Part VI: Environmental Impact Assessment (EIA)

Part VII: Strategic Environmental Assessment (SEA)

Part VIII: Pollution prevention and control

Part IX: Waste management

Part X: Environmental quality standards

Part XI: Environmental restoration, easements and conservation orders

Part XII: Analysis and records

Part XIII: Environmental Information

Part XIV: Public participation in environmental decision-making

Part XV: International arrangements

Part XVI: Compliance and enforcement

Part XVII: Environmental Appeals Tribunal

Part XVIII: National Environmental Trust Fund

Part XIX: Financial provisions

Part XX: General and transitional provisions

In addition to the Act, the EIA practice is also guided by the Environmental Impact Assessment and Audit Regulations (2005) prepared by the Vice President's Office. As for the fees and charges of EIA and audit, it is regulated by the Environmental Management (Fee and Charges) (Amendment) Regulations, 2016. The EIA and Audit Regulations is the operational tool of EMA. It has 12 parts setting out detailed steps for conducting EIA as follows:

Part I: Preliminary provisions

Part II: General prohibition

Part III: Project registration and screening

Part IV: The Environmental Impact Assessment

Part V: The Environmental Impact Statement

Part VI: Review process of Environmental Impact Statement\

Part VII: Decision of the Minister

Part VIII: Access to Environmental Impact Statements and Information

Part IX: Period of validity

Part X: Environmental Audit

Part XI: Monitoring

Part XII: General provisions

According to the First Schedule of the EIA and Audit Regulations (2005), the following projects require EIA for Energy Sector.

1. Production and distribution of electricity, gas, steam, and geothermal energy
2. Storage of natural gas
3. Thermal power development

4. Hydroelectric power
5. Development of other large scale renewable and non-renewable sources of energy

The EIA administration in Tanzania is as shown in the Figure 6-1.2.

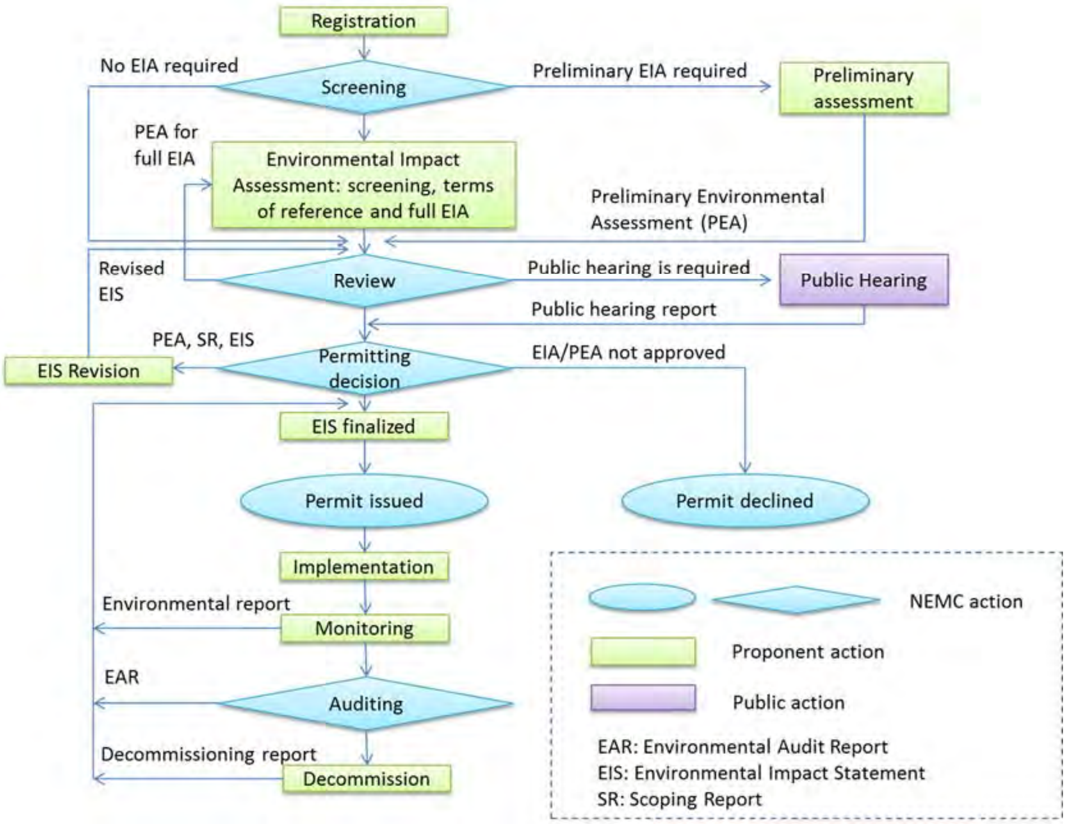


Figure 6-1.2 EIA Administration (Energy Sector EIA guideline, MEM, 2012)

(2) Legal and Regulatory Requirements of SEA

The legal and regulatory requirements of SEA are provided in Section 104 and 105 of EMA. Section 104 requires that when preparing a Bill that is likely to have effect on the management, conservation and enhancement of the environment; or sustainable development of natural resources, SEA should be undertaken and submitted to the Minister responsible for environment. Moreover, the Act requires that when promulgating regulations, public policies, programmes and development plans that may have effects on the environment, SEA should be conducted.

Authority Responsible to Undertake SEA: Regulation 8(1) of the SEA Regulations requires Sector Ministry, government agency or department, where it is found necessary at the commencement of preparation of a Bill, regulations, policy, strategy, program or plan to carry out a SEA. In so doing the responsible authority may form a team to undertake the assessment, comprising experts in SEA or environmental and natural resource management from a sector ministry, government agency, department and public research institutions or registered environmental experts.

Steps of SEA: According to the Division of Environment of the Vice President Office (VPO-DOE), followings are the major steps of SEA. The SEA report will be reviewed by the regulatory authorities, which will prepare a report on adequacy of the assessment and make recommendations to the relevant decision-makers. If favourable, the assessment report will be approved.

1. Screening
   - Submit a letter to VPO (Registration letter and Attachment of brief description of the Master Plan)
   - VPO conduct screening and send the result to MEM
2. Scoping
   - Develop Scoping report and detailed TOR
   - Submit Scoping report and TOR to VPO
   - VPO will send the copy to key stakeholders asking for their comments. After receiving comment, VPO approve them
3. Conduct SEA
   - Conduct SEA based on the approved TOR
4. SEA report
   - Submit 1st draft SEA report to VPO
   - VPO will send the copy and have a stakeholder workshop
   - Submit 2nd draft SEA report to VPO
   - VPO will send the copy and have a stakeholder workshop
   - Submit final draft SEA report to VPO
5. Review
   - Technical review team will review the final draft SEA report and prepare advice for the minister responsible for environment
6. Approval
   Minister responsible for environment approves the SEA

6-1-4 Environmental Standards and other related legislation

According to the section 140(1) of the EMA, the National Environmental Standards Committee of the Tanzanian Bureau of Standards is required to develop, review and submit proposals for environmental standards relating to: water quality, discharge of effluent, air quality, noise and vibration, subsonic vibration, ionising and other radiation, soil quality, noxious smells, light pollution, electromagnetic waves and microwaves.

Standards Act, 2009: It provides for the promotion of the standardization of specifications of commodities and services, to re-establish the Tanzania Bureau of Standards (TBS) and to provide better provisions for the functions, management and control of the Bureau. Some of the TBS related standards are: TZS 825:2012 (Air quality-Specification), TZS 860:2006 (Municipal and industrial wastewaters – General tolerance limits for municipal and industrial wastewaters), TZS 932:2007 (Acoustics – General tolerance limits for environmental noise), TZS 972:2007 (Soil quality – Limits for soil contaminants in habitat and agriculture). All the projects identified under DSCMP have been taken into consideration the necessary environmental standards to ensure the implementation of

DSCMP is in compliance with such standards.

6-2 Gaps between Tanzanian legislation and JICA Environmental Social Guidelines

There are some gaps between JICA guideline, World Bank Safeguard Policy and Tanzanian legislation on environmental and social consideration as below.

6-2-1 EIA

Response policy including JICA's guideline and the World Bank's Safeguard Policy	Relevant laws in Tanzania	Main gaps
・Projects must not involve significant conversion or significant degradation of critical natural habitats and critical forests. ・Whenever feasible, projects are sited on lands already converted (excluding any lands considered to have been converted in anticipation of the project). JICA does not support projects involving the significant conversion of natural habitats unless there are no feasible alternatives for the project and its siting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs. If the environmental assessment indicates that a project would significantly convert or degrade natural habitats, the project includes mitigation measures acceptable to JICA. Such mitigation measures include, as appropriate, minimizing habitat loss (e.g., strategic habitat retention and post-development restoration) and establishing and maintaining an ecologically similar protected area. JICA accepts other forms of mitigation measures only when they are technically justified.	・The Environmental Management Act 2004 stipulates that the Minister responsible for Environmental Protected Areas by considering flora and fauna, special feature, the interests of the local communities and accordance with international society. (Article 47) ・Under the National Policies for National Parks in Tanzania, 1994, although, the primary objectives are the protection and inheritance of natural resources (Article3.1), permission of all projects in National Parks is granted based on Environmental Impact Assessment, which clarify positive and negative impacts.	Under the domestic law in Tanzania, even within National Parks, project permission can be granted depending on the EIA result. The purpose of conducting EIA is to identify both positive and negative impact of the project and suggests the mitigation measures for negative impact and enhancement measures for positive impacts..
・Confirm that projects comply with the laws or standards related to the environment and local communities in the central and local governments of host countries; it also confirms that projects conform to those governments' policies and plans on the environment and local communities.	There is Environmental Impact Assessment System provided by EMA.	There is no difference in particular.
・EIA reports (which may be referred to differently in different systems) must be written in the official language or in a language widely used in the country in which the project is to be implemented. For explanations, documents must be formulated in a language and manner, and that are understandable to the affected local people.	EISs (EIA reports) etc. should be formulated in languages understandable to stakeholders.	There is no difference in particular.
・In principle, host countries etc. disclose information about the environmental and social considerations of their projects. Assist project proponents etc.as needed. ・Encourage host countries etc. to disclose and present information about environmental and social considerations to local stakeholders. ・EIA reports are required to be made available to the local residents of the country in which the project is to be implemented. The EISs are required to be available at all times for perusal by project stakeholders such as local residents and copying must be permitted. ・In principle, host countries etc. consult with local stakeholders to a reasonable extent. Assist host countries as needed.	・From screening step of project, participation opportunities are provided. During EIS review period, public consultation is held and EIS is made public and comments are received verbally and in writing. ・Also, EIS is stored as official document by NEMC and available for perusal when needed.	There is no difference in particular.

Response policy including JICA's guideline and the World Bank's Safeguard Policy	Relevant laws in Tanzania	Main gaps
・Confirm monitoring results through host countries etc. to verify environmental and social considerations are implemented surely. The information necessary for monitoring confirmation must be supplied by host countries etc. by appropriate means, including in writing. ・Also, disclose the results of monitoring conducted by host countries etc. on its website to the extent that they are made public in host countries etc.	NEMC shall conduct environmental assessment. Project proponents should store monitoring data and formulate annual report and report actual result compared with original plan to NEMC. When negative impacts were occurred, appropriate mitigation measures shall be planned and implemented.	There is no difference in monitoring environmental standards. In Tanzania, different standards are in place as described in 6-1.4

6-2-2 Land Acquisition and Resettlement

Response policy including JICA's guideline and the World Bank's Safeguard Policy	Relevant laws in Tanzania	Main gaps
Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. (JICA GL)	No specific provisions on avoiding involuntary resettlement and loss of means of livelihood although these can come from Environmental and Social Impact Assessment (ESIA)	Avoiding involuntary resettlement is not mentioned in Tanzania land laws.
When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken. (JICA GL)	・When displacement is unavoidable, compensation will be given as follows (Land Act, 1999 – Cap 113, Part II Section 3 (1) (g) , Section 34 and 156) ・Market value of unexhausted improvement [1], disturbance allowance, transport allowance, accommodation allowance and loss of profits, although depreciated replacement value is given and valuation is often not done properly because some aspects that need to be included are not taken into account – for example, using market values is sometimes ignored and information to affected persons is not sufficiently provided	・Full replacement value (market value) plus transaction costs are not mentioned in Tanzania laws. ・Measures to minimize impacts are not explicit in Tanzania laws.
People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels. (JICA GL)	Livelihood restoration is not addressed although, sometimes done through provision of alternative affected social services- for example, providing an alternative health facility or a school are cases in point.	Livelihood restoration is not explicit in Tanzania laws.
Compensation must be based on the full replacement cost as much as possible. (JICA GL)	Market values but usually in practice provide with depreciated replacement values (although the law does not direct the use of depreciated values)	Full replacement cost not paid.
For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. (JICA GL)	For large scale involuntary resettlement compensation must be provided (Land Acquisition Act 1967 Part II Section 11 and Land Cap 113, Part II Section 3 (1) (g))	Tanzania Law does not consider Resettlement Action Plan as mandatory.

[1] Land Act, 1999 interprets unexhausted improvement as anything or any quality permanently attached to the land directly resulting from the expenditure of capital or labor by an occupier or any person acting in his behalf and increasing the productive capacity, the utility, the sustainability of its environmental quality and includes trees standing crops and growing produce whether of an agricultural or horticulture nature. This condition has been amended by the Land (Amendment Act), 2004 by replacing Subsection 8 and 9 of the Land Act 1999 to allow for sale land without unexhausted improvements. For development purposes or as joint venture.

Response policy including JICA's guideline and the World Bank's Safeguard Policy	Relevant laws in Tanzania	Main gaps
Appropriate and accessible grievance mechanisms must be established for the affected people and their communities. (JICA GL)	Tanzania land law provides a mechanism for dealing with grievances including lodging complaints to the courts (Land Acquisition Act 1967, Section 13 (1) and (2) and Land Act, Cap 113. Part XIII Section 167 (1))	Tanzania grievance mechanism is not easily accessible to affected persons.
Eligibility of benefits includes, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying. (WB OP4.12 Para.15)	Eligibility of benefits includes, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of valuation but have invested on land will be eligible for compensation of assets but not land (recognized as tenants) Land Act Cap 133	Tanzania Law does not recognize encroachers.
Provide support for the transition period (between displacement and livelihood restoration). (WB OP4.12 Para.6)	-	The law is silent about provision of support during transition and for livelihood restoration.

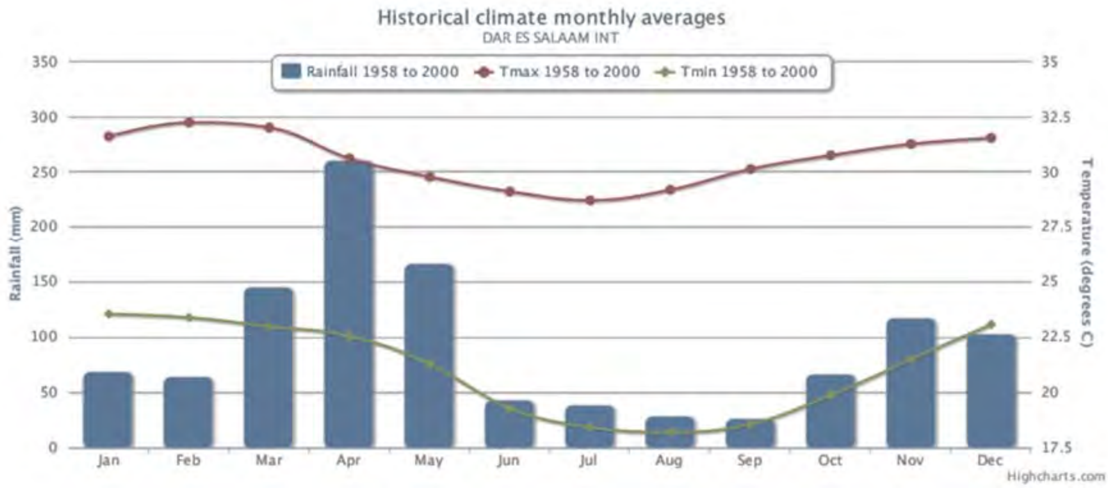
6-3 Baseline and issues considered

6-3-1 Weather and climate change

Climate: According to the 2nd National Communication of Tanzania, climate condition of Central Coastal area, which includes Dar es Salaam and Pwani region, is as follows:

Rainfall regime is bimodal with peaks in November and April. Mean annual rainfall is 1268 mm. Mean monthly maximum temperature is observed in February and is 32.4 degrees. Mean monthly minimum temperature is observed in July and is 18.2 degrees.

Generally, Dar es Salaam city bears a humid climate with temperatures that vary from 26 degrees in August to 35 degrees in December and January. Having a typical coastal equatorial climate, the regime of Dar es Salaam can be characterized as being hot and humid with small seasonal and daily variations in temperature. The temperature ranges from a maximum of 31.5 to 32.1 degrees to a minimum of 18.1 to 18.6 degrees. The mean daily temperature is about 26 degrees, the seasonal range is about 4 degrees, and the mean daily range is about 8 degrees. The relative humidity reaches 100% on almost every night of the year and rarely drops below 55 % during the day.



Source: Climate System Analysis Group at the University of Cape Town, http://cip.csag.uct.ac.za/webclient2/app/

Figure 6-3.1 Historical climate averages in Dar es Salaam

Climate Change/Variability: Recent studies on climate change in Tanzania show that there will be an increase in extreme weather events, mainly associated with intense, frequent and unpredictable flooding, drought and tropical storms. Rainfall has also become scare and unpredictable. Dar es Salaam city also has a Disaster Management Unit that coordinates responses to disasters that happen, including those related to climate change.

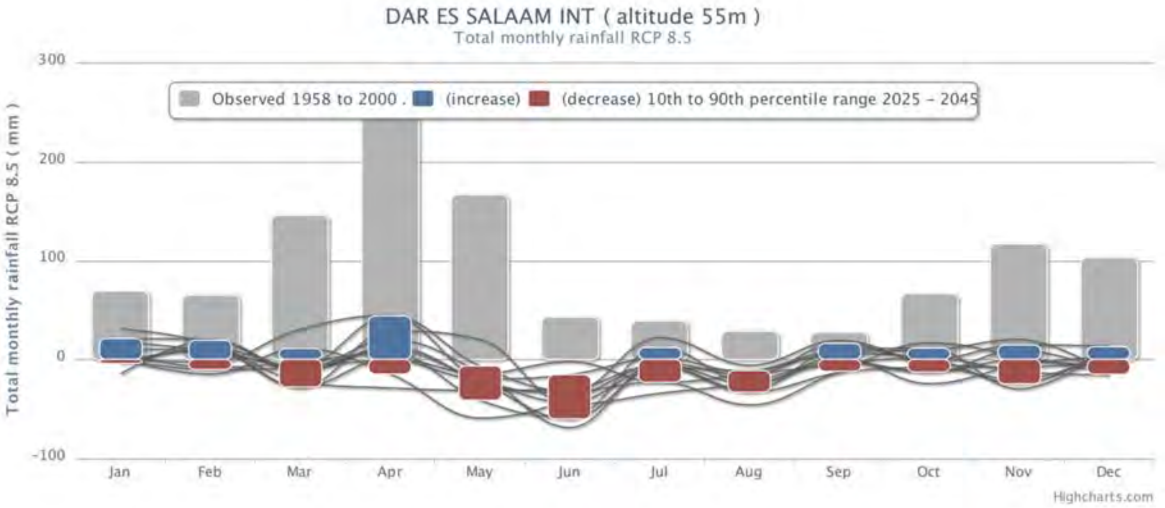
According to the 2nd National Communication, projected climate for the year 2050 in Central Coastal Region is as shown in Table 6-3.1.

Table 6-3.1 Projected change in temperature and rainfall by 2050 in North Coastal area (Dar es Salaam and Pwani)

	Season	Projected change by 2050
Temperature	Annual mean change	+1.61 degree
	December–February season	+1.57 degree
	March-May season	+1.61 degree
	June-August season	+1.62 degree
Rainfall	Annual mean change	+1.8%
	December–February season	+11.7%
	March-May season	+4.2%
	June-August season	-7.2%

Source: 2nd National Communication of Tanzania

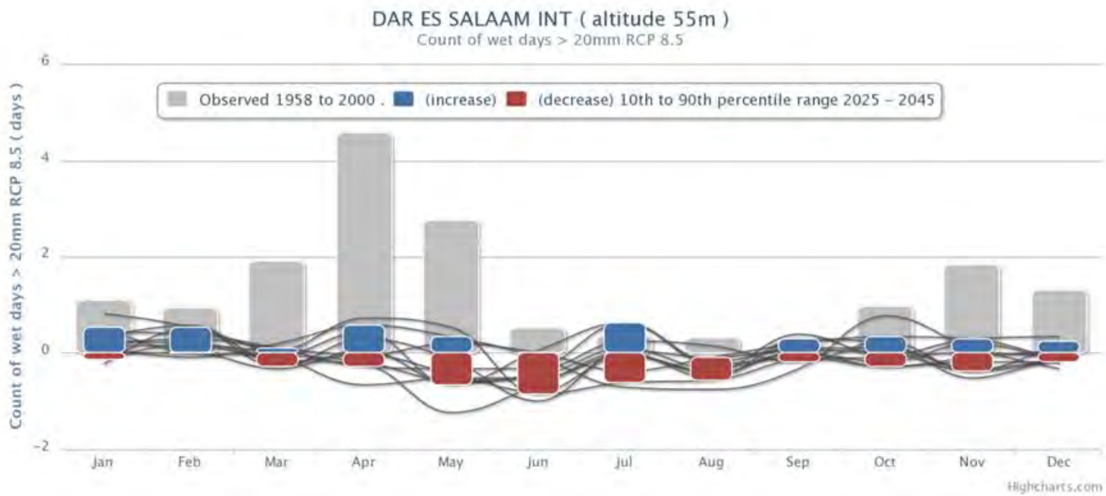
Figure 6-3.2 and 6-3.3 show the statistically downscaled climate projections for Dar es Salaam, using the RCP8.5 scenario (high emissions) at near- to medium-term projections (2025-2045), as the master plan target year is 2030. Figure 6-3.2 shows the projected changes in total monthly rainfall, Dar es Salaam, 2025-2045. Most models suggest an increase in total monthly rainfall during April. April is likely to stay the wettest month, and with a higher monthly average might result in more extensive flooding events.



Source: Climate System Analysis Group at the University of Cape Town, http://cip.csag.uct.ac.za/webclient2/app/

Figure 6-3.2 Projected changes in total monthly rainfall, Dar es Salaam, 2025-2045, under RCP 8.5

Figure 6-3.3 shows how the number of heavy rain days (>20 mm) might change by 2025-2045, compared with the 1958-2000 record. The lines show the results for each of 10 climate models; the coloured bars indicate patterns in the data. The number of wet days (>20 mm of rain) from January, February, April may increase. This parameter is important because very heavy rains can cause floods.



Source: Climate System Analysis Group at the University of Cape Town, http://cip.csag.uct.ac.za/webclient2/app/

Figure 6-3.3 Projected changes in number of heavy rain days, Dar es Salaam, 2025-2045, under RCP 8.5

6-3-2 Forest, protected areas, important species

Forestry: Forest resources in Dar es Salaam are highly influenced by human activities, especially farming, settlement and other development. In Dar es Salaam, there are limited natural forests within the city boundaries, the only ones being Dondwe and Mabwepande. A small part of Pugu forest in Coast region also extends into Dar es Salaam city. Other natural forests include the mangrove forest reserves. The Mabwepande forest accommodates some endemic plants.

According to "Coast Region Investment Profile (January, 2015)," the Coast Region has 44 official forest reserves covering a total area of 335,712 ha for forest conservation and production. In addition to that, 2.2 million ha is unofficial forest in general land. As a part of Pwani region, Mafia island has also forest reserves.

In the Coast region, there are some forest reserves located near the proposed transmission lines such as Ruvu North, Ruvu South, Pugu, Kazimzumbwi and Vikindu forest reserves.

Wildlife and protected areas: There are limited wildlife resources in Dar es Salaam city due to its high demand for land for settlements and industrial development. The city remains with only one wildlife protected area which is Mabwepande Forest Reserve in Kinondoni Municipality. The reserve is among the eight national hotspots in the coastal forest sites requiring critical attention for their global biological importance. It contains a high diversity of monkeys, bats and birds, making the city an important bird area.

Coast region has some wildlife protected are as Saadan National Park, Selous Game Reserve, Wami Mbiki Wildlife Management Area (WMA), Presence of 300 km of Coastal line covering Bagamoyo, Mafia, Mkuranga and Rufiji Districts which consists of Sand beaches, Mangroves swamps, Marine corals and Sea breeze.

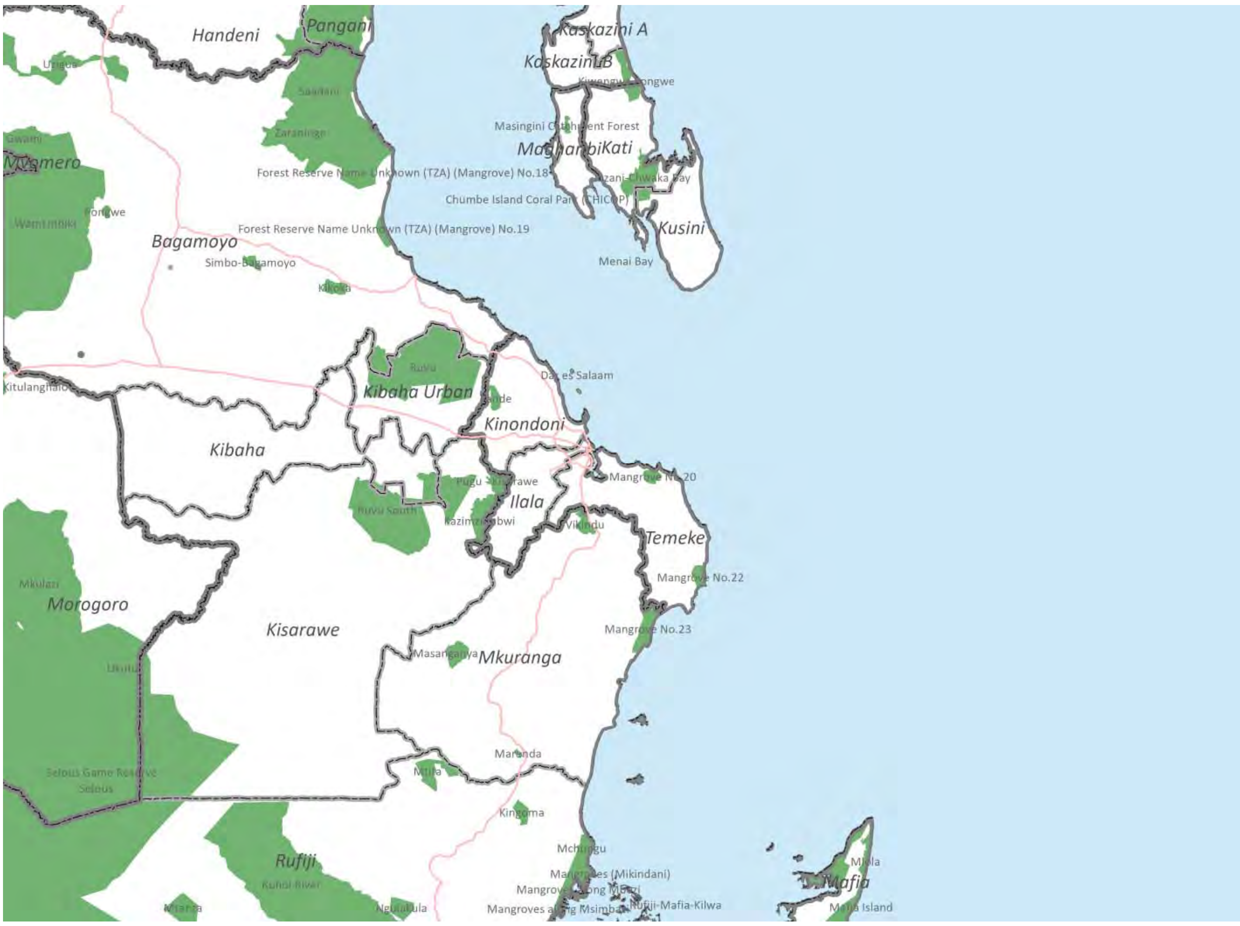


Figure 6-3.4 Protected areas in Dar es Salaam and Pwani region (Green: Protected area)

Dar es Salaam City and Coastal Region contains a variety of aquatic resources of both marine and freshwater ecosystems. The coastal and marine ecosystems include coral reefs, seagrass beds, mangrove forests, bays, estuaries and sandy beaches. Freshwater ecosystems include both surface waters (rivers and streams) and groundwater resources. In past years, aquatic ecosystems were endowed with a great diversity and abundance of aquatic life. However, during recent decades, these ecosystems have become partially exposed to severe degradation by various human activities such as overexploitation of resources and pollution.

6-3-3 Indigenous people

In Tanzania, there is no concept of indigenous people although a concept of tribe does exist. Currently, it is estimated that there are more than 120 tribes. Because no national census has been conducted on tribes since 1970's when the last census was conducted. Therefore, there is no up-to-date information available on the exact number of people who belong to the each tribe.

6-3-4 Cultural Heritage

Tanzania is well endowed with abundant significant cultural heritage resources, which range from the Pliocene period about four million years ago to present time. These resources are categorized into seven groups as follows:-

a) Archaeological or Paleontological sites such as Olduvai Gorge, Laetoli Footprint, Isimila Stone Age site, Engaruka Ruins;
b) Historical sites such as Kaole Ruins, Kunduchi Ruins, Kilwa Kisiwani Ruins, Songo Mnara Ruins;
c) Historical towns such as Bagamoyo, Kilwa Kivinje, Mikindani;
d) Traditional Settlements such as Kalenga in Iringa and Bweranyange in Kagera;
e) Historic Buildings like Colonial Administrative Buildings (BOMAs) in many Districts in Tanzania;
f) Sites with special memories like Colonialists Cemetery, Cemeteries of World War I and II and Defensive Walls;
g) Natural Features and Structures such as Mbozi Meteorite, Amboni Caves and Kondoa Rock Art Shelters to name only a few.

The Division of Antiquities as a Government Institution is responsible for conservation, preservation, protection and management of these cultural heritage resources. The cultural heritage resources are legally protected through Antiquities Act of 1964 (Act No.10 of 1964 Cap 550), which is the principal, legislation and the Antiquities (Amendment) Act of the 1979 (Act No. 20 of 1979) as well as Rules and Regulations of1981, 1991, 1995 and 2002.

Table 6-3.2 Heritage sites in Dar es Salaam and Pwani region

Region	District	Site name	Type of heritage	Dating	Ownership
Pwani (Coast)	Bagamoyo	Bagamoyo Historic Town	Historic Town	19th C	Central Government
Pwani (Coast)	Bagamoyo	Kaole Ruins	Swahili Cultural Site	13th C	Central Government
Dar es Salaam	Kinondoni	Kunduchi Ruins	Swahili cultural site	20th C	Central Government

Region	District	Site name	Type of heritage	Dating	Ownership
Dar es Salaam	Kinondoni	Magomeni Museum	Museum	13th C	Central Government

Source: ANTIQUITIES SITES, Antiquities Division, Ministry of Natural Resource and Tourism

According to the Dar es Salaam City Master plan, there are 67 buildings with historical and architectural value in the central of Dar es Salaam.

6-4 Environmental planning and Strategic Environmental Assessment (SEA)

Because of time limitationsto conduct SEA, high level environmental analysis was conducted considering the concept of the SEA.

6-4-1 Scoping

Table below shows the potential impacts of transmission and distribution lines, and substations in the DSMP.

Table 6-4.1 Possible impacts

		Transmission	Distribution	Substation
Location	Urban area	+ + +	+ + +	+ + +
	Peri-urban area	+ +	+	+
	Rural area	+	+	+
	Environmental Item			
1.Pollution Control	Air Quality	D	D	D
	Water quality	B	D	B
	Waste	D	D	B
	Soil Contamination	D	D	B
	Noise and Vibration	B	D	B
	Ground Subsidence	D	D	D
	Odor	D	D	D
	Bottom Sediment	D	D	D
2.Natural Environment	Protected Areas	B/D	B/D	D
	Ecosystem	B	B	B/D
	Hydrology	D	D	B/D
	Topography and Geology	D	D	D
3.Social Environment	Resettlement	B/C	B/C	B/C
	Living and livelihood	B	B/D	B/D
	Heritage	B/C	B/C	B/C
	Landscape	B	B	B
	Ethnic Minorities and Indigenous People	N/A	N/A	N/A
	Land Use and Natural Resources	B	B	B/D
	Water Use	D	D	D
	Existing Social Infrastructure and Institution	B	B	B
	Misdistribution of Benefit and Damage	B	B	D
	Gender/Children's right	D	D	D
	Local Conflict of Interest	D	B	B/D
	HIV/AIDS and diseases	D	D	D
	Working Condition	D	D	B

		Transmission	Distribution	Substation
4.Others	Accidents	B	B	B
	Electromagnetic waves	B	B	B

A：Significant negative impact is expected.
B：Some negative impact is expected.
C：Extent of impact is unknown at this stage
D: No impact is expected (except tentative impacts to be managed by future detailed construction plan)

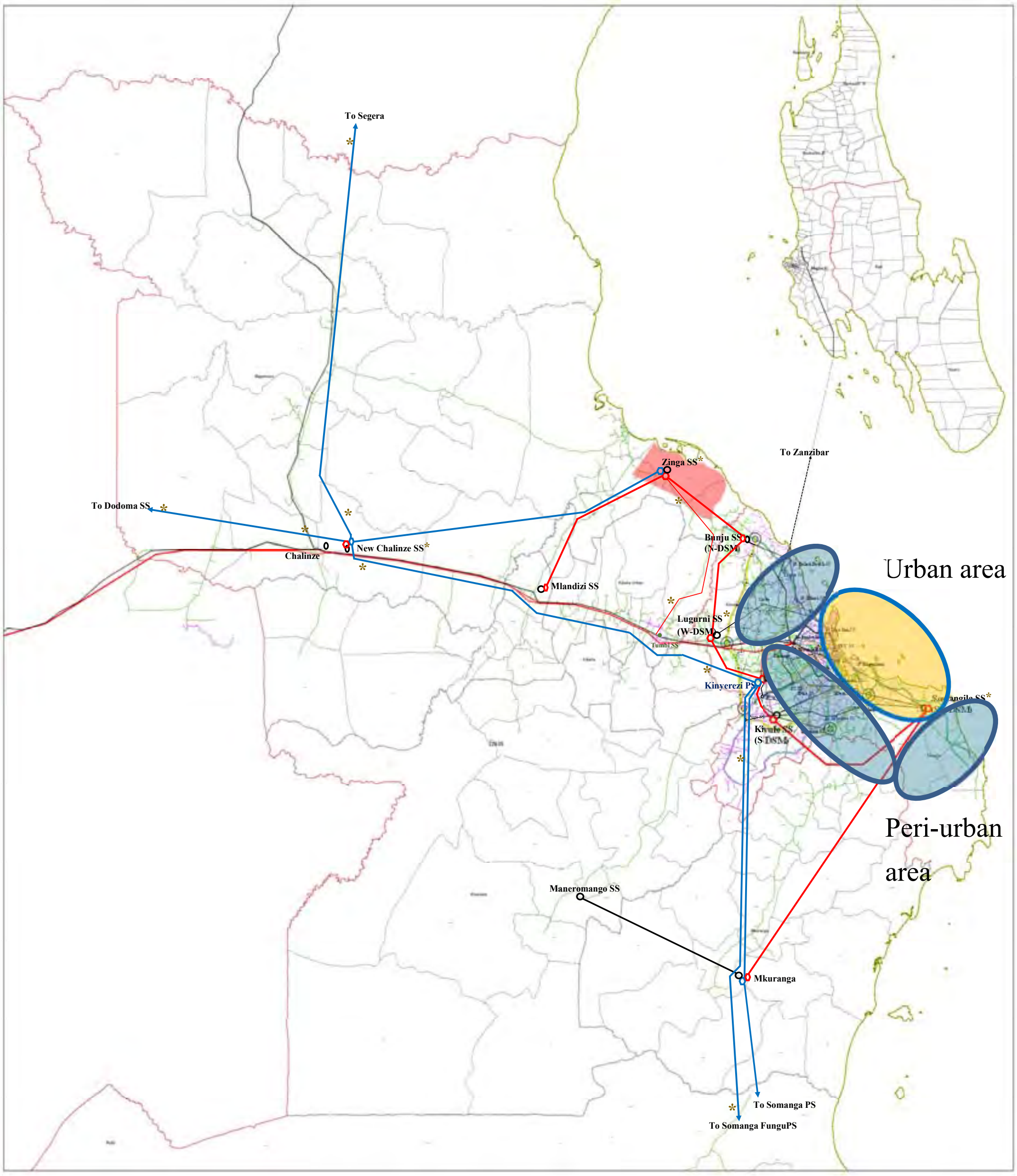


Figure 6-4.1 Map of the DSMP

6-4-2 Outline of the components of the DSMP and consideration of potential alternatives

(1) Transmission line

Table 6-4-2 shows the list of the transmission lines of DSMP and alternatives which could be considered when conducting the project level assessment (e.g. project EIA or F/S).

Table 6-4.2 List of the transmission lines and potential alternatives

As of 13/Feb/2017

Rated Voltage (kV)	from	to	Included in PSMP	Route Length (km)	ROW (m)	Required area (ha)	No. of Circuit	Alternatives which could be considered in the project level assessment (project EIA or F/S)
400	Somanga Fungu SS	Kinyerezi PS	O	212	50	1,060.0	2	Potential alternative: consider parallel alignment with 400kV route from Kinyerezi to Mkuranga SS
400	Mkuranga SS	Kinyerezi PS		85	50	425.0	2	
400	Mkuranga SS	Somanga PS		185	50	925.0	2	
400	N.Chalinze SS	Segera SS	O	175	50	875.0	1	Potential alternative: consider parallel alignment with the existing 132 kV line from Chalinze SS for some part of the route.
400	N.Chalinze SS	Segera SS	O	175	50	875.0	1	
400	N.Chalinze SS	Dodoma SS	O	336	50	1,680.0	1	
400	N.Chalinze SS	Zinga SS (Bagamoyo)	O	100	50	500.0	2	Potential alternative: consider parallel alignment with 220kV route from Mlandizi SS to Zinga SS for some part of the route.
220	Zinga SS (Bagamoyo)	Bunju SS (North DSM)	O	29	35	101.5	2	Potential alternative: consider parallel alignment with 220kV route from Zonga SS to near Kibaha (Tumbi SS)
220	Bunju SS (North DSM)	Lugurni SS (West DSM)	O	35	35	122.5	2	Potential alternative: consider parallel alignment with 220kV route from Zonga SS to near Kibaha (Tumbi SS)
220	Mkuranga	Somangila SS (South-east DSM)	O	95	35	332.5	2	
220	Kivule SS (South DSM)	Somangila SS (South-east DSM)	O	60	35	210.0	2	Potential alternative: consider utilizing ROW of the existing 132kV route from around Kivule SS to near Kibada SS
220	Zinga SS (Bagamoyo)	Mlandizi SS	O	51	35	178.5	2	
220	Kinyerezi PS	Lugurni SS (West DSM)	O	21	35	73.5	2	Potential alternative: consider utilizing ROW of the existing 220kV route from around Kinyerezi PS to Lugurni SS
220	Kinyerezi PS	Kivule SS (South DSM)	O	15	35	52.5	2	Potential alternative: consider utilizing ROW of the existing 132 kV route from around Kinyerezi PS and FZ II SS to near Kivule SS
220	Kinyerezi PS	Ubungo SS	O	12	35	42.0	2	
132	Kinyerezi PS	FZ-II SS	O	5	27	13.5	2	Potential alternative: consider parallel alignment with 220kV route from Kinyerezi PS to Kivule SS
132	N.Chalinze SS	Chalinze SS		4	27		1	Note: using existing line between Chalinze SS and Mlandizi SS
132	N.Chalinze SS	Mlandizi SS		46	27		1	Note: using existing line between Chalinze SS and Mlandizi SS
132	Bunju SS (North DSM)	N. Bahari Beach SS		15	27	40.5	2	
132	N. Bahari Beach SS	Tegeta SS		4	27	10.8	1	Option 2 (alternative): Monopole tower could be considered
132	N. Bahari Beach SS	N. Mbezi SS		10	27	27.0	2	
132	N. Bahari Beach SS	N. Mbezi SS		4	27	10.8	1	Option 3 (alternative): Underground cable is chosen
132	N. Mbezi SS	Kawe SS		4	27	10.8	1	
132	N. Mbezi SS	Kawe SS		2	27	5.4	1	Option 3 (alternative): Underground cable is chosen
132	Lugurni SS (West DSM)	Goba SS		20	27	54.0	2	
132	Goba SS	Kawe SS		15	27	40.5	1	Option 2 (alternative): Monopole tower could be considered
132	Kawe SS	Drive Inn SS		5	27	13.5	1	Option 2 (alternative): Monopole tower and/or Option 3 (alternative): underground cablecould be considered
132	Kawe SS	Drive Inn SS		5	27	13.5	1	
132	Drive Inn SS	NCC SS		10	27	27.0	1	Option 3 (alternative): Underground cable is chosen
132	Drive Inn SS	N. Mburahati SS		15	27	40.5	1	Option 3 (alternative): Underground cable is chosen
132	N. Mburahati SS	Kimanga SS		10	27	27.0	1	Option 2 (alternative): Monopole tower could be considered
132	N. Mburahati SS	N.Ilala SS		5	27	13.5	2	
132	Mtoni	Kimanga SS		15	27	40.5	2	
132	Mtoni	Kimanga SS		4	27	10.8	2	
132	Ubungo SS	Makumbusho SS		7	27		1	Note: using existing tower
132	Kivule SS (South DSM)	Mtoni SS		20	27	54.0	2	
132	Kivule SS (South DSM)	Mianzini SS		15	27	40.5	2	
132	Kivule SS (South DSM)	Pugu SS		12	27	32.4	2	
132	Kivule SS (South DSM)	Buza SS		12	27	32.4	1	Option 2 (alternative): Monopole tower could be considered
132	Somangila SS (South-east DSM)	N. Kigamboni SS		25	27	67.5	1	Option 2 (alternative): Monopole tower could be considered
132	Buza SS	Kibada SS		20	27	54.0	1	Potential alternative: consider parallel alignment with 132kV line from neear Kivule SS to Kurasini SS for some part of the route
132	N.Kigamboni SS	Kibada SS		12	27	32.4	1	Option 2 (alternative): Monopole tower could be considered
132	N. Bahari Beach SS	Zanzibar		38	27		1	Note: submarine cable
132	Ubungo SS	FZ-III SS		9	27		2	Note: using existing tower
132	Mkuranga SS	Maneromango SS		55	27	148.5	2	
132	Kivule SS (South DSM)	Branch to FZ-II SS		0.5	27	1.4	1	
132	Kivule SS (South DSM)	Branch to Mbagala SS		0.5	27	1.4	1	
						8,317	ha	

Table 6-4.3 shows the standard width of ROW for each voltage, the typical designs of the transmission towers and design alternatives for 132kV line. The indicated tower designs for

400kV and 220kV are considered possible minimum size. The width of ROW could be reduced from the standard width depending on the design. For example, Kakobe Transmission line uses the corridor of 7 to 10 meter by using monopole design and the cross arm is located on the road side. According to the TANESCO standard specification for underground cable, the depth should be 1.5m by width of 1m, this standard is also used in the TEDAP project.

Table 6-4.3 Expected typical designs of the transmission towers and alternatives

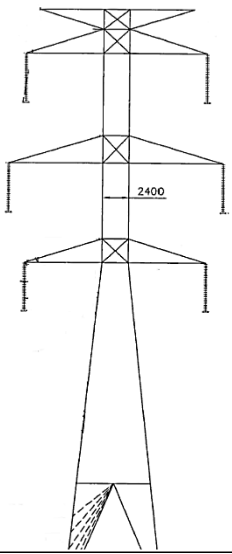
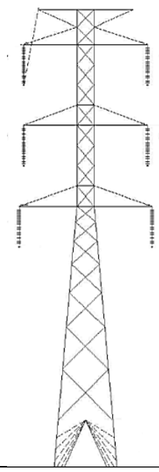
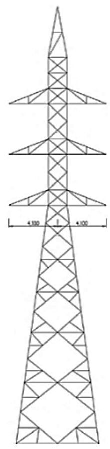
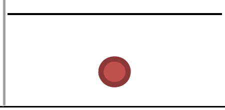
	400kV	220KV	132kV		
Standard width of ROW	50m	35m	27m		
Height	50m	40m	38m	19m	-
Expected typical design			Option 1 	Option2 (alternative) *ROW width can be reduced 	Option 3 (alternative) * Depth 1.5m by width of 1m Underground cable 

Figure 6-4.2 and Figure 6-4.3 show the potential alignment alternatives to reduce necessary land by using ROW of existing transmission line or parallel alignment with other line.

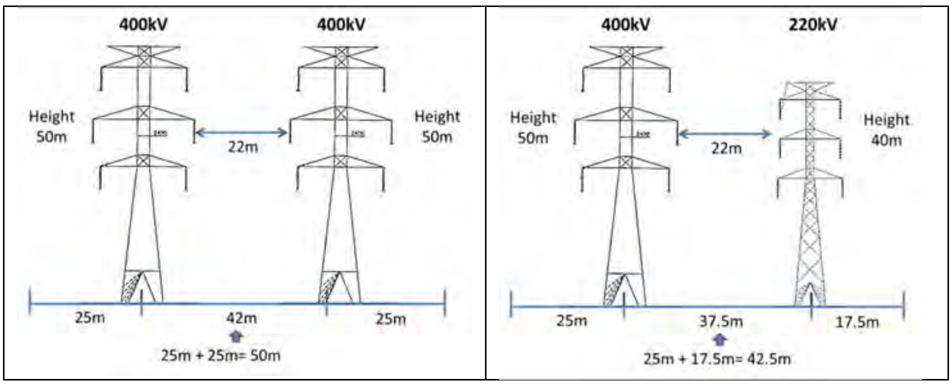


Figure 6-4.2 Alignment alternatives to reduce the require land area (400kV-400kV, 400kV-220kV)

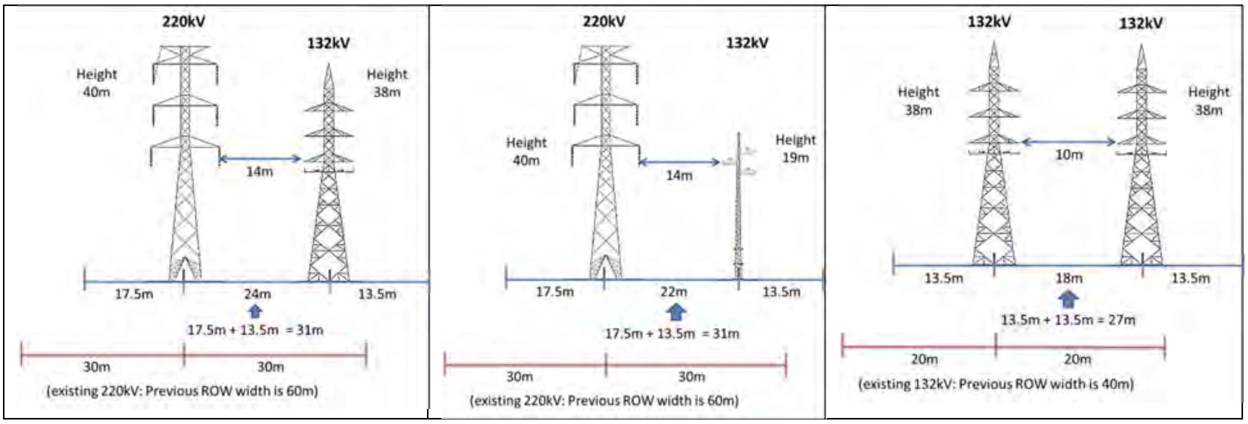


Figure 6-4.3 Alignment alternatives to reduce the require land area (220kV-132kV, 132kV-132kV)

(2) Distribution line

Table 6-4.4 Expected typical designs of the distribution lines and alternative

	33 kV	11kV
ROW	10m	5m
Height	6.0 m(Normal Ground Clearance)	6.0 m(Normal Ground Clearance)
Expected typical design	 Typical type: overhead (horizontal, vertical, and triangular configurations)	 Typical type: overhead (horizontal, vertical, and triangular configurations)
Potential alternative		Alternative option: Underground cable Location: City center, crossing road, nearby substations, locations where establishment of overhead line is difficult or securing ROW is difficult.

(3) Substations

65% of the new substations in Table 6-4.5 require new lands. One of the potential alternative options to reduce necessary land area, if it is difficult to secure enough land area, is to use gas-insulated switchgear (GIS). GIS substation requires less than half of the land area when using air-insulated switchgear (AIS) although it requires more cost. Apart from the listed substations in Table 6-4.5, there are 35 new substations of 33/11kV planned in the DSMP, which require the land area of 24m x 40m, with transformer of 15MVA (72dB) or 30MVA (76dB).

Table 6-4.5 List of the Substations of the DSMP and its necessary land area and noise of transformer

Substation	Existing /New	Included in PSMP	Expected Necessary Land (m)	Voltage (kV)				Transformer		
				400	220	132	33	Capacity (MVA)	Units	Noise (dB)
Bunju (North DSM)	N	O	150m x 200m		O	O		100	3	84
						O	O	50	2	80
Tegeta	E		1 x 132 kV bay extension & Tr. Modification			O	O	65	2	82
New Bahari Beach	N		Existing site is available.			O	O	100	2	82
New Mbezi	N		Existing site is available.			O	O	75	2	81
Kawe	N		100m x 100m			O	O	75	2	81
Goba	N		100m x 100m			O	O	100	2	82
Drive Inn	N		100m x 100m			O	O	100	2	82
City Center	E		Extension within existing plot			O	O	50	1	80
Makumbusho	E		Extension within existing plot			O	O	55	1	80
New Ilala	N		100m x 100m			O	O	100	2	82
Luguruni (West DSM)	N	O	150m x 200m		O	O		400	3	88
						O	O	100	2	82
Kinyerezi	E	O	Extension within existing plot		O	O		200	2	86
FZ-II	E		Extension within existing plot			O	O	50	2	80
Kivule (South DSM)	N	O	150m x 200m		O	O		400	2	88
						O	O	75	2	81
Kimanga	N		100m x 100m			O	O	100	2	82
New Mburahati	N		100m x 100m			O	O	100	2	82
Mtoni	N		100m x 100m			O	O	100	3	82
Buza	N		100m x 100m			O	O	100	3	82
Mianzini	N		100m x 100m			O	O	100	3	82
Pugu	N		100m x 100m			O	O	100	2	82
Kibada	N		100m x 100m			O	O	50	2	80
New Kigamboni	N		100m x 100m			O	O	100	2	82
Kurasini	E		Extension within existing plot			O	O	65	2	83
Mbagala	E		Extension within existing plot			O	O	65	2	83
Somangila (Southeast DSM)	N	O	150m x 200m		O	O		400	2	88
						O	O	50	2	80
Mlandizi	N	O	100m x 100m		O	O		100	3	84
						O	O	50	2	80
						O	O	20	2	76
Chalinze	E	O	Existing			O	O	50	1	80
Mkuranga	N	O	250m x 300m	O	O			500	4	90
					O	O		100	2	84
						O	O	50	2	80
Maneromango	N		100m x 100m			O	O	50	1	80

6-4-3 Major potential impacts for each power system and its evaluation method

(1) Evaluation and Assessment method of Impacts

Tanzania is a member of the Southern African Power Pool (SAPP). According to the SAPP monthly report of November, 2016, in-country disclosure workshops for the Environmental and Social Management framework for the SAPP were held in Swaziland, Mozambique, Namibia Botswana, South Africa and Tanzania where stakeholders gave their input to the draft final report. The final report has since been completed and submitted to the SAPP. The Environmental and Social Management Framework (ESMF)" is as a reference manual to assist in the high-level environmental and social screening of projects to strengthen the assessment, mitigation and management of risks and impacts. The ESMF provides a methodology to identify, categorize and rate risks and impacts. Therefore, when implementing the DSMP, it is recommended to refer and follow the ESMF of SAPP. In the ESMF, a quantitative risk assessment is formed by two components; the magnitude of the potential loss, and the probability that the loss will occur.

(2) Major potential impacts

1) Natural Environment

Forest/vegetation

Transmission & distribution line: Transmission line construction and maintenance can lead to the permanent removal of woody vegetation and in some cases to the complete conversion of strips of forest ecosystem into bare land or land covered by completely different vegetation communities. Fragmentation, pesticide use, and invasive plant species within the right-of-way can also affect surrounding forest areas. There are some forest reserves such as Ruvu North, Ruvu South, Pugu, and Kazimzumbwi forest reserves near the planned area. The proposed lines avoid the protected areas as shown in Figure 6-4.4. When conducting detail project feasibility study and EIAs, these forest reserves are to be considered.

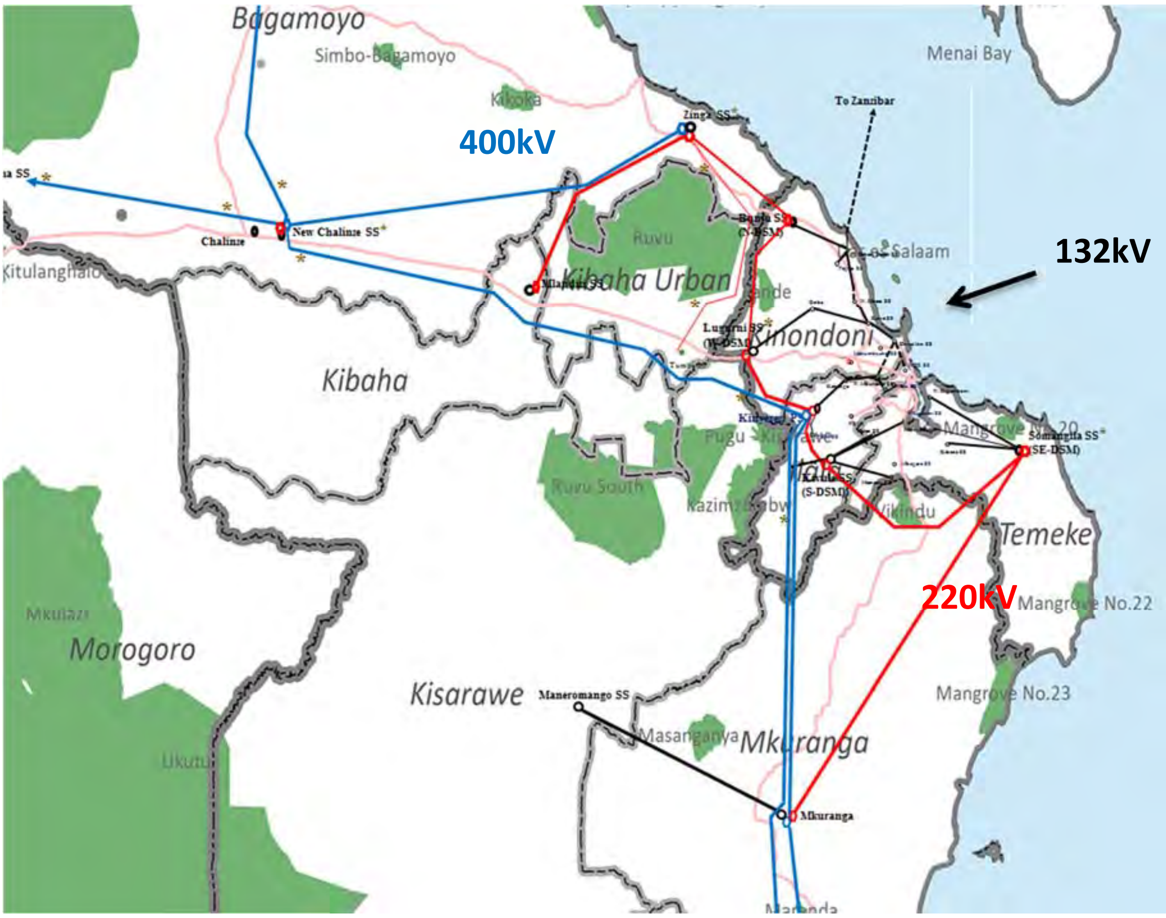


Figure 6-4.4 Proposed transmission line and protected areas (Green area: protected area)

At the time of the Master plan, the specific exact location of the transmission line is not determined. The figure shows the approximate location of the lines and detail citing need to be determined in the project level EIA and F/S.

Although it is approximate location, the potential affected areas are as shown in Figure 6-4.5:

- Most of the 132kV are in built-up area

- 132kV from Mkuranga to Maneromango passes through Woodland.
- 400kV from Somanga Fungu to Mkuranga, pass through cultivated area, crop land and close to wetland.
- 400kV from Kinyerezi to Mkuranga also pass through crop land.

During the course of project EIA, these affected area to be surveyed to determine the detail route siting.

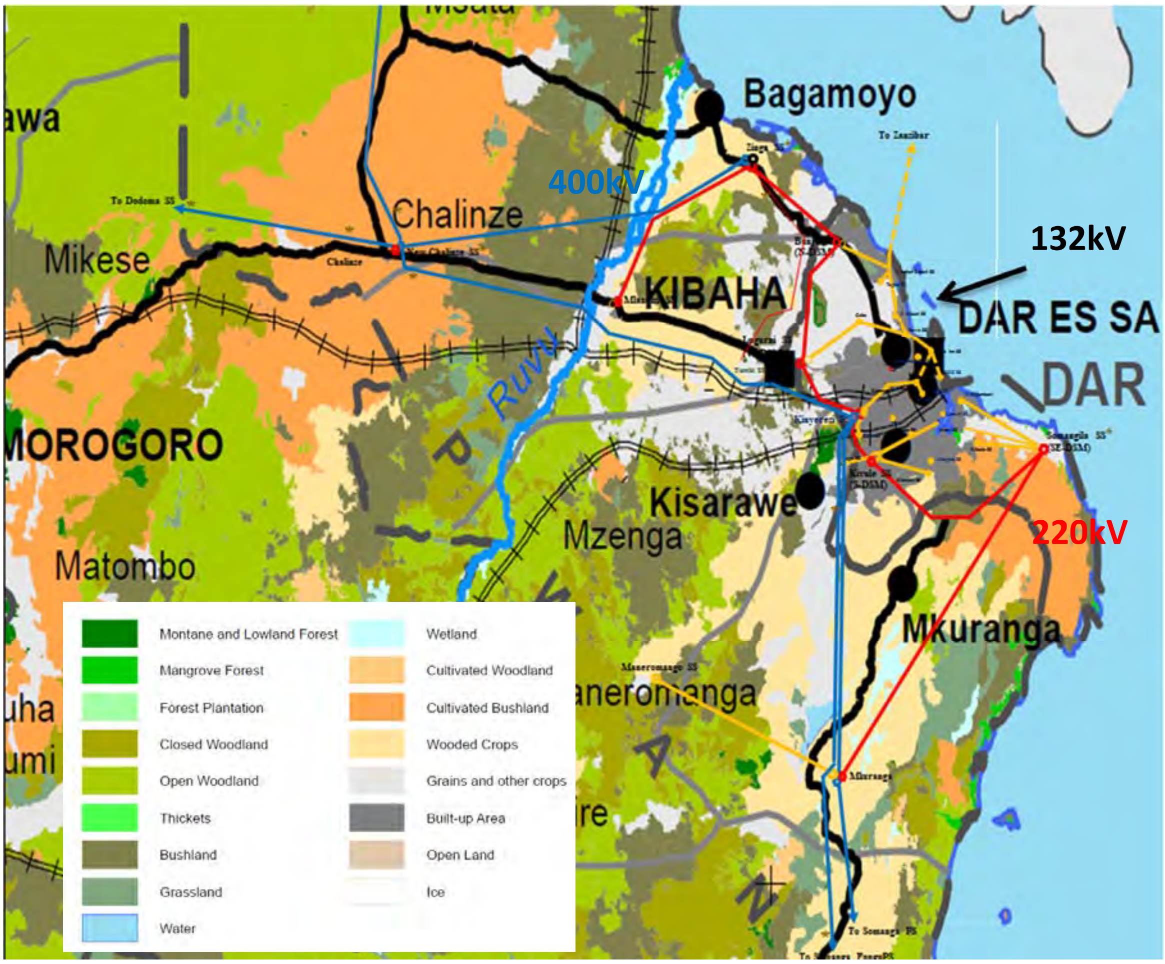


Figure 6-4.5 Proposed transmission line and land cover

Substation: In order to ensure safety for utility employees and the public, it is important to prevent the ground grid from being compromised by vegetation growth. In order to remove weeds in the substation yards, the gravels are used to cover the substation yards or mechanical ways are used to remove it. New substation sites within existing wooded areas will result in the loss of trees and woodland habitat for birds and other wildlife.

Wildlife

Transmission & distribution line: The wildlife impacts of transmission line construction and operation include bird electrocutions and collisions, changes in predator-prey relations in and along the edges of rights-of-way, destruction or alteration of wetland and aquatic environments, and increases in hunting and fishing enabled by rights-of-way and construction/maintenance roads.

Substation: Construction and operation of a substation could have direct impacts on rare species or their habitat if the substation is cited in an area with high-quality habitat suitable for protected species. It is recommended to consult with MNRT to determine if protected species or high-quality habitat are present on the site. When these resources might be present, it is required to avoid or reduce possible impacts. Methods to avoid or minimize impacts may include choosing an alternative site, scheduling construction so as to avoid active breeding seasons, or other methods.

2) Physical Environment

Air, Noise and Vibrations

Corona from the operation of high voltage transmission lines can make audible noises, often described as hissing, in the vicinity of the right-of-way. Transformers also produce noises often described as humming, which are frequently audible outside substation borders. People often consider such noises to be a nuisance. Temporary impacts associated with the construction often include machinery noise and fugitive dust. During the maintenance of the transmission lines and distribution lines and substations, air quality could be slightly affected by such as dust caused by maintenance activities. Noise and vibrations would also increase during the maintenance activities. However, these impacts are expected to be temporary and minimized by adopting appropriate mitigation measures such as limiting operating times to daytime.

Water

Water pollution can result from inadequate wastewater treatment for construction camps, workshops, and staff quarters. Transmission line construction can alter hydrology by compacting soil, removing plant cover, and altering existing drainages or creating new ones. Altered hydrology can affect aquatic, wetland, and riparian habitats and species, and can affect soil moisture and surface water availability in other kinds of ecosystems.

Because of the need for a stable, level ground surface, new substations are rarely constructed within wetlands. If wetlands or waterways are present near an upland substation site, it is likely that construction of a storm water pond to retain runoff from the substation site could be necessary.

The maintenance activities during operation phase might lead accidental oil or lubricant spillage that could affect water quality near the sites. Erosion from access road could lead modification of water quality and siltation in nearby water stream or body.

Soil erosion and contamination

Transmission line construction can lead to soil erosion by removing vegetation cover, compacting soils, and cutting into banks. Erosion can reduce soil fertility and lead to siltation, which affects water quality and productivity in aquatic and wetland ecosystems.

Soil erosion and storm water runoff can occur during construction of substations when the existing vegetation is removed during foundation excavation, temporarily exposing bare ground. Installation of appropriate erosion control measures, such as silt fencing should occur during construction and remain in place until the disturbed vegetation surrounding the fenced-in site has stabilized. The maintenance activities during operation phase might lead to oil leaks from machineries and vehicles. It could cause soil contamination. Highly-refined, mineral insulating oils are used to cool transformers and provide electrical insulation between live components. They are typically found in the largest quantities at substations and there is a risk of leakage of insulating oil during maintenance activity.

3) Social Environment

Aesthetics

Transmission & distribution line: Transmission lines and towers could have impact on land scape which may be visually intrusive and undesirable to local people, especially when located near their homes or near scenic sites such as parks and river crossings.

Substation: The overall aesthetic impact of a new substation is highly dependent on the size and location of the facility. Smaller distribution substations can be camouflaged fairly easily with berms, fencing, or landscaping. Larger substations that interconnect transmission lines can appear quite industrial in nature. They have the potential to affect the character and desirability of the residential area unless adequately landscaped or designed to be less obtrusive.

Cultural resources

Transmission & distribution line: Transmission line construction can affect cultural sites such as areas of archaeological, historical, or religious significance. Burial sites and buried artifacts may be disturbed, especially when trenches are required for underground cables. Some areas in Dar es Salaam are historical areas and it is recommended to consider such building and locations in project feasibility study and EIA.

Substation: Cultural resources include archeological sites, historic buildings, and sacred places. Potential impacts to cultural resources could occur in two ways: 1) ground disturbing activities could result in the loss of or damage to archeological artifacts or unmarked burial sites; or 2) the views and site lines to or from an important historical site could be adversely affected by the physical presence of a new substation. Both of these potential impacts must be considered when an applicant is selecting its final site alternatives.

Safety

Transmission & distribution line, substations: Transmission lines present a risk of electrocution to the public, by direct contact with high- voltage equipment and lines, and also by induced voltages.

Waste

Transmission & distribution line, substation: Liquid petroleum fuels for vehicles and other equipment may also be used and stored at transmission and distribution projects. Prevention and control of hazards associated with spill prevention is recommended.

Electric and Magnetic Field (EMF)

Transmission & distribution line: The effects of power-line frequency electromagnetic fields (EMF) on humans are scientifically uncertain at this point, but some studies indicate that chronic exposure to relatively high-level EMFs from overhead high-voltage transmission lines can lead to an increased incidence of adverse health effects.

Substation: EMF levels within the fenced area of a substation can be much higher than the surrounding area, especially at larger substations containing several transformers. However, these EMF levels decrease rapidly with distance from the transformers and other electrical equipment.

Negatives impacts (noises, water pollution, soil contamination, air pollution etc.)

Resettlement

Transmission & distribution line, substation: The need to clear land for transmission rights-of-way and associated facilities can result in the removal of people living in these locations, and their resettlement in new locations. Depending on conditions, resettlement can be socially and economically disruptive to the people affected, and ecologically damaging to the area in which they are resettled. Since Dar es Salaam and its surrounding areas are populated area and price of land is increasing, land acquisition and its compensation is one of the key issues to be considered in implementing the DSMP. Figure 6-4.6 shows the land use in Dar es Salaam and the approximate location of the proposed lines. Yellow area and yellow ocher shadowed area is residential area. Light green area is urban agriculture area.

- 220kV is expected to pass through the urban agriculture land and residential area.
- 132kV is expected to pass through mainly residential areas.

Most affected area in Dar es Salaam is “residential area” and “urban agriculture area”, which results in land acquisition of such land to establish ROW

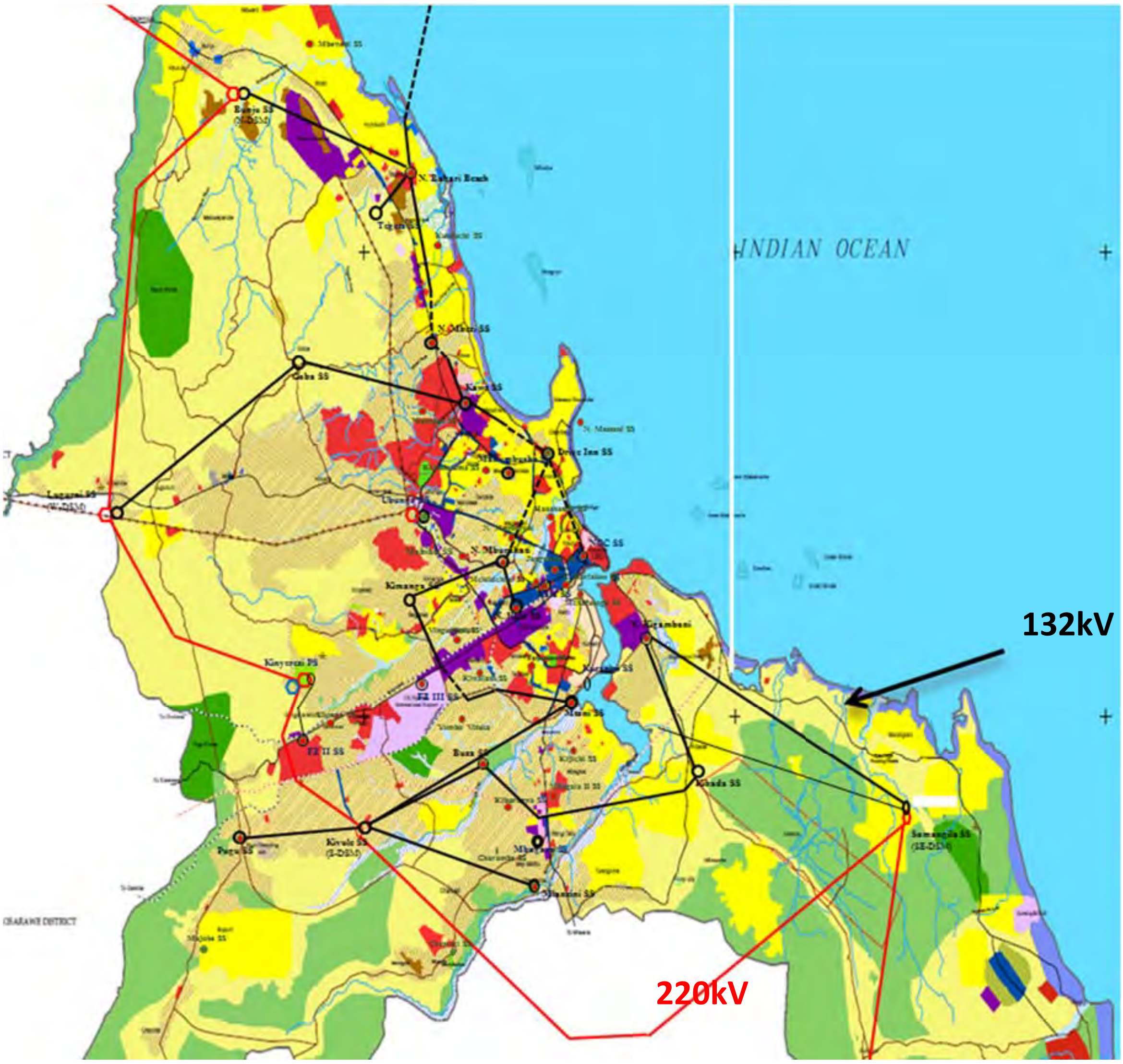


Figure 6-4.6 Proposed transmission line and land cover in Dar es Salaam

Economic disruption

Transmission & distribution line: The construction and operation of transmission lines and associated facilities can affect local economies by disrupting agriculture, by producing or eliminating local jobs in construction or maintenance, and by affecting property values for reasons such as aesthetic changes, perceptions of hazard, and road access. Agriculture can be affected, by the elimination of cropland, the temporary loss of crop production due to construction, and the incompatibility of certain crops and agricultural activities with transmission facilities.

Substation: Locating a substation in a rural area that is primarily agricultural could result in the loss of productive farmland.

(3) Potential mitigation measures and consideration of alternatives

1) Natural Environment

Vegetation

Where possible the line corridors and substation should be cited in low-productivity farming areas or uncultivated land, avoiding areas in which the existing plant formations have a high ecological economic value.

During project EIAs, attention should be paid on minimizing potential impacts when mapping transmission line routes including evaluation of the scale and level of ecosystem fragmentation.

Wildlife

The line route and substation site should be chosen so as to avoid any areas or spots listed as protected areas due to the importance of their animal communities, especially those protected because of birds or if not possible, lines should be equipped with bird protection devices.

2) Physical Environment

Water

The citing of towers should be chosen so as to avoid any damage to the natural drainage network, especially to permanent surface watercourses, avoiding their interruption. Transformer oil, in case of a failure, needs to be collected in totally sealed basins to protect the water resources nearby.

Noise

Substation: The substation in operation should be designed so that it will not add to the ambient noise level above the regulated limits considering the land use of the site. If the estimated noise level is expected to exceed the permissive level at the substation compound boundary, mitigation measure is to be considered such as adjusting the location of the transformer in the compound and installing noise protection wall. Table 6-4.6 shows Tanzanian standards of permissive noise level in each area category and Table 6-4.7 shows noise level guidelines by IFC EHS guidelines.

Table 6-4.6 Maximum permissive noise level for general environment by TBS standards

Facility	DAY (6:00-22:00)	NIGHT (22:00-6:00)
Any building used as hospital, convalescence home, home for the aged, sanatorium, and learning institutions, conference rooms, public library, and environmental and recreational site.	45 dBA	35 dBA
Residential building	50 dBA	35 dBA
Mixed residential (with some commercial and entertainment)	55 dBA	45 dBA
Residential and Industry/small scale production and commerce	60 dBA	50 dBA
Industrial area	70 dBA	60 dBA

Table 6-4.7 Noise Level Guidelines by IFC EHS guidelines

Receptor	Daytime (7:00-22:00)	Nighttime (22:00-7:00)
Residential; institutional; educational	55 dBA	45 dBA
Industrial; commercial	70 dBA	70 dBA

3) Social Environment

Aesthetics

When citing power lines, and designing substations, with due consideration to landscape views and locating high-voltage transmission lines in less populated areas, where possible.

Wherever possible, the substation must be cited in areas of little scenic value. Some examples of substation landscaping or design include surrounding the substation with tree-covered berms, or the use of low-profile facility designs.

According to the Dar es Salaam City Master Plan, along the coastal area from north of the Msasani peninsula is the touristic development area. In addition, there are 67 historical building in Dar es Salaam. The transmission line around such area need to consider aesthetics impact on the touristic areas and historical areas in the project EIA or F/S.

Cultural heritage

All areas should be avoided that contain items belonging to the cultural heritage, to prevent either direct damage, such as the deterioration or destruction of archaeological remains, or indirect, resulting from erecting towers or stringing conductors in the vicinity of such a monument and affecting its visual setting. If the transmission or distribution line needs to pass close to the cultural heritage or historical building, mitigation measure is to be considered such as diverting or using underground cable.

Safety

To maintain safe conditions for the general public, all substations are fenced and have gates that must be locked at all times. Appropriate signage must also be posted that shows the owner of the substation, the hazardous nature of the substation, and contact information. Both during construction and operation phase of the transmission and distribution lines and substations, there is a risk of accident for workers. Safety hazards specific to power transmission and distribution projects are live power lines, working at height, electric and magnetic fields, and exposure to chemicals. Personal Protective Equipment (PPE) provides additional protection to workers exposed to workplace hazards in conjunction with other facility controls and safety systems (e.g. safety glasses for eye and face protection, plastic helmets for head protection, ear plugs for hearing protection, safety boots for foot protection, etc.).

Electric and Magnetic Field (EMF)

Since there is no specific guideline on exposure to electromagnetic waves in Tanzania, it is recommended to refer the levels developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

Resettlement & Economic disruption

As far as possible the line corridor must be cited away from population centers, isolated dwellings and areas of potential urban, tourist or recreational development. If technically this cannot be avoided then special design considerations and construction practices ought to be sought. Zones with a tourist and/or recreational potential should be avoided as much as possible. In the course of EIA, it is recommended to consider several alternative routes for proposed transmission line. Manage resettlement in accordance with Guideline recommendations and applicable laws.

Utilize alternative tower designs to reduce ROW width requirements and minimize land use impacts.

Under the legal requirement, acquisition of way leave is governed by the Land Act of 1999, its Regulations of 2001, and also Land Acquisition Act, 1967, whereby full, fair and prompt compensation is required before land acquisition.

Where possible, the use of higher voltage and multiple conductors per phase is recommended to reduce the number of lines. It is also recommended to use transmission lines that require less space for the safety corridor to save land and reduce risk of impacts.

Regional or urban development planning

The regional or urban development planning needs to be taken into account when citing the line corridor to avoid urban areas, development land or land held in reserve for possible future development. Dar es Salaam and Coast regions have development plans and they are to be considered in project EIAs and Feasibility studies.

(4) Monitoring

Objective: To ensure that the mitigation measures are implemented appropriately and to collect information on the changes of the environmental quality on a regular basis to identify any impacts on the environment caused by sub-component projects.

Institutional arrangement: In order to monitor and manage the environmental and social consideration in implementing the DSMP, the Environmental Unit of TANESCO should work collaboratively with Transmission line Department and Distribution Department of TANESCO as well as TANESCO Regional office.

Monitoring: Transmission line Department and Distribution Department should take charge of the monitoring of each project in accordance with project EIA and Environmental Management Plan (EMP). The Environmental Unit of TANESCO should conduct monitoring in cooperation with NEMC.

Table 6-4.8 Potential items for monitoring the projects under DSMP

Category	Potential key monitoring item	Related component		
		Transmission line	Distribution line	Substation
Physical Environment				
Noise	· Noise level at the boundary of the substation site			✓
Soil and water pollution	· Leakage of insulation oil			✓
Waste	· Types of the waste, amount, disposal method			✓
Natural Environment				
Natural habitat	· Interference with habitats · Impacts on ecosystems and sensitive areas including protected areas, wildlife habitat, forest area, etc.	✓	✓	✓
Vegetation	· Vegetation clearance (ha)	✓	✓	✓
Social Environment				
Land acquisition	· Implementation of resettlement plan, compensation of affected persons	✓	✓	✓
Safety	· Implementation of health and safety management plan · Accident record	✓	✓	✓
Access to electricity	· % of access to electricity · Electricity consumption (kWh/capita)	✓	✓	✓

Reporting: The Transmission and Distribution lines Departments report to the Environmental Unit of TANESCO on the status of environmental and social consideration in implementing the projects outlined under DSMP including implementation progress of mitigation measures and changes in environmental quality referring to the relevant regulations and environmental standards in Tanzania.

6-5 Stakeholder consultations in implementation of the DSMP

Based on the section 178 of “the Environmental Management Act, 2004” and the Section 17 of “the Environmental Impact Assessment and Audit Regulations, 2005”, in implementing the DSMP, it is necessary to conduct stakeholder consultation during the process of EIA for the construction of the component of the DSMP. The relevant stakeholders are to be identified for each project during the project EIA process and detailed feasibility studies.

Chapter 7 Economic and Financial Analysis

7-1 Tariff rate

7-1-1 Tariff rate in Tanzania

In Tanzania, entities that implement electricity projects are TANESCO, for those projects owned by the government, and private Independent Power Producers (IPP). Currently most of the IPP companies are interested in power generation business, and only TANESCO is implementing a comprehensive bulk electricity business of power generation, power transmission and distribution that supplies electricity to the end users despite of the policy being allowed the participation of IPP in generation and distribution of Electricity to end user.

To set the electricity Tariff to the end users, TANESCO will first submit the tariff proposal and apply to the Energy and Water Utilities Regulatory Authority (EWURA) for approval. EWURA is an independent regulatory Authority.

The customer categories for the tariff are as follows.

- D1: Domestic low usage (single phase 230V)
- T1: General usage (general purposes including residential, small commercial and light industrial use, public lighting and billboards: 230V~400V)
- T2: Low demand voltage (400V, less than 500kVA per month)
- T3-MV: Medium demand voltage
- T3-HV: High demand voltage

Tariffs for the customer categories are shown in the Table below.

Table 7-1.1 Tariffs for the customer categories

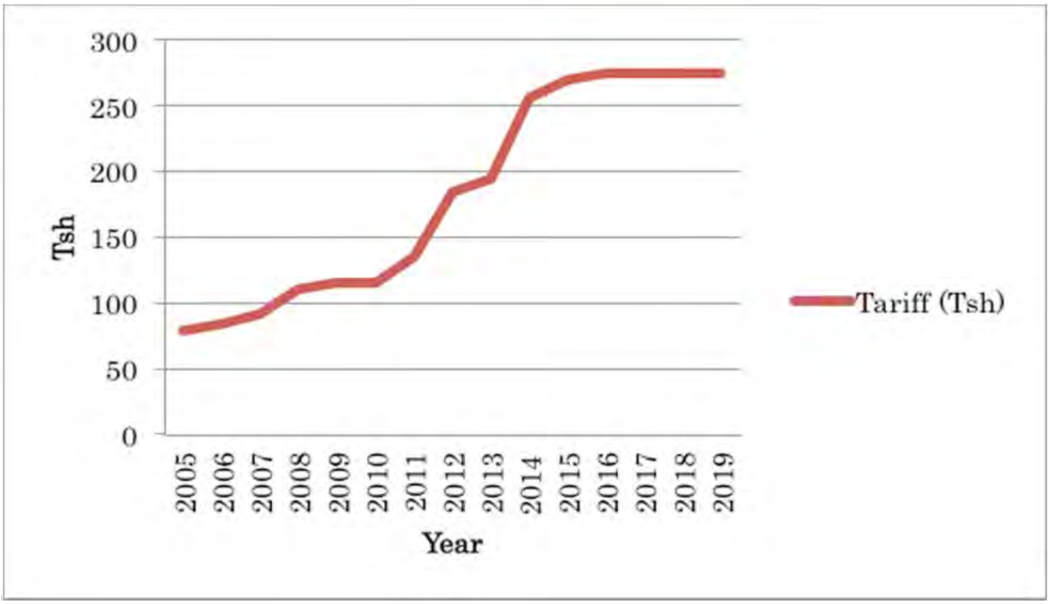
Unit: TSh/kWh. VAT excluded

TANZANIA ELECTRIC SUPPLY COMPANY LIMITED												
TARIFF RATES As of 2005 to December 2016												
VAT EXCLUSIVE												
TARIFF STEP		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2016**
		Tsh	**Tsh**	**Tsh**	**Tsh**	**Tsh**	**Tsh**	**Tsh**	**Tsh**	**Tsh**	**Tsh**	**Tsh**
D1	Energy Charge(0-75 kWh)	38	38	40	49	49	49	60	60	60	100	100
	Above 75kWh	115	121	128	156	156	156	195	273	273	350	350
	Service charge	0	0	0	0	0	0	0	0	0	0	0
T1	Energy Charge (kWh)	95	100	106	129	129	129	157	221	221	306	292
	Maximum Demand Charge	0										
	Service charge	1,700	1,785	1,892	2,303	2,303	2,303	2,738	3,841	3,841	5,520	0
T2	Energy Charge (kWh)	63	66	70	85	85	85	94	132	132	205	195
	Maximum Demand Charge	6,900	7,245	7,680	9,347	9,347	9,347	12,078	16,944	16,944	15,004	15,004
	Service charge	6,300	6,615	7,012	8,534	8,534	8,534	10,146	14,233	14,233	14,233	14,223
T3-MV	Energy Charge (kWh)	59	61	65	79	79	79	84	118	118	163	163
	Maximum Demand Charge	6,400	6,720	7,123	8,669	8,669	8,669	10,350	14,520	14,520	13,200	13,200
	Service charge	6,300	6,615	7,012	8,534	8,534	8,534	10,146	14,233	14,233	16,769	16,769
T3-HV	Energy Charge (kWh)	24	26	28	75	75	75	83	106	106	159	152
	Maximum Demand Charge	3,510	3,686	3,907	4,755	4,755	4,755	8,610	12,079	12,079	16,550	16,550
	Service charge	6,300	6,615	7,012	8,534	8,534	8,534	10,146	14,233	14,233	0	0

Source: TANESCO

The following figure shows the trends in average charges since 2005 and the prospects for charges after 2016. The Average tariff is 275 (TSh/kWh) in 2016, and the subsequent rates are predicted by TANESCO. The average price has increased by 3.5 times from 78 Tsh to 275 Tsh in the decade from 2005 to 2016, especially up quickly 2.0 times from 2011 to 2016.

Unit TSh./kWh

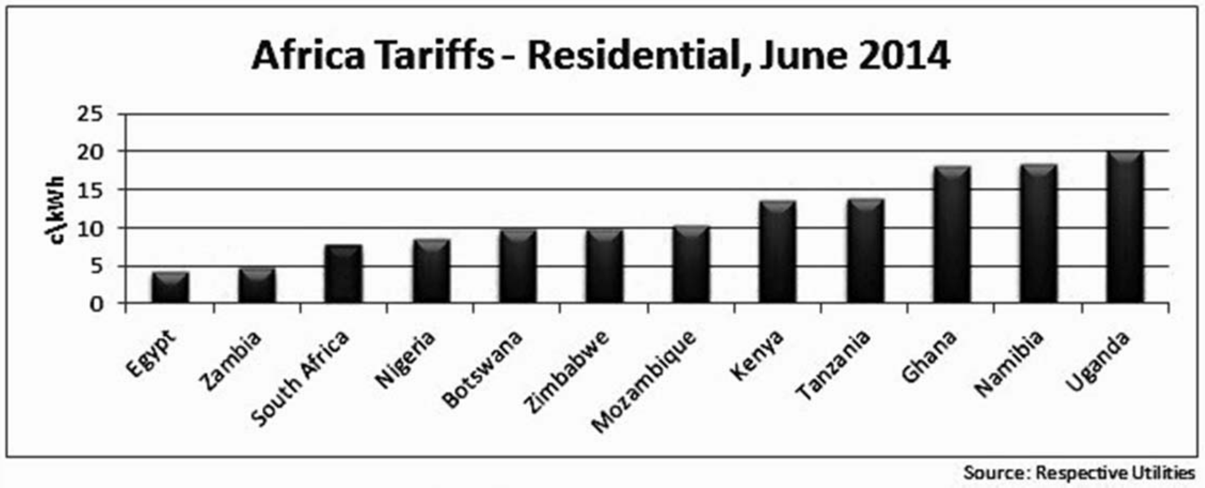


Source: JICA Study Team based on TANESCO data

Figure 7-1.1 Average Tariff Rate of TANESCO

7-1-2 Comparison of Tanzania tariff with other African Countries

Tanzania household electricity charges in 2014 are almost average in major African countries (Figure 7-1.2).



Source: Frost & Sullivan

Figure 7-1.2 Tariff Rate of African countries (2014)

7-2 Financial Situation of TANESCO

The fiscal year of TANESCO was changed from December to June. Therefore, the latest audited account statement contains results of 18 months from January 2014 to June 2015.

(1) Profit and Loss Account

The income statement (Revenue and expenditure) of TANESCO is shown in the following table in 7-2.1.

Operating profit for the year 2014/2015 is Tsh 261,111 million (About 13.9 billion yen), and ordinary income loss after deducting interest cost is Tsh 27,096 million (About 1.4 billion yen). TANESCO have recorded consecutive operating losses over the past three years, especially big loss in the year 2013, showing an operating loss of Tsh 399,438 (About 21.2 billion yen) and an ordinary income loss of Tsh 467,704 TSh (About 24.9 billion yen). By comparison with such big loss, the performance of TANESCO has improved rapidly in FY 2014/2015.

Table 7-2.1 Profit Loss Statement of TANESCO

Unit: TSh. million

Item / Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014-2015
Revenues										
Domestic	32,606	35,258	43,588	50,910	47,430	47,288	47,255	60,574	53,978	61,344
General use	72,881	70,237	93,452	114,291	130,370	164,611	205,175	335,276	410,254	956,222
Low-voltage	36,654	39,927	50,192	62,937	62,481	71,280	76,231	111,955	116,062	231,982
High Voltage	61,029	65,648	79,944	107,330	136,755	152,471	146,027	220,672	248,206	552,883
Zanzibar	6,038	6,799	8,453	18,650	22,020	15,065	27,548	37,586	47,450	98,765
Gold mines & other mining	12,450	14,277	16,377	17,139	14,445	15,762	43,422	54,373	57,575	56,558
Total sales revenues	221,658	232,146	292,006	371,257	413,501	466,477	545,658	820,436	933,525	1,957,754
Government contribution	41,075	55,132	109,312	32,709	37,501	30,651	171,134	185,903	225,301	156,344
Customer contribution for orders	7,911	3,433	5,453	39,689	26,182	40,289	34,755	55,586	43,163	78,639
Interest on overdue bills	27,309	26,872	28,882	26,433	18,452	15,237	20,436	6,954	8,050	27,480
Support services & grant	4,596	1,713	579	252	1,537	-	1,338	198	7,482	9,456
Reconnection fees	473	335	648	283	491	528	634	759	589	653
Profit on disposal of plant, etc.	101	127	108	106	60	145	73	72	-	8
Other	1,743	2,563	7,148	13,200	82,367	19,657	50,961	49,917	53,570	101,816
Total other operating revenues	83,208	90,175	152,130	112,672	166,590	106,507	279,331	299,389	338,155	374,396
Total operating revenues	304,866	322,321	444,136	483,929	580,091	572,984	824,989	1,119,825	1,271,680	2,332,150
Sales expenditures										
Own Gener. & Transm.	32,039	56,748	59,204	71,438	109,423	120,541	230,730	401,379	359,971	686,624
Purchased electricity	179,252	241,998	243,503	193,433	195,446	211,713	346,021	527,816	824,577	613,774
Distribution expenses	41,277	44,260	51,271	67,121	95,497	107,828	121,355	160,359	160,896	337,168
Depreciation	26,788	27,812	30,349	35,032	38,758	52,170	55,291	72,883	84,252	133,776
Total sales expenditures	279,356	370,818	384,327	367,024	439,124	492,252	753,397	1,162,437	1,429,696	1,771,342
Trade & other impairment	13,586	62,978	35,008	33,395	25,781					41,870
VAT liability provision			2,627	7,454	1,462	7,349				-
Consultancy expense	5,986	1,713	579	252			9,685	3,091	9,649	1,818
Staff costs	20,038	27,939	30,326	34,676	32,476	39,613	43,985	58,522	54,674	109,702
Depreciation	3,380	3,531	3,495	5,245	10,135	10,474	17,295	13,797	12,087	18,482
AFUDC prepayment amortiz'n	528	528	528	20	2,176	4,217				
Obsolete inventory provision		1,337	(4,209)	2,247	(4,079)		(3,361)	(139)	587	(697)
Stock write-off (provisions)	18,989		4,308	4,041	2,295	(665)	116	8,035		
Repairs & maintenance	760	680	669	2,202	1,160	505	297	636	260	14
Transport & travel	2,275	1,695	1,815	2,614	3,284	3,643	5,453	7,365	9,038	16,438
Other administrative expenses	7,757	15,629	47,785	22,152	39,706	11,715	32,807	39,649	155,127	112,070
Retrenchment costs	12	7								
Capital work write-off	2,115	45	149							
Operating expenditures	75,426	116,082	123,080	114,298	114,396	76,851	106,277	130,956	241,422	299,697
Total operating expenditures	354,782	486,900	507,407	481,322	553,520	569,103	859,674	1,293,393	1,671,118	2,071,039
Investment adjustm't impairm't		1,054	12							
Operating profit or loss	(49,916)	(165,633)	(63,259)	2,607	26,571	3,881	(34,685)	(173,568)	(399,438)	261,111
Net finance expense/income	73,646	(17,523)	(3,975)	(24,311)	(63,200)	(47,810)	(41,526)	(50,515)	(68,266)	(288,207)
Profit/ loss before tax	23,730	(183,156)	(67,234)	(21,704)	(36,629)	(43,929)	(76,211)	(224,083)	(467,704)	(27,096)
Income tax/ credit	(24,590)	(187)			76,786	(3,383)	32,784	45,629	-	(98,972)
Profit/ loss after tax	(860)	(183,343)	(67,234)	(21,704)	40,157	(47,312)	(43,427)	(178,454)	(467,704)	(126,068)

Source: TANESCO, 「Financial Statements of TANESCO」, 2006 - 2013

The principal reason for improvement in business performance was a decline in the ratio of cost of sales. In 2013, the cost of sales was significantly higher than the sales, which was 153%, but in 2014/2015 it decreased to 90%. This significant drop of cost resulted to realizing sales profit, which was recorded for the first time since 2009. In addition, the proportion of government subsidies, which are non-operating income, to total revenues also dropped sharply from 17.7% to 6.7%, and the government's financial support for TANESCO has declined greatly since last year (Table 7-2.2).

Table 7-2.2 Ratio of the Government Contribution in Operating Revenue & Sales Expenditure in Sales Revenue

Items	2006	2007	2008	2009	2010	2011	2012	2013	2014/ 2015
Government Contribution/ Operating Revenue	160%	132%	99%	106%	106%	138%	142%	153%	90%
Sales Expenditure/ Sales Revenue	17.1%	24.6%	6.8%	6.5%	5.3%	20.7%	16.6%	17.7%	6.7%

Reduction in purchase cost greatly contributes to the decline in cost of sales. Especially the large increase in whole purchase cost of electricity in 2013 was a big factor in TANESCO's deficit, but in 2014/2015 the share of purchase cost in operating expenditure accounted for 30%, big decline from 2013. On the other hand, TANESCO's own expenditure for generation and transmission has increased from 22% to 33% (Table 7-2.3). This is due to a reduction in costly emergency purchase transactions due to the restart of existing facilities at TANESCO and the operation of new facilities, and the recovery of own production largely contributes to the lowering of cost of sales cost.

Table 7-2.3 Ratios of Purchased Electricity, Generation and Transmission in Sales Expenditure

Items	2006	2007	2008	2009	2010	2011	2012	2013	2014/ 2015
Purchased Electricity	50%	48%	40%	35%	37%	40%	41%	49%	30%
Generation & Transmission	12%	12%	15%	20%	21%	27%	31%	22%	33%

In terms of sales revenues, the proportion of general use (general use: small commercial, light industry and public street lights) is increasing, accounting for 49% of total sales. The next is 28% at high-voltage demand. Home use has declined from about 15% of previous sales revenues to 3% recently (Table 7-2.4). This is due to the economic development of Tanzania, reflecting the demand for electricity has increased in the industrial field more than in household.

Table 7-2.4 Ratio of Electric Type Usage in Sales Revenue

Items	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014/ 2015
Domestic Use	15%	15%	15%	14%	11%	10%	9%	7%	6%	3%
General Use	33%	30%	32%	31%	32%	35%	38%	41%	44%	49%
Low Voltage	17%	17%	17%	17%	15%	15%	14%	14%	12%	12%
High Voltage	28%	28%	27%	29%	33%	33%	27%	27%	27%	28%

(2) Balance Sheet

The balance sheet of TANESCO is shown in Table 7-2.5, and the ratio of major items is shown in Table 7-2.6. In assets, tangible fixed assets have decreased to 53% of total assets, and the assets under construction increased to 29% instead. It is understood that new investment of electric power facilities and equipment is rapidly progressing with the increase of domestic electric power demand.

Shareholders' equity and capital surplus accounted for 29% of total assets, down from 36% in the previous year, showing a decreasing trend, while the proportion of grants and borrowings totaled 56%, the debt ratio is rising. This is because most of the funds necessary for new investment are procured through contribution/grants and borrowings instead of capital. As a result, the capital adequacy ratio has continued to decline consistently, the most recent being 12%.

Table 7-2.5 Balance Sheet of TANESCO

Unit: TSh. million

Item / Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014-2015
Non-current assets										
Property, plant equipment	1,144,890	1,157,578	1,181,449	1,302,071	1,828,480	1,982,451	2,035,738	2,247,081	2,662,769	2,741,150
Capital work in progress	25,895	14,579	124,813	77,221	66,359	189,165	396,106	435,314	427,424	1,521,601
Intangible asset					232	116		-	2,734	928
Investment property								-	725	453
Investments	1,055	1	13	13	13	13	13	1,056	1,056	2,201
Capacity charges prepayment	9,274	8,746	8,218	8,198	65,393	61,176	56,356	51,878	47,399	40,681
Total non-current assets	1,181,114	1,180,904	1,314,493	1,387,503	1,960,477	2,232,921	2,488,213	2,735,329	3,142,107	4,307,014
Current assets										
Inventories	33,004	24,382	35,435	53,535	65,452	57,761	73,566	127,739	123,659	235,730
Assets held for sale								-	561	561
Trade & other receivable	79,325	56,409	58,543	89,873	250,101	169,515	209,198	224,914	260,618	344,560
Prepayments								100,650	65,663	54,431
Current income tax recoverable	6,269	6,082	4,742	4,901	5,392	2,140	2,479	2,617	3,013	3,536
Bank & cash balances	11,929	43,113	88,724	176,017	94,470	104,256	139,891	127,591	178,241	228,961
Total current assets	130,527	129,986	187,444	324,326	415,415	333,672	425,134	583,511	631,755	867,779
Total assets	1,311,641	1,310,890	1,501,937	1,711,829	2,375,892	2,566,593	2,913,347	3,318,840	3,773,862	5,174,793
Capital & reserves										
Share capital	293,912	293,912	986,717	986,717	986,717	986,717	986,717	986,717	986,717	986,717
Advance towards share capital	693,193	837,846	154,346	156,967	158,406	158,635	159,943	161,913	359,909	494,316
Accumulated losses	(493,445)	(676,788)	(733,136)	(753,640)	(713,483)	(760,795)	(804,222)	(982,676)	(1,450,380)	(1,576,446)
Revaluation reserve	501,286	501,286	499,784	499,033	781,370	853,192	853,270	854,325	854,325	704,615
Total equity	994,946	956,256	907,711	889,077	1,213,010	1,237,749	1,195,708	1,020,279	750,571	609,202
Non-current liabilities										
Grants	154,568	19,167	130,283	169,382	249,172	406,046	629,768	816,097	1,021,181	1,788,548
Borrowings	60,038	101,603	248,785	408,833	466,891	402,236	377,299	237,206	1,000,543	1,107,131
Consumer deposits	8,710	10,568	11,961	13,105	13,865	14,431	15,329	15,895	23,048	21,165
Other employment benefits			19,116	18,766	19,273	20,028	20,275	21,396	22,482	24,119
Trade and other payables								-	34,594	
Deferred tax liability					44,216	78,380	45,629			374,993
Total non-current liabilities	223,316	131,338	410,145	610,086	793,417	921,121	1,088,300	1,090,594	2,101,848	3,315,956
Current liabilities										
Bank overdraft							36,723	126,728	-	-
Trade & other payables	70,968	108,560	164,887	202,236	321,883	302,798	472,213	707,012	789,439	989,786
Borrowings	22,411	114,736	19,194	10,430	47,582	104,925	120,403	374,227	132,004	255,750
Income tax payable										4,099
Total current liabilities	93,379	223,296	184,081	212,666	369,465	407,723	629,339	1,207,967	921,443	1,249,635
Total liabilities	316,695	354,634	594,226	822,752	1,162,882	1,328,844	1,717,639	2,298,561	3,023,291	4,565,591
Total equity & liabilities	1,311,641	1,310,890	1,501,937	1,711,829	2,375,892	2,566,593	2,913,347	3,318,840	3,773,862	5,174,793

Source: TANESCO, 「Financial Statements of TANESCO」 2006 - 2013

Table 7-2.6 Ratio of Major Assets, Liability and Capital in total assets of Balance Sheet

Items / Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014/ 2015
Property, Plant & Equipment	87%	88%	79%	76%	77%	77%	70%	68%	71%	53%
Capital work in progress	2%	1%	8%	5%	3%	7%	14%	13%	11%	29%
Share capital + Advance towards Share capital	75%	86%	76%	67%	48%	45%	39%	35%	36%	29%
Grants + Borrowings	16%	9%	25%	34%	30%	31%	35%	32%	54%	56%
Total Equity (owned capital)	76%	73%	60%	52%	51%	48%	41%	31%	20%	12%

Source: JICA Study Team based on TANESCO data

(3) The Borrowings and Grants

The balance of loans outstanding at the end of June 2015 and December 2013 is shown in Table 7-2.7 below, and the grant outstanding is shown in Table 7-2.8. Increase in outstanding borrowings compared to 2013 is due to new borrowings from national donors and syndicated loans to electric power equipment investment. Grant money has been increased significantly from 2013, with the new provision of about 760,000 million Tsh. (About 40 billion yen) from the Tanzanian government.

Table 7-2.7 Borrowings

Long-term: Tsh.1,000,543 million, Short-term: Tsh.132,004 million.

	December, 2013	June, 2015
Tanzanian Government (converted into equity):	100,072	109,758
Syndicate Loan：	54,086	6,681
Tanzanian Government (Capacity charge):	237,515	292,968
INGBAnk (Optical Fiber)：	34,265	36,544
ING Bank (Tageta 45MW)：	32,706	32,706
IDA (Songosongo)：	6,188	7,944
EDCF (TEDAP)：	10,962	12,914
ADF (Electricity V):	15,111	9,387
EDCF Korea (Transmission)：	10,456	10,653
EIB (Transmission)：	15,217	39,950
IDA (Transmission)：	14,543	25,298
ADF (Transmission)：	8,511	10,710
JICA (Transmission)：	7,578	9,255
Syndicated loan (Facility A):	205,475	281,085
Syndicated loan (Facility B):	135,553	174,017
Government（Standard Bank）：	158,868	228,579
Government（IDA）：	49,137	73,161
CRDB Short term credit：	36,304	-----
Total	1,132,547	1,362,881

Source: TANESCO, 「Financial Statements of TANESCO」2015

Table 7-2.8 Grants

TSh. million

	December, 2013	June, 2015
SIDA (Sweden)：	10,533	10,340
ORET (Netherlands)：	36,069	32,946
TEDAP (Transmission)：	52,272	68,077
Songosongo：	16,800	15,943
Tanzania Treasury：	638,345	1,394,628
World Bank (Songas)：	39,046	39,046
JICA ：	35,084	33,963
MCC T&D：	163,088	170,297
Total：	1,021,181	1, 788,435

Source: TANESCO, 「Financial Statements of TANESCO」2015

(4) Financial Analysis of TANESCO

The performance of TANESCO in 2015 shows a significant improvement compared with 2013. It is noteworthy that TANESCO turned to sales profit from continued sales loss in the past 10 years. As a factor of improving profit, the ratio of cost of sales declined due to a decline in purchase cost and sales revenue is more than doubled over the period of 1 year and 6 months due to the increase in electricity tariff and effort made in collecting debits from end user fee. It is predicted that profit improvement will continue in FY 2016 and it will be possible to record ordinary income of 45,430 million TSh. (About 2.5 billion Japanese yen) (Table 7-2.9).

Table 7-2.9 Estimation of TANESCO's income in 2016

Unit: TSh. million

Year	Projection 2016
Sales Revenue	1,955,000
Other Operating Revenue	105,129
Total Operating Revenue	2,060,129
Generation & Transmission Cost	610,356
Purchased Energy	830,875
Distribution Cost	195,500
Depreciation	136,850
Total Sales Cost	1,773,581
General Operating Expenses	136,850
Total Operating Expenses	1,910,431
Operating Income (Tsh, million)	149,698
Operating Income (US$, million)	68
Finance Cost	104,268
Non operational transaction	-----
Income before Tax (Tsh million)	45,430
Income before Tax (US$, million)	21

Source：JICA Study Team

7-3 Recommendations for improvement of financial situation

(1) Enhancement of own capital

In 2015, sales profit was posted and profit margin improved significantly. On the other hand, the shareholders' equity in the balance sheet declines and the debt ratio rises. This is because most of the funds necessary for new investment are procured not by capital but by grant and borrowing. Furthermore, in order to respond to the demand for electricity due to economic growth in Tanzania, capital investment by borrowings is expected to increase in the future. It is not desirable to further lower the capital adequacy ratio, and in the future it will be necessary to transfer own funds to investment. For that purpose, it is necessary to record the ordinary profit on an ongoing basis and to accumulate retained earnings.

(2) Tariff Rate for appropriate profits

TANESCO's electricity charges until recent years have failed to cover operating expenses, and business results have continued to fill the shortfall in sales revenues with government subsidies. In the future, it is necessary to set up the electricity fee that can appropriately profit the management as well as improving the management efficiency for the reserve of retained earnings. Rapid price hikes in electricity rates can lead to an opposite opinion from the public and the industrial world, but government subsidies are still a tax money from ordinary people and companies. Promotion of understanding to the public of the mechanism to set the electricity-selling price based on the total cost required for EWURA's electricity generation and transmission and distribution, setting and approval of the electricity fee generating appropriate profit is required.

(3) Diversity of Borrowings/Debt

Most of the current TANESCO long-term borrowings are loans from international donor agencies, which interest rates are lower than market interest rates. Therefore, it is important for the Tanzanian government to keep raising these funds as a source of funds for national development in the future.

On the other hand, issuing US dollar-denominated bonds by the Tanzanian government as a new source of funding can also be considered as a long-term financing source for TANESCO. Issuance of government bonds in the international market leads to the discovery of new investors in the world and diversification of financial sources. In the current developed countries, the central government's monetary easing policy continues the historical low interest rate situation, and the willingness to invest in African countries where growth is expected is strong. Already some African countries such as Zambia, Rwanda, Nigeria and Ethiopia have issued bonds in the international market, and Tanzania is expected to issue such bonds in the near future. The issuance of bonds denominated in foreign currencies in the international market will also strengthen the government's awareness of fiscal discipline.

7-4 Preconditions for the investment plan based on DSMP

Based on the DSMP power development plan corresponding to the power demand of Dar es Salaam, Coastal region (Pwani), and Zanzibar an investment over 14 years from 2017 to 2030 and the finance plan were calculated.

7-4-1 Preconditions for DSMP are stated below.

(1) Yearly development of electric supply on DSMP

Supply electricity amount was calculated based on electric power demand forecast of each area of Dar es Salaam, Pwani (Pwani), Zanzibar.

(2) Yearly development of capital investments for Transmission, Substation and Distribution

The necessary equipment cost was calculated for power Transmission, Substation and Distribution system.

(3) Cost of Power generation

The power supply price to DSMP was calculated based on the investment cost, fuel, operation management expenses, and wheeling charge for transmission lines as of PSMP 2016 update. As a result, the power supply price was calculated as US $ 0.093 / kWh, and the power supply cost was developed yearly for DSMP.

(4) Foreign currency for the investment plan and the exchange rate

US Dollar is used as a currency to calculate for capital expenditure, revenue and cost.
Exchange rate between US Dollar/Tanzanian Shilling is set at US$ 1 = TZS 2200.

(5) Debt and equity ratio for financing

Debt: Equity ratio is set at 70: 30 for financing the investment plan.

(6) Interest during construction (IDC)

IDC is set at 7.0% and this interest cost is included in the capital expenditure.

(7) Electricity tariff rate

The average tariff rate is approved by the Energy and Water Utilities Regulatory Authority (EWURA), a regulator of electricity charges in 2016, is 275 Tsh / kWh. In the calculation of the Investment Plan, the following average sales price was set.

- From year 2016 to 2020: 275 Tsh/kWh (US$0.125/kWh)
- From year 2021 to 2026: 300 Tsh/kWh (US$0.136/kWh)
- From year 2026 to 2030: 330 Tsh/kWh (US$0.150/kWh)

(8) Sales revenue of electricity

Electricity sales revenue of each year was calculated using the DSMP supply electricity amount and the above electricity charge.

(9) Operation and maintenance (O&M) and Fuel cost

O&M cost for Transmission and Substation is set at 5% and O&M cost for Distribution is set at 10% of sale revenue respectively based of financial data obtained from TANESCO.

(10) Price escalation

Forecasting inflation rate in long term is hard to do and not reliable. Price escalation of benefit and cost will be balance out if the escalation rate is the same for the both of them in this investment plan. Therefore, price escalation is not priced in this investment plan.

(11) Depreciation

Depreciation is the accounting term of cost to realize depreciated value of assets annually. As it does not expense real cash flow, a depreciation cost is not included in the investment plan of the project. However, this depreciation is realized as cost for the projection of profit and loss of TANESCO.

(12) Discount rate

Discount rate is set at 10% in PSMP 2016 Update. The same 10% rate is used for this investment plan for the hurdle rate of the business.

(13) Borrowing cost

Loan interest rate is varied from 1.0% to 7.1% in the long-term borrowing of TANESCO. Loan interest cost for operation is set at 7.0% per annum for this investment plan. Also, with reference to the debt cost[1] of capital markets in neighboring countries, the borrowing interest rate of business funds in the investment plan is 7% per annum.

(14) Tax and public due

Benefit exceeding cost is subject to be deducted by 30% by tax in this investment plan.

7-4-2 DSMP Capital Expenditure and financing plan

Based on the long-term power demand of the Dar es Salaam, Coastal region (Pwani) and Zanzibar, the capital investment fund plan required for transmission and distribution was calculated from 2017 to 2030 (Table 7-4.1)

Capital expenditures due to the investment plan are $ 1,187 million in electricity transmission, $ 595 million in electricity substation and $ 185 million in electricity distribution totaling $ 1,967 million. The total investment capital of US $ 1,377 million will be debt financed and US $ 590 million will be financed through equity investment.

[1] As of December 2016 Kenya bonds (remaining term 7 years) are traded at the US dollar 7.85% level (Bloomberg Markets News).

Table 7-4.1 Capital investment amount of each year based on DSMP

US Dollar, million

	Capital Expenditure including IDC				Debt: Equity Ratio 0.7	0.3
Year	Transmission	Substation	Distribution	Annual Capital Cost	Financed by Debt	Financed by Equity
2017	26	3	1	30	21	9
2018	136	17	4	157	110	47
2019	257	31	8	296	207	89
2020	105	13	3	121	85	36
2021	21	16	4	42	29	13
2022	79	62	16	157	110	47
2023	180	139	37	356	249	107
2024	190	148	40	377	264	113
2025	58	45	12	115	81	35
2026	5	5	2	13	9	4
2027	20	18	9	47	33	14
2028	46	41	20	107	75	32
2029	48	44	21	113	79	34
2030	15	13	6	35	24	10
Sub Total	1,187	595	185			
Total Capital Cost for DSMP				1,967		
Total Capital Cost Financed by Debt				1,377		
Total Capital Cost Financed by Equity				590		

Source: JICA Study team

7-4-3 Financial analysis of the investment plan

Financial Internal Rate of Return (FIRR) is used for financial evaluation. IRR is a discount rate to make an equal NPV of both benefit and cost.

Cash flows for financial analysis for DSMP is stated in the Table 7-4.2. Details of benefits and costs are shown in the Calculation Sheet 1.

Table 7-4.2 Cash Flows for DSMP benefits and cost

US Dollar, million

Year	Cost (Transmission, Substation, Distribution and Electricity supply cost by Generation)	Benefits (Electricity Revenue for TANESCO)	Net Benefit for DSMP	Tax (30%)	Net Benefit for DSMP after Tax
2017	580	612	33	10	23
2018	813	732	(82)	0	(82)
2019	1,059	851	(208)	0	(208)
2020	991	970	(21)	0	(21)
2021	1,017	1,167	151	45	106
2022	1,223	1,277	54	16	38
2023	1,512	1,386	(126)	0	(126)
2024	1,624	1,495	(129)	0	(129)
2025	1,455	1,605	150	45	105
2026	1,502	1,927	426	128	298
2027	1,661	2,090	428	128	300
2028	1,846	2,252	406	122	284
2029	1,977	2,414	437	131	306
2030	2,025	2,576	551	165	386
				IRR=	21.75%

Source: JICA Study team

The IRR calculated from the cost and benefit of the investment plan is 21.75%. The investment plan meets the profitability, as it exceeds 10% of the opportunity cost.

7-4-4 Sensitivity Analysis

(1) Sensitivity Analysis on the various tariff scenarios

Sensitivity analysis is conducted for the IRR on the different tariff scenarios. IRR on the different tariff is stated in the Table 7-4.3.

Table 7-4.3 Sensitivity of IRR on the different tariff scenarios

Tariff rate Tsh, kWh	Year			IRR
	2017~2020	2021~2025	2026~2030	Overall Period
Lower Tariff	275	275	300	4.5%
Base Tariff	275	300	330	21.7%
Higher Tariff	275	320	350	32.6%

Source: JICA Study team

(2) Sensitivity Analysis on the higher cost of DSMP

Sensitivity analysis is conducted for the IRR on the different cost scenarios. IRR on the different cost on the base tariff is stated in the Table 7-4.4.

Table 7-4.4 Sensitivity of IRR on the different cost scenarios

Changes in cost for DSMP	0%	5%	10%
Overall Project IRR	21.7%	7.3%	-3.7%

Source: JICA Study team

7-4-5 Financing and repayment plan of DSMP

Projections for investment plan financing and repayment are shown in Table 7-4.5 below. Figure 7-4.1 shows the amount of funds required for business operations in each year. The maximum amount of procurement through borrowing and investment is US $ 224 million in 2019. Procurement of external funds becomes unnecessary after 2025.

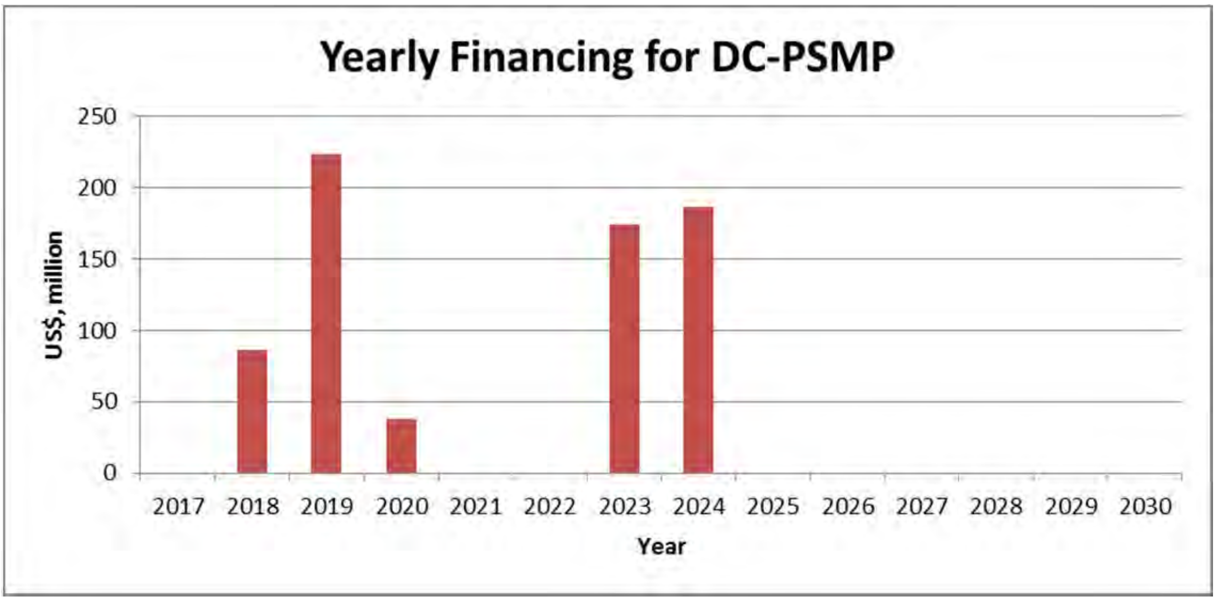
Table 7-4.5 The projection of financing and repayment for DSMP

US Dollar, million

Year		Out Flow (US$, million)				In Flow (US$, million)					Net Cash (USD, million)
		Project Cost for DSMP Electric	Loan		Total Out Flow	Electric Power Revenue	Finance			Total Inflow	
			Repayment	Interest			Equity	Debt	Total		
1	2017	580	0	0	580	612	0	0	0	612	33
2	2018	813	0	4	818	732	26	60	86	818	0
3	2019	1,059	0	15	1,074	851	67	157	224	1,074	0
4	2020	991	0	17	1,008	970	11	27	38	1,008	0
5	2021	1,017	6	17	1,039	1,167	0	0	0	1,167	128
6	2022	1,223	22	16	1,260	1,277	0	0	0	1,277	17
7	2023	1,512	24	24	1,560	1,386	52	122	174	1,560	0
8	2024	1,624	24	33	1,682	1,495	56	130	186	1,682	0
9	2025	1,455	24	33	1,512	1,605	0	0	0	1,605	93
10	2026	1,502	37	32	1,571	1,927	0	0	0	1,927	357
11	2027	1,661	50	31	1,742	2,090	0	0	0	2,090	347
12	2028	1,846	50	31	1,927	2,252	0	0	0	2,252	325
13	2029	1,977	50	31	2,058	2,414	0	0	0	2,414	356
14	2030	2,025	50	31	2,106	2,576	0	0	0	2,576	471

Source: JICA Study team

US Dollar, million



Source: JICA Study team

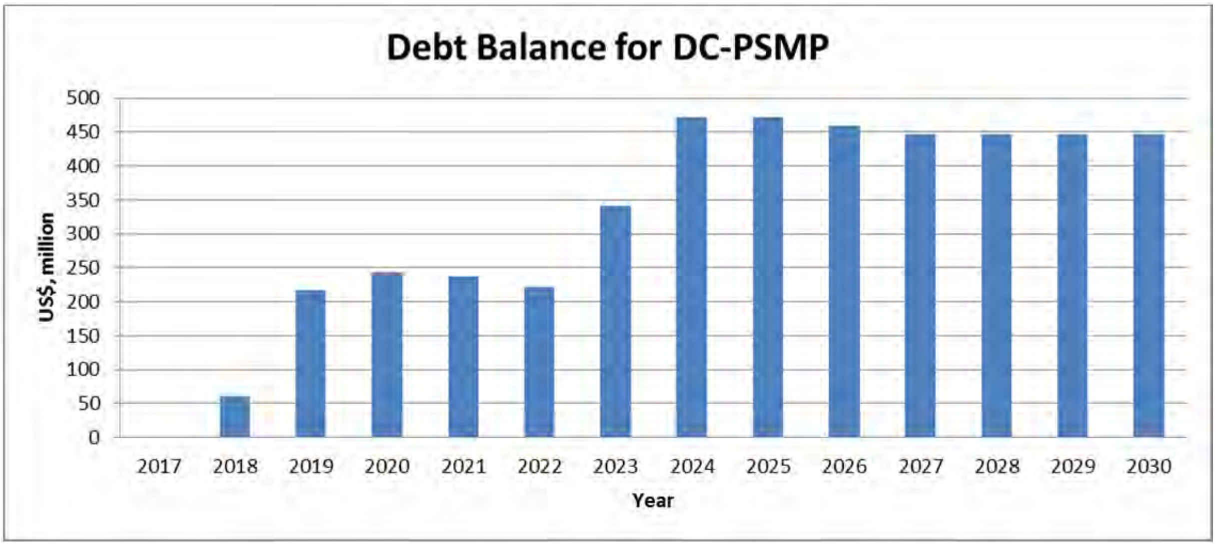
Figure 7-4.1 Yearly Financing Amount for the DSMP business operation

7-4-6 Debt stock of DSMP

The projection of financing of investment plan is carried out and calculated annual borrowing amount that is necessary for DSMP. Cash flow of borrowing and repayment Details are shown in Calculation sheet 2.

The borrowing balance required for DSMP peaks in 2024 with approximately US $ 472 million, which is US $ 446 million in 2030. The balance of outstanding borrowing is shown in Figure 7-4.2.

US Dollar, million



Source: JICA Study team

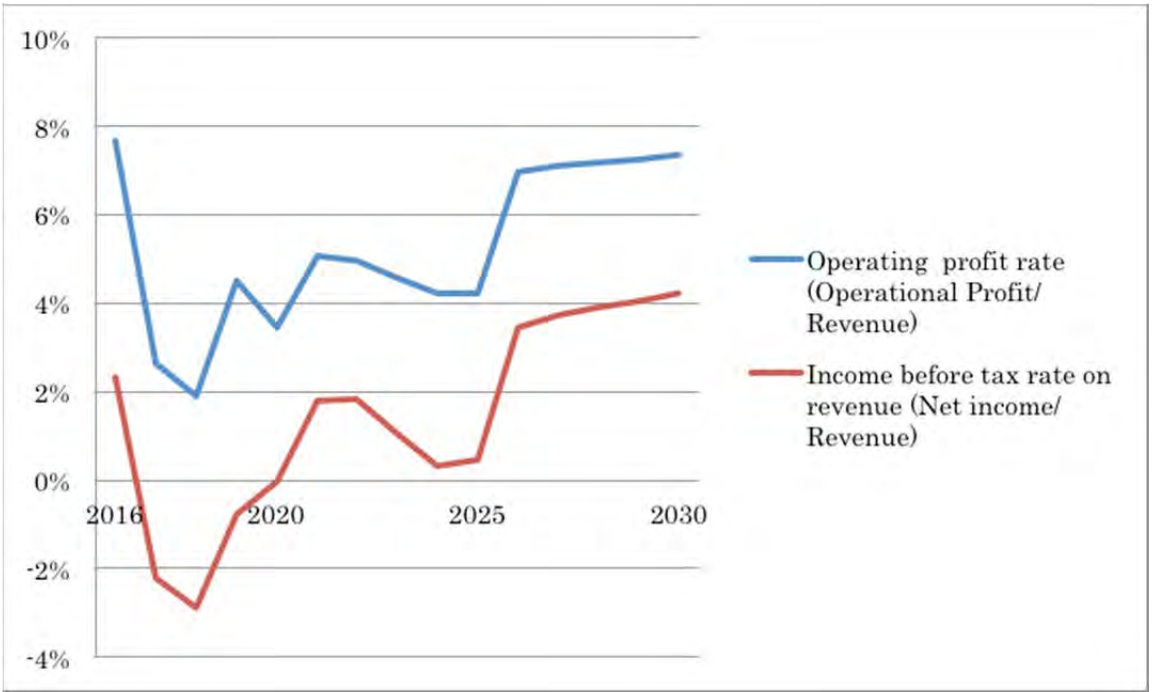
Figure 7-4.2 Debt balance for DSMP

7-4-7 Financial analysis and projection of TANESCO's operation based on DSMP

TANESCO's operational income, expense and interest rate cost is projected up to 2030 based of the investment plan (Calculation Sheet 3). Depreciation cost of fixed assets such as plants and facilities is deducted from operational income in accounting term. Depreciation period of the each facilities are stated as follows. Straight-line method is used for depreciation and residual value after the service life is set at nil.

- Facilities and equipment for Transmission, Substation, Distribution 35 years' service life

The operating profit margin (Operational Profit) and the trend of the ordinary income ratio (Net Income before tax) minus interest cost from operating profit are shown in Figure 7-4.3 below. Although the operating margin will decline to 2% and the ordinary profit margin will decline to minus 3% until 2018, due to the depreciation cost of new capital investment and the increase in borrowings cost interest expense, business profitability will improves to the level of the operating income margin of 7 %, And ordinary profit margin to 4%. Ordinary profit ratios of 4% to 10% are appropriate profit levels for business entities that continuously implement the utility power business. Therefore, we predict that TANESCO financial situation will improve over the long term to achieving proper profit by implementing DSMP.



Source: JICA Study team

Figure 7-4.3 Operational profit ratio of TANESCO

Calculation Sheet 1: Cash Flows for the invest on the DSMP

US Dollar, million

Year	Electric Power Supply (GWh)				Generation Cost for Power Sales (Including Cap, Fuel,	Cost for Transmission, Substation & Distribution													Tariff Rate (US$, kWH)	Benefit	Income (Loss)	Tax	Net Benefit/ Cost
						Transmission			Substation			O&M Cost	Total Cost for Trans.& Substation	Distribution				Total Cost with IDC					
	Dar es Salaam Region	Pwani Region	Zanzibar	Total		Cap. Exp. Transmission	IDC at 70:30 Debt:Equity	Cost for Transmission	Cap. Exp. Substation	IDC at 70:30 Debt:Equity	Cost for Substation			Capital Expenditure	IDC at 70:30 Debt:Equity	O&M Cost	Cost for Distribution			Total Revenue			
2017	4,133	315	452	4,900	458	25	1	26	3	0	3	31	60	1	0	61	62	580	0.125	612	33	10	23
2018	4,931	405	518	5,853	547	131	6	136	16	1	17	37	190	4	0	73	77	813	0.125	732	(82)	0	(82)
2019	5,728	495	583	6,806	636	246	10	257	30	1	31	43	331	8	0	85	93	1,059	0.125	851	(208)	0	(208)
2020	6,526	585	649	7,759	725	101	4	105	12	1	13	48	166	3	0	97	100	991	0.125	970	(21)	0	(21)
2021	7,139	705	718	8,561	800	20	1	21	16	1	16	58	96	4	0	117	121	1,017	0.136	1,167	151	45	106
2022	7,752	825	786	9,363	875	76	3	79	59	3	62	64	205	16	1	128	143	1,223	0.136	1,277	54	16	38
2023	8,365	945	854	10,165	949	172	7	180	134	6	139	69	388	36	2	139	174	1,512	0.136	1,386	(126)	0	(126)
2024	8,979	1,066	923	10,967	1,024	182	8	190	142	6	148	75	413	38	2	150	187	1,624	0.136	1,495	(129)	0	(129)
2025	9,592	1,186	991	11,769	1,099	56	2	58	43	2	45	80	183	12	0	160	172	1,455	0.136	1,605	150	45	105
2026	10,495	1,300	1,055	12,850	1,200	5	0	5	5	0	5	96	107	2	0	193	195	1,502	0.150	1,927	426	128	298
2027	11,399	1,413	1,119	13,931	1,301	19	1	20	17	1	18	104	143	8	0	209	217	1,661	0.150	2,090	428	128	300
2028	12,303	1,527	1,183	15,013	1,402	44	2	46	40	2	41	113	199	19	1	225	244	1,846	0.150	2,252	406	122	284
2029	13,206	1,641	1,246	16,094	1,503	46	2	48	42	2	44	121	213	20	1	241	262	1,977	0.150	2,414	437	131	306
2030	14,110	1,755	1,310	17,175	1,604	14	1	15	13	1	13	129	157	6	0	258	264	2,025	0.150	2,576	551	165	386

Calculation Sheet 2: Cash Flows for the financing on the DSMP

US Dollar, million

Financing Projection for DSMP											
	Year	Out Flow (US$, million)				In Flow (US$, million)					Net Cash (USD, million)
		Project Cost for PSMP Electric	Loan		Total Out Flow	Electric Power Revenue	Finance			Total Inflow	
			Repayment	Interest			Equity	Debt	Total		
1	2017	580	0	0	580	612	0	0	0	612	33
2	2018	813	0	4	818	732	26	60	86	818	0
3	2019	1,059	0	15	1,074	851	67	157	224	1,074	0
4	2020	991	0	17	1,008	970	11	27	38	1,008	0
5	2021	1,017	6	17	1,039	1,167	0	0	0	1,167	128
6	2022	1,223	22	16	1,260	1,277	0	0	0	1,277	17
7	2023	1,512	24	24	1,560	1,386	52	122	174	1,560	0
8	2024	1,624	24	33	1,682	1,495	56	130	186	1,682	0
9	2025	1,455	24	33	1,512	1,605	0	0	0	1,605	93
10	2026	1,502	37	32	1,571	1,927	0	0	0	1,927	357
11	2027	1,661	50	31	1,742	2,090	0	0	0	2,090	347
12	2028	1,846	50	31	1,927	2,252	0	0	0	2,252	325
13	2029	1,977	50	31	2,058	2,414	0	0	0	2,414	356
14	2030	2,025	50	31	2,106	2,576	0	0	0	2,576	471

Overall Debt					
Year	Accumulated Loan	Loan Principal Payment	Year	Debt balance	Interest payment
1	0		2017	0	0
2	60		2018	60	4
3	217		2019	217	15
4	243	0	2020	243	17
5	243	6	2021	237	17
6	243	22	2022	222	16
7	365	24	2023	341	24
8	496	24	2024	472	33
9	496	24	2025	472	33
10	496	37	2026	459	32
11	496	50	2027	446	31
12	496	50	2028	446	31
13	496	50	2029	446	31
14	496	50	2030	446	31

Calculation Sheet 3: TANESCO Income Projection on the DSMP

US Dollar, million

Year	Actual 2013	Estimate 2014	Actual 2014-2015	Estimate 2016	Projection 2017	Projection 2018	Projection 2019	Projection 2020	Projection 2021
Sales Revenue	933,525	1,296,885	1,957,756	1,955,000	2,212,336	2,498,307	2,784,278	3,070,249	3,482,019
Other Operaing Revenue	325,974	78,872	374,396	105,129	107,232	109,377	111,564	92,107	104,461
Total Operaing Revenue	1,259,499	1,375,757	2,332,152	2,060,129	2,319,568	2,607,684	2,895,842	3,162,356	3,586,480
Generation & Transmission Cost	359,971	360,293	686,624	610,356	802,573	913,619	1,024,665	1,135,711	1,239,819
Purchased Energy	812,396	619,204	613,774	830,875	940,243	1,061,780	1,183,318	1,304,856	1,479,858
Distribution Cost	160,896	170,000	337,168	195,500	208,984	235,198	261,412	287,626	331,079
Depreciation	84,252	90,123	133,776	136,850	154,863	174,881	106,300	113,589	116,117
Total Sales Cost	1,417,515	1,239,620	1,771,342	1,773,581	2,106,663	2,385,479	2,575,696	2,841,783	3,166,874
General Operating Expenses	228,637	321,385	299,697	136,850	154,863	174,881	194,899	214,917	243,741
Total Operating Expenses	1,646,152	1,561,005	2,071,039	1,910,431	2,261,527	2,560,361	2,770,595	3,056,700	3,410,616
Operating Income (Tsh, million)	(386,653)	(185,248)	261,113	149,698	58,041	47,323	125,247	105,656	175,864
Operating Income (US$, million)	(176)	(84)	119	68	26	22	57	48	80
Finance Cost	85,386	59,298	287,999	104,268	107,179	119,450	146,645	106,133	113,441
Non operational transaction	294,640	(223,158)	(208)	-----	-----	-----	-----	-----	-----
Income before Tax (Tsh million)	(177,399)	(467,704)	(27,094)	45,430	(49,138)	(72,127)	(21,398)	(476)	62,423
Income before Tax (US$, million)	(81)	(213)	(12)	21	(22)	(33)	(10)	(0)	28

Year	Projection 2022	Projection 2023	Projection 2024	Projection 2025	Projection 2026	Projection 2027	Projection 2028	Projection 2029	Projection 2030
Sales Revenue	3,738,600	3,995,181	4,251,762	4,508,343	5,239,875	5,618,351	5,996,826	6,375,302	6,753,777
Other Operaing Revenue	112,158	119,855	127,553	135,250	157,196	168,551	179,905	191,259	202,613
Total Operaing Revenue	3,850,758	4,115,036	4,379,315	4,643,593	5,397,071	5,786,901	6,176,731	6,566,561	6,956,390
Generation & Transmission Cost	1,334,228	1,428,637	1,523,046	1,617,454	1,764,052	1,892,998	2,021,943	2,150,888	2,279,833
Purchased Energy	1,588,905	1,697,952	1,806,999	1,916,046	2,226,947	2,387,799	2,548,651	2,709,503	2,870,355
Distribution Cost	355,134	379,188	403,243	427,297	498,288	533,973	569,657	605,342	641,027
Depreciation	125,598	147,087	169,841	176,793	177,550	180,388	186,822	193,634	195,715
Total Sales Cost	3,403,865	3,652,864	3,903,128	4,137,590	4,666,837	4,995,157	5,327,073	5,659,367	5,986,931
General Operating Expenses	261,702	279,663	297,623	315,584	366,791	393,285	419,778	446,271	472,764
Total Operating Expenses	3,665,567	3,932,527	4,200,751	4,453,174	5,033,628	5,388,442	5,746,851	6,105,638	6,459,695
Operating Income (Tsh, million)	185,191	182,510	178,564	190,419	363,443	398,459	429,880	460,922	496,695
Operating Income (US$, million)	84	83	81	87	165	181	195	210	226
Finance Cost	116,162	139,678	164,894	170,026	182,777	188,338	195,907	203,477	211,046
Non operational transaction	-----	-----	-----	-----	-----	-----	-----	-----	-----
Income before Tax (Tsh million)	69,029	42,832	13,670	20,393	180,666	210,121	233,973	257,446	285,649
Income before Tax (US$, million)	31	19	6	9	82	96	106	117	130

Chapter 8 Project Implementation Plan

8-1 New Construction, Reinforcement and Replacement of Transmission Lines and Substations

8-1-1 Substations

As mentioned in Chapter 5, the substations are classified as new construction, reinforcement and replacement with the voltage classes, shown in Table 8-1.1. There are total 65 substations, including 40 new substations. The new 6 x 220 kV substations are planned in PSMP 2016 update. In addition, Table 8-1.2 shows Substation Equipment List with their cost in yearly basis.

Table 8-1.1 Classification Table of Substations

	220 kV		132 kV		33 kV		Total
New Construction	Zinga North DSM (Bunju) West DSM (Luguruni) South DSM (Kivule) Southeast DSM (Somangila) Mkuranga	6	Kawe Goba Drive Inn Kimanga New Ilala Mtoni Pugu Kibada Buza Mianzini Maneromango	11	Mbeweni Kunduchi New Msasani Mukongo Mabibo Kijitonyama Hananasifu Jangwani New Magomeni New Kariakoo Muchafukoge Mchikichini Ukonga Majohe Kiwalani Vingunguti Temeke Kijichi Yombo Vituka Mbagala II Kiburugwa Charambe Chamazi	23	40
Reinforcement	Kinyerezi Mlamdizi Ubungo New Chalinze	4	Tegeta New Bahari Beach New Mbezi New Mburahati New City Center Makumbusho FZ II FZ III Kurasini Mbagala	10	Ilala Jangwani Beach Mwananyamala Tandale Muhimbili Mburahati FZ I TOL Tandika	9	23
Replacement		0	New Kigamboni	1	New Tumbi	1	2
Total	20		22		33		65

Source: JICA Study Team

Table 8-1.2 Substation Equipment List with cost

Name of Substations	Year	**Bus Config.**: **1-1/2**; One & Half, **DB**; Double Bus, **SB**; Single Bus, **Line**; Transmission line Bay, **TR**; Transformer Bay, **BC**; Bus Coupler																				Transformer (in MVA)				Capa-citor	Cost (kUS$)
		400 kV				220 kV				132 kV				33 kV				11 kV				Voltage	Rating	Q'ty	Total MVA		
		Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	(kV)	(MVA)				
Zinga (Bagamoyo)	2020					DB	2	2	1					SB	8	4	1	SB				220/33	90	2	180		*1
Zinga (Bagamoyo)	2027					DB	1							SB				SB									*1
Zinga (Bagamoyo)	2030	DB	2	2	1	DB	4	1						SB				SB				400/220	500	2	1,000		*1
Bunju (North DSM)	2025					DB	2	1	1	SB		1	1	SB				SB				220/132	400	1	400		19,180
Bunju (North DSM)	2025					DB		1		SB	2	3		SB	6	2	1					220/132	400	1	400		23,200
																						132/33	100	2	200		
Bunju (North DSM)	2030					DB	2																				1,870
Tegeta	2020									SB		1		SB	1	2		Modification to ONAF (50 -> 65) ->				132/33	65	2	130	60	5,820
Tegeta	2030									SB	1			SB												130	8,080
Bahari Beach	2020													SB		1		SB		1		33/11	15	1	15		1,060
New Bahari Beach	2025									SB	4	3	1	SB	5	4	1	SB	6	2	1	132/33	100	2	200	30	19,030
New bahari Beach	2025																					33/11	30	2	60		
New Bahari Beach	2030									SB	1															140	8,580
New Mbezi	2025									SB	2	2	1	SB	3	2	1	SB	3	1		132/33	75	2	150		11,380
New Mbezi	2030													SB	2	1		SB	3	1	1	33/11	30	1	30		1,990
Kawe	2025									SB	3	2	1	SB	2	3	1	SB	3	1		132/22	75	2	150		13,490
Kawe	2025																					33/11	30	1	30		
Kawe	2030									SB				SB		1		SB	3	1	1	33/11	30	1	30		1,540
Goba	2025									SB	3	2	1	SB	6	2	1					132/33	100	2	200		13,190
Goba	2030													SB	2												300
Drive Inn	2025									SB	3	2	1	SB	3	3	1	SB	3	1		132/33	100	2	200		14,510
Drive Inn	2025																					33/11	30	1	30		
Drive Inn	2030													SB	3												450
Luguruni (West DSM)	2025					DB	4	2	1	DB	2	4	1	SB	6	2	1					220/132	400	2	800		41,840
Luguruni (West DSM)	2025																					132/33	100	2	200		
Kinyerezi	2020					DB	2	2		DB	2	2	1									220/132	200	2	400		16,050
Kinyerezi	2025									DB	4																3,740
Kimanga	2025									SB	3	2	1	SB	6	2	1					132/33	100	2	200		13,190
New Mburahati	2025									SB	2	2	1	SB	5	3	1	SB	3	1		220/132	100	2	200		13,710
New Mburahati	2025																					33/11	30	1	30		
New Mburahati	2030									SB	2																1,400
New City Center	2025									SB	1			SB	1	1	1	SB		1		33/11	15	1	15		1,900
New City Center	2030									SB		1		SB	1	3		SB				132/33	50	1	50	60	6,510
Makumbusho	2020													SB		2		Modification to ONAF (45 -> 55) ->				132/33	55	2	110	35	2,790
Makumbusho	2025													SB	2			SB									300
Makumbusho	2030									SB		1		SB	1	2		SB		1		132/33	60	1	60		3,640
Makumbusho	2030																					33/11	15	1	15		
New Ilala	2030									SB	2	2	1	SB	6	4	1	SB	6	2	1	132/33	100	2	200		16,790
New Ilala	2020																					33/11	30	2	60		
FZ-II	2020									SB	3	1		SB		3		SB		2		132/33	50	1	50		5,530
FZ-II	2020																					33/11	15	2	30		
FZ-III	2020													SB	1	2										15	1,940
FZ-III	2025													SB	1												150
FZ-III	2030									SB	1																700

Name of Substations	Year	**Bus Config.**: **1-1/2**; One & Half, **DB**; Double Bus, **SB**; Single Bus, **Line**; Transmission line Bay, **TR**; Transformer Bay, **BC**; Bus Coupler																				Transformer (in MVA)				Capa-citor	Cost (kUS$)
		400 kV				220 kV				132 kV				33 kV				11 kV				Voltage (kV)	Rating (MVA)	Q'ty	Total MVA		
		Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC						
Kivule (South DSM)	2025					DB	4	1	1	DB		1	1									220/132	400	1	400		20,720
Kivule (South DSM)	2025					DB		1		DB	9	3	1	SB	6	2	1					220/132	400	1	400		26,090
Kivule (South DSM)	2025																					132/33	75	2	150		
Kivule (South DSM)	2030					DB		1		DB		1										220/132	400	1	400		11,970
Mtoni	2025									SB	4	2	1	SB	5	4	1	SB	7	2	1	132/33	100	2	200		17,330
Mtoni	2025																					33/11	30	2	60		
Mtoni	2030									SB		1		SB	1	2		SB	2	1		132/33	100	1	100		5,270
Mtoni	2030																					33/11	30	1	30		
Pugu	2025									SB	2	2	1	SB	4	3	1	SB	3	1		132/33	100	2	200		13,910
Pugu	2025																					33/11	30	1	30		
Kibada	2025									SB	2	2	1	SB	6	2	1					132/33	50	2	100		10,000
New Kigamboni	2020													SB		1		3	1			33/11	30	1	30		2,690
New Kigamboni	2025									SB	2	2	1	SB	4	3	1	SB	3	1	1	132/33	100	2	200		13,640
New Kigamboni	2025																					33/11	30	1	30		
New Kigamboni	2030													SB		1		SB	3	1		33/11	30	1	30		1,560
Somangila (SE DSM)	2025					DB	4	1	1	DB		1	1									220/132	400	1	400		20,720
Somangila (SE DSM)	2025					DB		1		DB	6	3		SB	6	2	1					220/132	400	1	400		22,100
Somangila (SE DSM)	2025																					33/11	50	2	100		
Kurasini	2020									SB		1		SB		1						132/33	65	1	65	30	4,960
Kurasini	2020																	Modification to ONAF (50 -> 65) ->				132/33	65	1	65		
Kurasini	2025													SB	2	2		SB	3	1		33/11	30	1	30		2,990
Kurasini	2030													SB	2	1	1	SB	3	1	1	33/11	30	1	30		2,140
Buza	2025									SB	2	2	1	SB	5	4	1	SB	7	2	1	132/33	100	2	200		15,570
Buza	2025																					33/11	30	2	60		
Buza	2030									SB	1			SB	3	3		SB	5	2		132/33	100	1	100		6,900
Buza	2030																					33/11	30	1	30		
Mianzini	2025									SB	2	3	1	SB	7	5	1	SB	6	2	1	132/33	100	3	300		19,100
Mianzini	2025																					33/11	30	2	60		
Mbagala	2020									SB		1		SB		2						132/33	65	1	65	45	6,530
Mbagala	2020																	Modification to ONAF (50 -> 65) ->				132/33	65	1	65		
Mbagala	2025													SB	4												600
Mlandizi	2020									DB	3		1														2,690
Mlandizi	2025									DB		2		SB	6	2	1					132/33	50	2	100		5,330
Mlandizi	2030					DB	2	2	1	DB		2										220/132	100	2	200		12,790
New Chalinze	2020	1-1/2	5	3		DB		3	1	DB		1	1									220/132	90	1	90	50	*1
New Chalinze	2020									DB	2																1,400
New Chalinze	2025	1-1/2	2			DB		1		DB		1										220/132	90	1	90		11,425
Mkuranga	2022	DB	2		1																						13,930
Mkuranga	2025	DB		3		DB	2	2	1													400/220	500	2	1,000	50	42,580
Mkuranga	2025					DB		2		DB	2	4	1	SB	6	2	1					220/132	100	2	200		17,340
Mkuranga	2025																					132/33	75	2	150		
Mkuranga	2030	DB		1		DB		1														400/220	500	1	500		2,975
Maneromango	2030									SB	2	2	1	SB	3	2	1					132/33	50	2	100		9,330
Mbeweni	2025													SB	1	2		SB	3	1		33/11	15	1	15		2,500
Mbeweni	2030													SB	1	1	1	SB	3	1	1	33/11	15	1	15		1,600
Jangwani Beach	2020													SB	1	1	1	SB	3	1	1	33/11	15	1	15		1,600
Mwananyamala	2025													SB	1	1	1	SB	3	1	1	33/11	15	1	15		1,600
Kunduchi	2030													SB	1	2		SB	3	1		33/11	30	1	30		2,890
New Msasani	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890

Name of Substations	Year	**Bus Config.**: **1-1/2**; One & Half, **DB**; Double Bus, **SB**; Single Bus, **Line**; Transmission line Bay, **TR**; Transformer Bay, **BC**; Bus Coupler																				Transformer (in MVA)				Capa-citor	Cost (kUS$)
		400 kV				220 kV				132 kV				33 kV				11 kV				Voltage (kV)	Rating (MVA)	Q'ty	Total MVA		
		Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC						
Ubungo	2020					DB		1		DB		1										220/132	300	1	300		18,150
Ubungo	2025													SB	1	1		SB		1		33/11	30	1	30		1,660
Ubungo	2030													SB	1												150
Tandale	2020													SB		1		SB		1		33/11	15	1	15		1,060
Mukongo	2030													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Mabibo	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Kijitonyama	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Kijitonyama	2030													SB	1	1	1	SB	3	1	1	33/11	30	1	30		1,990
Hananasifu	2030													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Muhimbili	2020													SB	1	1	1	SB	3	1	1	33/11	15	1	15		1,600
Jangwani	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Mburahati	2030													SB		1		SB		1		33/11	15	1	15		1,570
New Magomeni	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Ilala	2020													SB		1		SB		1		33/11	15	1	15		1,020
Ilala	2025													SB	3												450
Ilala	2030													SB	1												150
New Kariakoo	2030													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Mchafukoge	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Mchikichini	2025													SB	2	3	1	SB	6	2	1	33/11	30	2	60		4,750
FZ-I	2030													SB		1		SB		1		33/11	15	1	15		770
TOL	2025													SB	1	1		SB		1		33/11	15	1	15		1,270
Ukonga	2030													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Majohe	2025													SB	2	3	1	SB	6	2	1	33/11	30	2	60		4,750
Tandika	2020													SB	1	1		SB		1		33/11	15	1	15		1,340
Kiwalani	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Vingunguti	2025													SB	2	3	1	SB	6	2	1	33/11	30	2	60		4,750
Temeke	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Kijichi	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Yombo Vituka	2025													SB	2	3	1	SB	6	2	1	33/11	30	2	60		4,750
Mbagala II	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Mbagala II	2030													SB	1	1	1	SB	3	1	1	33/11	30	1	30		1,990
Kiburugwa	2025													SB	1	2		SB	3	1		33/11	15	1	15		2,500
Kiburugwa	2030													SB	1	1	1	SB	3	1	1	33/11	15	1	15		1,600
Charambe	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
Charambe	2030													SB	1	1	1	SB	3	1	1	33/11	30	1	30		1,990
Chamazi	2025													SB	1	2		SB	3	1		33/11	30	1	30		2,890
New Tumbi	2020													SB	1	2		SB	3	1		33/11	5	1	5		2,240
New Tumbi	2030													SB	1	1	1	SB	3	1	1	33/11	5	1	5		1,340
			2	0	1		8	11	1		80	62	20		178	157	36		184	73	22			139	9,700	545	570,720
		Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Bus Config.	Line	TR	BC	Voltage (kV)	Rating (MVA)	Q'ty	Total MVA	Capa-citor	Cost (kUS$)
		400 kV				220 kV				132 kV				33 kV				11 kV									
		Bus Config.: 1-1/2; One & Half, DB; Double Bus, SB; Single Bus, Line; Transmission line Bay, TR; Transformer Bay, BC; Bus Coupler																				Transformer (in MVA)					

Note; 1. The equipment colored in yellow background are included in PSMP2016 update and excluded in the total number of equipment.
2. The cost marked with *1 in Cost column has already been commited.

Source: JICA Study Team

8-1-2 Transmission Lines

Table 8-1.3 shows the list of the Transmission lines with the voltage classes, No. of conductors, their cross sections, etc. which are planned in DSMP, and the cost of the each transmission line is indicated in Table 8-1.4.

Table 8-1.3 Specification List of Transmission Lines

Conductors/Cables		Voltage (kV)	No. of Conductors	Cross Sections (mm^2)	Total Length (km)	No. of Circuits
Planned in PSMP 2016 update	Bluejay	400	8	564	312	2
			4		488	12
			2		336	1
		220	4		160	8
			2		95	4
			1		63	4
	Hawk	132	2	242	5	2
				Sub-Total	1,459	33
Planned in DSMP	Bluejay	400	8	564	270	4
	Rail	132	2	483	179	16
			1		32	7
	ACCC Hawk	132	1	310	7	1
	Hawk	132	2	242	5	2
			1		68	5
	Wolf	132	1	150	1	2
	XLPE Cu	132	2	1,600	38	6
			1		2	1
				Sub-Total	602	44
Total					2,061	77

Source: JICA Study Team

Table 8-1.4 Cost of Transmission Lines

No	Rated Voltage (kV)	from	to	Route Length (km)	No. of Circuit	Conductor/Cable			Year to be Com-missioned	Construction Cost (Thousand USD)	Every 5 Year Expenditure (Thousand USD)		
						Code Name	No. of Cond. per Phase	Aluminum Sectional Area (mm2)			2017-2020	2021-2025	2026-2030
1	400	Somanga Fungu PS	Kinyerezi PS	212	2	Bluejay	8	564	2018	180,200	180,200	0	0
2	400	Kinyerezi PS	N. Chalinze SS	138	2	Bluejay	4	564	2020	77,280	77,280	0	0
3	400	N. Chalinze SS	Segera SS	175	1	Bluejay	4	564	2020	70,000	70,000	0	0
4	400	N. Chalinze SS	Segera SS	175	1	Bluejay	4	564	2020	70,000	70,000	0	0
5	400	N. Chalinze SS	Dodoma SS	336	1	Bluejay	2	564	2020	100,800	100,800	0	0
6	400	Mkuranga SS	Somanga PS	185	2	Bluejay	8	564	2022	157,250	0	157,250	0
7	400	Mkuranga SS	Kinyerezi PS	85	2	Bluejay	8	564	2022	72,250	0	72,250	0
8	400	N. Chalinze SS	Zinga SS (Bagamoyo)	100	2	Bluejay	8	564	2030	85,000	0	0	85,000
9	220	Kinyerezi PS	Ubungo SS	12	2	Bluejay	1	564	2020	3,240	3,240	0	0
10	220	Bunju SS (North DSM)	Lugurni SS (West DSM)	35	2	Bluejay	2	564	2025	11,200	0	11,200	0
11	220	Kinyerezi PS	Lugurni SS (West DSM)	21	2	Bluejay	4	564	2025	9,450	0	9,450	0
12	220	Kinyerezi PS	Kivule SS (South DSM)	15	2	Bluejay	4	564	2025	6,750	0	6,750	0
13	220	Kivule SS (South DSM)	Somangila SS (South-east DSM)	60	2	Bluejay	2	564	2025	19,200	0	19,200	0
14	220	Mkuranga SS	Somangila SS (South-east DSM)	95	2	Bluejay	4	564	2025	42,750	0	42,750	0
15	220	Zinga SS (Bagamoyo)	Bunju SS (North DSM)	29	2	Bluejay	4	564	2030	13,050	0	0	13,050
16	220	Zinga SS (Bagamoyo)	Mlandizi SS	51	2	Bluejay	1	564	2030	13,770	0	0	13,770
17	132	Kinyerezi PS	FZ-II SS	5	2	Hawk	2	242	2020	1,200	1,200	0	0
18	132	N. Chalinze SS	Branch to Chalinze SS	0.5	1	Wolf	1	150	2020	95	95	0	0
19	132	N. Chalinze SS	Branch to Mlandizi SS	0.5	1	Wolf	1	150	2020	95	95	0	0
20	132	Bunju SS (North DSM)	N. Bahari Beach SS	15	2	Rail	2	483	2025	3,900	0	3,900	0
21	132	Buza SS	Kibada SS	20	1	Rail	2	483	2025	4,600	0	4,600	0
22	132	Drive Inn SS	N. Mburahati SS	15	1	XLPE Cu	2	1,600	2025	23,250	0	23,250	0
23	132	Drive Inn SS	NCC SS	10	1	XLPE Cu	2	1,600	2025	15,500	0	15,500	0
24	132	Goba SS	Kawe SS	15	1	Rail	2	483	2025	23,250	0	23,250	0
25	132	Kawe SS	Drive Inn SS	5	1	Rail	2	483	2025	1,150	0	1,150	0
26	132	Kawe SS	Drive Inn SS	5	1	XLPE Cu	2	1,600	2025	1,150	0	1,150	0
27	132	Kivule SS (South DSM)	Mtoni SS	20	2	Rail	2	483	2025	31,000	0	31,000	0
28	132	Kivule SS (South DSM)	Mianzini SS	15	2	Rail	1	483	2025	3,900	0	3,900	0
29	132	Kivule SS (South DSM)	Pugu SS	12	2	Rail	1	483	2025	2,760	0	2,760	0
30	132	Kivule SS (South DSM)	Buza SS	12	1	Rail	2	483	2025	2,760	0	2,760	0
31	132	Kivule SS (South DSM)	Branch to FZ-II SS	0.5	1	Rail	1	483	2025	115	0	115	0
32	132	Kivule SS (South DSM)	Branch to Mbagala SS	0.5	1	Rail	1	483	2025	110	0	110	0
33	132	Lugurni SS (West DSM)	Goba SS	20	2	Rail	2	483	2025	4,400	0	4,400	0
34	132	Mtoni	Kimanga SS	15	2	Rail	2	483	2025	3,900	0	3,900	0
35	132	Mtoni	Kimanga SS	4	2	XLPE Cu	2	1,600	2025	1,040	0	1,040	0
36	132	N. Bahari Beach SS	N. Mbezi SS	10	1	Rail	2	483	2025	30,000	0	30,000	0
37	132	N. Bahari Beach SS	N. Mbezi SS	4	1	XLPE Cu	2	1,600	2025	920	0	920	0

No	Rated Voltage (kV)	from	to	Route Length (km)	No. of Circuit	Conductor/Cable			Year to be Com-missioned	Construction Cost (Thousand USD)	Every 5 Year Expenditure (Thousand USD)		
						Code Name	No. of Cond. per Phase	Aluminum Sectional Area (mm2)			2017-2020	2021-2025	2026-2030
38	132	N. Kigamboni SS	Kibada SS	12	1	Rail	2	483	2025	18,600	0	18,600	0
39	132	N. Mbezi SS	Kawe SS	4	1	Rail	1	483	2025	920	0	920	0
40	132	N. Mbezi SS	Kawe SS	2	1	XLPE Cu	1	1,600	2025	440	0	440	0
41	132	N. Mburahati SS	Kimanga SS	10	1	Rail	2	483	2025	8,500	0	8,500	0
42	132	Somangila SS (South-east DSM)	N. Kigamboni SS	25	1	Rail	2	483	2025	5,750	0	5,750	0
43	132	Ubungo SS	Makumbusho SS	7	1	ACCC Hawk	1	310	2026	1,295	0	0	1,295
44	132	Mkuranga SS	Maneromango SS	55	2	Hawk	1	242	2030	12,100	0	0	12,100
45	132	N. Bahari Beach SS	Tegeta SS	4	1	Hawk	1	242	2030	760	0	0	760
46	132	N. Mburahati SS	N. Ilala SS	5	2	Hawk	2	242	2030	1,200	0	0	1,200
47	132	Ubungo SS	FZ-III SS	9	2	Hawk	1	242	2030	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**

marked lines are planned in PSMP 2016 update.

Source: JICA Study Team

8-2 Implementation Plan of Transmission Lines and Substations

8-2-1 Reinforcement of Existing Facilities by 2020

In order to supply the necessary power to Dar es Salaam and Coast area in 2020, it is recommended that the following projects should be implemented by 2020.

(1) Reinforcement of Ubungo 220/132 kV substation for power from Kinyerezi power plant

- Completion of the project: by 2020
- Approximate Project Cost: MUS$ 24
- Purpose: To reinforce the power incoming facilities in Ubungo substation for the power from Kinyerezi power plant (No. 1 to No. 4 units till 2020 in PSMP 2016 update)
- Contents: Addition of double circuits of 220 kV transmission line between Ubungo substation and Kinyerezi power plant, and 220/132 kV, 300 MVA transformers at Ubungo substation

  a) Ubungo substation
  - Two units of 220/132 kV, 300MVA transformers
  - 220 kV switchgear expansion (Gas-insulated switchgear to be used due to no space for switchgear expansion)
    - Two bays for transmission lines
    - Two bays for transformers
  - 132 kV switchgear expansion (Gas-insulated switchgear to be used due to no space for switchgear expansion)
    - Two bays for transformers

  Note) It is said that TANESCO is going to purchase one unit of 220/132 kV, 300 MVA transformer at the site survey in December 2016. According to TANESCO, it is under bid evaluation stage. Hence, the above cost includes one unit of 300 MVA transformer and its associated switchgear.

  The situation about the contract of 300 MVA transformer should be confirmed before the implementation.

  Further, according to Ubungo substation monthly reports from January to December 2016, the remote operation of 132 kV switchgear cannot be done from the central control room of Ubungo substation since January 2016. Since it is almost impossible to implement this project under this condition, this issue should be solved before the implementation.

  b) 220 kV Switchyard in Kinyerezi power plant
  - 220 kV switchgear expansion
    Two bays for transmission lines

c) Construction of double circuits of 220 kV transmission lines between Kinyerezi and Ubungo

(2) Reinforcement of 132 kV FZ II substation for power for the power from Kinyerezi power plant

- Completion of the project: by 2020
- Cost: Approximate MUS$ 18
- Purpose: To reinforce the power incoming facilities in FZ-II substation for the power from Kinyerezi power plant (No. 1 to No. 4 units till 2020 in PSMP 2016 update)
- Contents: Addition of 2 x 220/132 kV, 200 MVA transformers at Kinyerezi substation and double circuit of 220 kV transmission line between Kinyerezi power plant and FZ-II substation

a) 220/132 kV switchyard in Kinyerezi power station
- Two units of 132/33 kV, 200MVA transformers
- 220 kV switchgear expansion
  - Two bays for transformers
- 132 kV switchgear expansion
  - Two bays for transmission lines
  - Two bays for transformers

b) FZ-II substation
- 132 kV switchgear expansion
  - Two bays for transmission lines

c) Construction of double circuits of 132 kV transmission lines between Kinyerezi and FZ-II

(3) Additional transformers and modification of existing transformers in existing 132/33 kV substations by 2020

1) Additional 132/33 kV transformers

Cost: Approximate MUS$ 8

Applied units
- One unit of 65 MVA transformer at Kurasini substation
- One unit of 65 MVA transformer at Mbagala substation
- One unit of 50 MVA transformer at FZ-II substation
- 45MVA -> 55MVA at Makumbusho substation (two units, Takaoka made)

2) Modification of Transformers (from self-cooling to forced cooling)

Cost: Less than MUS$ 1

Applied units
- 50 MVA -> 65 MVA at Tegeta substation (two units, ABB made)
- 50 MVA -> 65 MVA at Kurasini substation (one unit, EMCO (India) made)
- 50 MVA -> 65 MVA at Mbagala substation (one unit, CG (India) made)

(4) Additional 15 MVA transformers in DSM existing 33/11 kV substations by 2020

1) JICA Grant Aid substations

Cost: Approximate MUS$ 5

Applied substations

- Jangwani Beach
- Muhimbili
- Ilala

2) Other substations

Cost: Approximate MUS$ 6

Applied substations

- Bahari Beach
- Tandale
- FZ II
- Tandika

(5) Measures to maintain System voltage at substations' Bus by 2020

In order to maintain the bus voltage at the substations due to higher power flow in the System, Static Capacitor should be installed. At the result of power flow analysis, the following substations should have the capacitors as below.

Cost: Approximate MUS$ 16

Applied substations

- Tegeta (132 kV: 40 Mvar, 33 kV: 20 Mvar)
- Makumbusho (33 kV: 35 Mvar)
- FZ III (33 kV: 15 Mvar)
- Kurasini (33 kV: 30 Mvar)
- Mbagala (33 kV: 45 Mvar)

8-2-2 Formation of New 220/132/33 kV Network in Dar es Salaam (MUS$ 240)

In order to cope with power demand forecast of 2,711 MVA in 2030 and 6,101 MVA in 2040 (stated in PSMP 2016 update), new network in Dar es Salaam is necessary. The new network is consisting of 220 kV substations (described in PSMP 2016 update as North, West, South and Southeast DSM), the expansion of Kinyerezi 220 kV substation and the transmission lines between the substations (to be completed in 2025)

(1) New 220 kV network around Dar es Salaam

- Completion of the project: between 2025 and 2030
- Cost: Approximate MUS$ 225

1) New substations

- Bunju (North DSM)

- Luguruni (West DSM)
- Kivule (South DSM)
- Somangila (Southeast DSM)

2) Expansion substation

- Expansion of four bays for 220 kV switchgear in Kinyerezi

3) 220 kV Transmission lines

- Bunju (North DSM)～Luguruni (West DSM)
- Luguruni (West DSM)～Kinyerezi
- Kivule (South DSM)～Kinyerezi
- Kivule (South DSM)～Somangila (Southeast DSM)

(2) New 132 kV network and reinforcement of existing 132 kV network

- Completion: by 2025
- Cost: Approximate MUS$ 380
- Contents: The construction of new 132 kV transmission lines from new 220 kV substations to new 132 kV substations, 9 x new 132 kV substations, 5 x existing substations (including 4 x upgrade substations) and 132 kV transmission lines between 132 kV substations

(3) Reinforcement of existing transmission line between Ubungo and Makumbusho substation

- Completion: after 2026 (as soon as the new network is established)
- Cost: Approximate MUS$ 2
- Contents: After the completion of the new DSM 132 kV network, the conductors between Ubungo and Makumbusho substation should be replaced with new conductor (ACSR to AAAC) in order to increase its capacities. This project may be included in item 2 above.

(4) DSM 33/11 kV substations

- Completion: by 2025
- Cost: Approximate MUS$ 60
- Contents: The construction of 18 x new 33/11 kV substations from new and existing 132 kV substations (It should be noted that these 33/11 kV substations should be constructed after new 132 kV new network is established)
  - Mbeweni
  - New Msasani
  - Mabibo
  - Kijitonyama
  - Mchafukoge
  - Jangwani

- New Magomeni
- Mchikichini
- Majohe
- Kiwalani
- Vingunguti
- Temeke
- Kijichi
- Yombo Vituka
- Mbagala II
- Kiburugwa
- Charambe
- Chamazi

8-2-3 Replacement of obsolete substations

As the result of our site survey of existing substations, two substations mentioned below are not suitable for power supply. It is recommended that the substation should be replaced with new one as soon as possible in order to supply the power safely to the customers.

- Kigamboni substation (33/11kV) (Cost: Approximate MUS$ 3)
  Since this substation is planned to be upgraded to 132 kV in 2025, the substation should be so designed to accommodate 132 kV equipment accordingly.
- Tumbi substation (33/11kV) (Cost: Approximate MUS$ 3)

8-3 New Construction, Reinforcement and Replacement of Distribution Lines

The cost of the development plans formulated by the distribution facilities is shown by category in Table 8-3.1 below. Renewal work, including the removal and replacement of existing facilities, will be completed by 2025 and after 2026 expansion and changes to substation connections will be carried out in response to demand growth.

Table 8-3.1 Cost Summary of distribution categories

Cost Unit: Thousand USD

Distribution Category		2017~2020		2021-2025		2026-2030	
		Cost	Share	Cost	Share	Cost	Share
A	132/33kV SS to 33/11kV SS	2,959	13.5%	6,751	6.4%	4,698	8.0%
B	New	15,412	70.4%	74,046	70.4%	53,742	92.0%
C	Replacement	3,526	16.1%	24,403	23.2%	0	0.0%
	Total	21,897	100%	105,200	100%	58,440	100%

Source: JICA Study Team

In addition, the cost of new construction, reinforcement and replacement/renewal of substations is shown in Table 8-3.2, per substation voltage type, and TANESCO regional offices.

Table 8-3.2 Cost Summary of distribution facilities in each substation

Unit: Thousand USD

Substation	Voltage	2020			2025			2030			Grand Total
		Rep	New	Total	Rep	New	Total	Rep	New	Total	
Dar es Salaam and Coast Regions		3,526	15,412	18,938	24,403	74,046	98,449		53,742	53,742	171,130
Kinondoni North Region		1,714	3,803	5,517	9,246	13,158	22,404		9,121	9,121	37,042
Tegeta	33kV	1,291	2,997	4,288	7,831		7,831				12,119
Jangwani Beach	33kV										
	11kV		551	551							551
Bunju (N-DSM)	33kV					2,472	2,472		1,730	1,730	4,203
Mbeweni	33kV										
	11kV					871	871		871	871	1,742
N. Bahari Beach	33kV										
	11kV					1,307	1,307		1,307	1,307	2,614
Kunduchi	33kV										
	11kV								1,307	1,307	1,307
N. Mbezi	33kV										
	11kV								1,307	1,307	1,307
Jangwani Beach	33kV										
	11kV								653	653	653
Kawe	33kV										
	11kV					551	551		275	275	826
Goba	33kV					5,232	5,232		455	455	5,687
Makumbusho	33kV										
Msasani	33kV										
	11kV	423	256	679		511	511				1,190
Mwananyamala	33kV										
	11kV				746	184	930				930

Substation	Voltage	2020			2025			2030			Grand Total
		Rep	New	Total	Rep	New	Total	Rep	New	Total	
Kijitonyama	33kV										
	11kV					983	**983**		491	**491**	**1,474**
Drive Inn	33kV										
	11kV					659	**659**		220	**220**	**878**
Oysterbay	33kV										
	11kV				669		**669**				**669**
N. Msasani	33kV										
	11kV					389	**389**		130	**130**	**518**
Hananasif	33kV										
	11kV								374	**374**	**374**
Kinondoni South Region		**1,812**	**2,538**	**4,350**		**5,398**	**5,398**		**3,031**	**3,031**	**12,779**
Ubungo	33kV	1,812		**1,812**							**1,812**
	11kV										
Mlimanicity	33kV										
	11kV		760	**760**							**760**
Tandale	33kV										
	11kV		256	**256**		511	**511**				**767**
EPZ	33kV										
	11kV										
Mburahati	33kV										
	11kV		1,523	**1,523**							**1,523**
Makongo	33kV										
	11kV								551	**551**	**551**
Mabibo	33kV										
	11kV					367	**367**		184	**184**	**551**
Luguruni	33kV					3,374	**3,374**		1,152	**1,152**	**4,526**
N. Mburahati	33kV										
	11kV					572	**572**		572	**572**	**1,145**
N. Magomeni	33kV										
	11kV					572	**572**		572	**572**	**1,145**
Ilala Region			**1,752**	**1,752**	**2,339**	**12,040**	**14,379**		**10,216**	**10,216**	**26,347**
City Center	33kV										
	11kV				1,103		**1,103**		368	**368**	**1,470**
Muhimbili	33kV										
	11kV		630	**630**		368	**368**		368	**368**	**1,365**
Jangwani	33kV										
	11kV					1,103	**1,103**				**1,103**
Ilala	33kV										
	11kV				393		**393**				**393**
Kariakoo	33kV										
	11kV					126	**126**				**126**
N. Kariakoo	33kV										
	11kV								378	**378**	**378**
Mchafukoge	33kV										
	11kV					1,103	**1,103**				**1,103**
Mchikichini	33kV										
	11kV					1,103	**1,103**		735	**735**	**1,838**
N. Ilala	33kV								2,727	**2,727**	**2,727**
	11kV								1,103	**1,103**	**1,103**
FZI(Buguruni)	33kV										
	11kV								735	**735**	**735**

Substation	Voltage	2020			2025			2030			Grand Total
		Rep	New	Total	Rep	New	Total	Rep	New	Total	
FZII(Gongo'boto)	33kV		1,122	1,122							1,122
	11kV										
Ukonga	33kV										
	11kV								1,375	1,375	1,375
Pugu	33kV					1,128	1,128		1,316	1,316	2,445
	11kV					727	727				727
Majohe	33kV										
	11kV					2,063	2,063				2,063
FZIII(Kipawa)	33kV								455	455	455
	11kV				383		383				383
Kiwalani	33kV										
	11kV				460	580	1,040				1,040
Kimanga	33kV					998	998		657	657	1,655
	11kV					1,739	1,739				1,739
Kivule (S-DSM)	33kV					1,004	1,004				1,004
Temeke Region			**2,471**	**2,471**	**12,818**	**20,208**	**33,026**		**5,834**	**5,834**	**41,330**
Kurasini	33kV		1,111	1,111		2,222	2,222		578	578	3,911
	11kV		368	368		368	368		368	368	1,103
Motni	33kV					1,242	1,242				1,242
	11kV					2,146	2,146				2,146
Temeke	33kV										
	11kV					551	551				551
Kijichi	33kV										
	11kV					551	551				551
Buza	33kV					1,447	1,447		496	496	1,943
	11kV					727	727		727	727	1,454
Yombo Vituka	33kV										
	11kV					364	364				364
Somangila (SE-DSM)	33kV				2,454	3,165	5,619		742	742	6,361
N. Kigamboni	33kV				961	2,103	3,064		701	701	3,765
	11kV					727	727				727
Kibada	33kV				2,666		2,666				2,666
Mbagala	33kV		992	992	2,343	455	2,798				3,790
	11kV				4,395		4,395				4,395
Mbagala II	33kV										
	11kV					256	256				256
Kiburungwa	33kV										
	11kV					256	256				256
Mianzini	33kV					3,629	3,629		2,222	2,222	5,851
	11kV										
Coast Region			**4,848**	**4,848**		**23,243**	**23,243**		**25,540**	**25,540**	**53,631**
Chalinze	33kV					5,990	5,990		3,821	3,821	9,811
Mlandizi	33kV					8,458	8,458		2,796	2,796	11,255
N. Tumbi	33kV										
	11kV								727	727	727
Zinga	33kV		4,848	4,848		2,017	2,017				6,865
Mkuranga	33kV					6,777	6,777		3,452	3,452	10,230
Maneromango	33kV								14,744	14,744	14,744

Source: JICA Study Team

Table 8-3.3 Construction Cost for distribution line (132/33kV SS to 33/11kV SS) (Category-A)

No	Rated Voltage (kV)	from	to	Route Length (km)	No. of Circuit	Conductor			Year to be Com-missioned	Unit Cost (Thousand USD/km)	Construction Cost (Thousand USD)	Every 5 Year Expenditure (Thousand USD)		
						Code Name	No. of Cond. per Phase	Aluminum Sectional Area (mm2)				2017-2020	2021-2025	2026-2030
1	33	Tegeta SS	Bahari Beach SS	3.2	1	Dingo	1	150	2020	35	112	112	0	0
2	33	Tegeta SS	Jangwani Beach SS	6.5	1	Dingo	1	150	2020	35	227.5	227.5	0	0
3	33	Bunju SS (N-DSM)	Mbeweni SS	16	1	Dingo	1	150	2025	35	560	0	560	0
4	33	Bunju SS (N-DSM)	Mbeweni SS	16	1	Dingo	1	150	2030	35	560	0	0	560
5	33	N. Bahari Beach SS	Kunduti SS	6	1	Dingo	2	150	2030	53	318	0	0	318
6	33	N. Mbezi SS	Jangwani Beach SS	9	2	Dingo	1	150	2025	53	477	0	477	0
7	33	Kawe SS	Mikocheni SS	4	2	Dingo	1	150	2025	53	212	0	212	0
8	33	Ubungo SS	Tandale SS	6	1	Dingo	1	150	2020	35	210	210	0	0
9	33	Ubungo SS	Mbezi SS	14	2	Dingo	1	150	2020	53	742	742	0	0
10	33	Ubungo SS	Makongo SS	9	1	Dingo	2	150	2030	53	477	0	0	477
11	33	Ubungo SS	Mabibo SS	5	1	Dingo	2	150	2025	53	265	0	265	0
12	33	Makumbusho SS	Mwananyamala SS	1.1	1	Dingo	1	150	2025	35	38.5	0	38.5	0
13	33	Makumbusho SS	Kijitonyama SS	3	1	Dingo	2	150	2025	53	159	0	159	0
14	33	Makumbusho SS	Kijitonyama SS	3	1	Dingo	2	150	2030	53	159	0	0	159
15	33	Drive Inn SS	Oysterbay SS	2	2	Dingo	1	150	2025	53	106	0	106	0
16	33	Drive Inn SS	N. Msasani SS	4	1	Dingo	2	150	2025	53	212	0	212	0
17	33	Drive Inn SS	Hananasifu SS	5	1	Dingo	2	150	2030	53	265	0	0	265
18	33	NCC SS	Muhimbili SS	2	1	Dingo	1	150	2020	35	70	70	0	0
19	33	NCC SS	Sokoine SS	2	2	Dingo	1	150	2030	53	106	0	0	106
20	33	NCC SS	Jangwani SS	3	1	Dingo	2	150	2025	53	159	0	159	0
21	33	NCC SS	Mchafukoge SS	4	1	Dingo	2	150	2030	53	212	0	0	212
22	33	N. Mburahati SS	Magomeni SS	3	1	Dingo	1	150	2025	35	105	0	105	0
23	33	N. Mburahati SS	N. Magomeni SS	3	1	Dingo	2	150	2025	53	159	0	159	0
24	33	Ilala SS	N. Kariakoo	2	1	Dingo	2	150	2030	53	106	0	0	106
25	33	Ilala SS	Mchafukoge SS	4	1	Dingo	2	150	2030	53	212	0	0	212
26	33	Ilala SS	Mchikichini SS	2	2	Dingo	2	150	2025	53	106	0	106	0
27	33	Ilala SS	TOL SS	5	1	Dingo	1	150	2025	35	175	0	175	0
28	33	N. Ilala SS	FZ I	3	3	Dingo	1	150	2030	70	210	0	0	210
29	33	N. Ilala SS	TOL SS	3	2	Dingo	1	150	2030	53	159	0	0	159
30	33	FZ II	Ukonga SS	4	1	Dingo	2	150	2030	53	212	0	0	212
31	33	Pugu SS	Majohe SS	10	2	Dingo	2	150	2025	63	630	0	630	0
32	33	FZ III	Tandika SS	1	1	Dingo	1	150	2020	35	35	35	0	0
33	33	FZ III	Kiwalani SS	5	1	Dingo	2	150	2025	53	265	0	265	0
34	33	Kimanga SS	Vingunguti SS	8	2	Dingo	2	150	2025	63	504	0	504	0
35	33	Kurasini SS	Kimanga	7	2	Dingo	1	150	2025	53	371	0	371	0
36	33	Kurasini SS	N. Kigamboni SS	9	1	Dingo	2	150	2020	53	477	477	0	0
37	33	Mtoni SS	Tandika SS	4	2	Dingo	1	150	2025	53	212	0	212	0
38	33	Mtoni SS	Temeke SS	5	1	Dingo	2	150	2025	53	265	0	265	0
39	33	Mtoni SS	Kijichi SS	7	1	Dingo	2	150	2025	53	371	0	371	0
40	33	Buza SS	Yombo Vituka SS	4	2	Dingo	2	150	2025	63	252	0	252	0

No	Rated Voltage (kV)	from	to	Route Length (km)	No. of Circuit	Conductor			Year to be Com-missioned	Unit Cost (Thousand USD/km)	Construction Cost (Thousand USD)	Every 5 Year Expenditure (Thousand USD)		
						Code Name	No. of Cond. per Phase	Aluminum Sectional Area (mm2)				2017-2020	2021-2025	2026-2030
41	33	Mbagala SS	Mbagala II SS	4	1	Dingo	2	150	2025	53	212	0	212	0
42	33	Mbagala SS	Mbagala II SS	4	1	Dingo	2	150	2030	53	212	0	0	212
43	33	Mbagala SS	Kiburugwa SS	4	1	Dingo	1	150	2025	35	140	0	140	0
44	33	Mbagala SS	Kiburugwa SS	4	1	Dingo	1	150	2030	35	140	0	0	140
45	33	Mianzini SS	Charambe SS	5	1	Dingo	2	150	2025	53	265	0	265	0
46	33	Mianzini SS	Charambe SS	5	1	Dingo	2	150	2030	53	265	0	0	265
47	33	Mianzini SS	Chamazi SS	10	1	Dingo	2	150	2025	53	530	0	530	0
48	33	Mlandezi SS	N. Tumbi SS	31	1	Dingo	1	150	2020	35	1085	1085	0	0
49	33	Mlandezi SS	N. Tumbi SS	31	1	Dingo	1	150	2030	35	1085	0	0	1085
											Total	**2,959**	**6,751**	**4,698**

Source: JICA Study Team

Table 8-3.4 Construction Cost for distribution line (New and Replacement) (Category-B & C)

Kinondoni North Region

Regend= New : New / Extension   Rein : Reinforcement / Improvement   Rep : Replacement / Renew   New : New Line from 132/33kV substation   Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New
Kinondoni North Region						**1714.3**	**3803.1**			**9246.3**	**13157.9**			**0.0**	**9120.7**
Tegeta						**1291.1**	**3547.5**			**7831.2**	**0.0**			**0.0**	**0.0**
Tegeta	33kV	TG1	Wazo II	Rep	24.4	1291.1		Rein	24.4				24.4		
	33kV	TG2	Mbeji		8.4			Rep	8.4	447.6			8.4		
	33kV	TG3	Bagamoyo		139.3			Rep	139.3	7383.6			139.3		
	33kV	TG4	Bahari Beach		3.2			Rein	3.2				3.2		
	33kV	TG5	Wazo-1	New	35.1		1440.5	Rein	35.1				35.1		
	33kV	TG6	Spare		7.7			Rein	7.7				7.7		
	33kV	TG7	Jangwani Beach		6.5			Rein	6.5				6.5		
	33kV		Wazo-3	New (2cct)	25.1		1556.2		25.1				25.1		
	33kV		Wazo-4		25.1				25.1				25.1		
	33kV		Wazo-5									New	19.1		
	33kV	New	Bahari Beach SS	New	3.2				3.2				3.2		
	33kV	New	Jangwani Beach SS	New	6.5				6.5				6.5		
			Total			**1291.1**	**2996.7**			**7831.2**	**0.0**			**0.0**	**0.0**
Bahari Beach	33kV		Wazo area					N. Bahari				N. Bahari			
	33kV		Tegeta		3.2										
	33kV	New	Tegeta	New	3.2										
			Total			**0.0**	**0.0**								
	11kV	BB1			12.2										
	11kV	BB2			59.7										
	11kV	BB5			41.4										
			Total			**0.0**	**0.0**								
Jangwani Beach	33kV		Tegeta		6.5			N. Mbezi				N. Mbezi			
	33kV	New	Tegeta	New	6.5										
			Total			**0.0**	**0.0**								
	11kV	F1	Kawe	New	5.1		183.6								
	11kV	F2	Kunduchi-1	New	5.1		183.6								
	11kV	F3	Kunduchi-2	New	5.1		183.6								
			Total			**0.0**	**550.8**								
Mbezi	33kV		Tegeta	Ubungo				N. Mbezi				N. Mbezi			
			Total												
	11kV		Kunduchi												
	11kV		Packers												
	11kV		Lugalo												
	11kV		Mwenge												
			Total												
Bunju (N-DSM)						**0.0**	**0.0**			**0.0**	**3343.5**			**0.0**	**2601.4**
Bunju (N-DSM)	33kV	New	Mbweni					New	16.0				16.0		
(New)	33kV	New	Mbweni									New	16.0		
	33kV	F1	Bunju-1					New	18.1		742.1		18.1		
	33kV	F2	Bunju-2					New	18.1		742.1		18.1		
	33kV	F3	Bunju-3									New	18.1		742.1
	33kV	F4	Mabwepande-1					New	24.1		988.1		24.1		
	33kV	F5	Mabwepande-2									New	24.1		988.1
			Total						**76.3**	**0.0**	**2472.3**		**110.4**	**0.0**	**1730.2**
Mbeweni	33kV	New	Bunju (N-DSM)						16.0				16.0		
(New)	33kV	New	Bunju (N-DSM)										16.0		
			Total							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1	Mbweni-1					New	12.1		435.6		12.1		
	11kV	F2	Mbweni-2					New	12.1		435.6		12.1		
	11kV	F3	Mbweni-3									New	12.1		435.6
	11kV	F4	Mbweni-4									New	12.1		435.6
			Total							**0.0**	**871.2**		**48.4**	**0.0**	**871.2**

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Voltage	Feeder No.	Feeder Name	2020 Rein Rep New	2020 Total (km)	2020 Construction Cost (Thousand USD/km) Rep.	2020 Construction Cost (Thousand USD/km) New	2025 Rein Rep New	2025 Total (km)	2025 Construction Cost (Thousand USD/km) Rep.	2025 Construction Cost (Thousand USD/km) New	2030 Rein Rep New	2030 Total (km)	2030 Construction Cost (Thousand USD/km) Rep.	2030 Construction Cost (Thousand USD/km) New
N. Bahari Beach						**0.0**	**0.0**			**0.0**	**1306.8**			**0.0**	**2613.6**
N. Bahari Beach	33kV	New	Kunduchi									New	6.0		
(New)			**Total**							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1	Kunduchi					New (2cct)	12.1		653.4		12.1		
	11kV								12.1				12.1		
	11kV	F2	Kunduchi					New (2cct)	12.1		653.4		12.1		
	11kV								12.1				12.1		
	11kV	F3	Kunduchi									New (2cct)	12.1		653.4
	11kV												12.1		
	11kV	F4	Kunduchi									New (2cct)	12.1		653.4
													12.1		
			Total							**0.0**	**1306.8**			**0.0**	**1306.8**
Bahari Beach	33kV		Wazo area	Tegeta											
	33kV		Tegeta						3.2				3.2		
	33kV		Tegeta						3.2				3.2		
			Total							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	BB1							12.2				12.2		
	11kV	BB2							59.7				59.7		
	11kV	BB5							41.4				41.4		
			Total							**0.0**	**0.0**			**0.0**	**0.0**
Kunduchi	33kV	New	N. Bahari Beach									New	6.0		
(New)			**Total**											**0.0**	**0.0**
	11kV	F1	Kunduchi-1									New	12.1		435.6
	11kV	F2	Kunduchi-2									New	12.1		435.6
	11kV	F3	Kunduchi-3									New	12.1		435.6
			Total											**0.0**	**1306.8**
N. Mbezi						**0.0**	**0.0**			**0.0**	**0.0**			**0.0**	**1960.2**
N. Mbezi	33kV		Jangwani Beach						6.5				6.5		
(New)	33kV	New	Jangwani Beach					New	9.0				9.0		
			Total							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1	Kawe									New (2cct)	12.1		653.4
	11kV												12.1		
	11kV	F2	Makongo									New (2cct)	12.1		653.4
	11kV												12.1		
			Total							**0.0**	**0.0**			**0.0**	**1306.8**
Mbezi	33kV		N. Mbezi	Ubungo					8.4				8.4		
	33kV		Ubungo						14.0				14.0		
			Total							**0.0**	**0.0**			**0.0**	**0.0**
	11kV		Kunduchi						21.3				21.3		
	11kV		Packers						22.8				22.8		
	11kV		Lugalo						16.7				16.7		
	11kV		Mwenge						17.9				17.9		
			Total							**0.0**	**0.0**			**0.0**	**0.0**
Jangwani Beach	33kV		N. Mbezi	Tegeta					6.5				6.5		
	33kV	New	N. Mbezi					New	9.0				9.0		
			Total							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1							5.1				5.1		
	11kV	F2							5.1				5.1		
	11kV	F3							5.1				5.1		
	11kV	F4	Kawe									New (2cct)	12.1		653.4
	11kV												12.1		
			Total							**0.0**	**0.0**			**0.0**	**653.4**
Kawe						**0.0**	**0.0**			**0.0**	**550.8**			**0.0**	**275.4**
Kawe	33kV	New	Mikocheni					New	4.0				4.0		
(New)			**Total**							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1	Kijitonyama					New (2cct)	5.1		275.4		5.1		
	11kV								5.1				5.1		
	11kV	F2	Kijitonyama					New (2cct)	5.1		275.4		5.1		
	11kV								5.1				5.1		
	11kV	F3	Kijitonyama									New (2cct)	5.1		275.4
	11kV												5.1		
			Total							**0.0**	**550.8**			**0.0**	**275.4**
Mikocheni	33kV	New	Kawe	Makumbusho				New	4.0				4.0		
	33kV		Mikocheni						3.2				3.2		
			Total							**0.0**	**0.0**			**0.0**	**0.0**
	11kV								5.3				5.3		
	11kV								12.9				12.9		
	11kV								10.1				10.1		
	11kV								8.7				8.7		
	11kV								0.4				0.4		
	11kV								11.6				11.6		
			Total							**0.0**	**0.0**			**0.0**	**0.0**

Regend= New : New / Extension   Rein : Reinforcement / Improvement   Rep : Replacement / Renew   New : New Line from 132/33kV substation   Substation : Connection change to

Substation	Voltage	Feeder No.	Feeder Name	2020 Rein Rep New	2020 Total (km)	2020 Construction Cost (Thousand USD/km) Rep.	2020 Construction Cost (Thousand USD/km) New	2025 Rein Rep New	2025 Total (km)	2025 Construction Cost (Thousand USD/km) Rep.	2025 Construction Cost (Thousand USD/km) New	2030 Rein Rep New	2030 Total (km)	2030 Construction Cost (Thousand USD/km) Rep.	2030 Construction Cost (Thousand USD/km) New
Goba						**0.0**	**0.0**			**0.0**	**5231.6**			**0.0**	**455.1**
Goba	33kV	F1	Goba-1					New	11.1		455.1		11.1		
(New)	33kV	F2	Goba-2									New	11.1		455.1
	33kV	F3	Kimara					New	17.1		701.1		17.1		
	33kV	F4	Mbezi-1					New	28.1		1152.1		28.1		
	33kV	F5	Mbezi-2					New	28.1		1152.1		28.1		
	33kV	F6	Saranga					New	21.6		885.6		21.6		
	33kV	F7	Makongo					New	21.6		885.6		21.6		
			Total							**0.0**	**5231.6**			**0.0**	**455.1**
Makumbusho						**423.2**	**255.6**			**745.9**	**1677.6**			**0.0**	**491.4**
Makumbusho	33kV	H00	Msasani2		7.6				7.6				7.6		
	33kV	H02	Msasani1		8.3				8.3				8.3		
	33kV	H03	Oysterbay		1.6				1.6				1.6		
	33kV	H09	Industry		5.6				5.6				5.6		
	33kV	H10	Mikocheni		3.2				3.2				3.2		
	33kV	H13	Mwananyamala		1.1				1.1				1.1		
	33kV	J07	Mak3	Rein	11.8				11.8				11.8		
	33kV	J08	Mak4	Rein	13.4				13.4				13.4		
	33kV	New	Mwananyamala					New	1.1				1.1		
	33kV	New	Kijitonyama					New	3.0				3.0		
	33kV	New	Kijitonyama									New	3.0		
			Total			**0.0**	**0.0**			**0.0**	**0.0**			**0.0**	**0.0**
Oysterbay	33kV		Makumbusho		1.6			Drive Inn				Drive Inn			
			Total			**0.0**	**0.0**								
	11kV				3.5										
	11kV				14.5										
	11kV				6.1										
	11kV			Rein	5.3										
			Total			**0.0**	**0.0**								
Mikocheni	33kV		Makumbusho		3.2			Kawe				Kawe			
			Total		**3.2**	**0.0**	**0.0**								
	11kV				5.3										
	11kV				12.9										
	11kV				10.1										
	11kV				8.7										
	11kV				0.4										
	11kV				11.6										
			Total			**0.0**	**0.0**								
Msasani	33kV		Makumbusho1		8.3				8.3				8.3		
	33kV		Makumbusho2		7.6				7.6				7.6		
			Total			**0.0**	**0.0**			**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1		Rep	9.2	423.2			9.2				9.2		
	11kV	F2			9.9				9.9				9.9		
	11kV	F3			11.6				11.6				11.6		
	11kV	F4	Msasani-1	New	7.1		255.6		7.1				7.1		
	11kV	F5	Msasani-2					New	7.1		255.6		7.1		
	11kV	F6	Msasani-3					New	7.1		255.6		7.1		
			Total			**423.2**	**255.6**			**0.0**	**511.2**			**0.0**	**0.0**
Mwananyamala	33kV		Makumbusho		1.1				1.1				1.1		
	33kV	New	Makumbusho					New	1.1				1.1		
			Total			**0.0**	**0.0**			**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1			16.2			Rep	16.2	745.9			16.2		
	11kV	F2			9.9				9.9				9.9		
	11kV	F3			11.6				11.6				11.6		
	11kV	F4	Mwananyamala					New	5.1		183.6		5.1		
			Total			**0.0**	**0.0**			**745.9**	**183.6**			**0.0**	**0.0**
Kijitonyama	33kV	New	Makumbusho					New	3.0				3.0		
(New)	33kV	New	Makumbusho									New	3.0		
			Total							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1	Kijitonyama-1					New (2cct)	9.1		491.4		9.1		
	11kV		Kijitonyama-2						9.1				9.1		
	11kV	F2	Kijitonyama-3					New (2cct)	9.1		491.4		9.1		
	11kV		Kijitonyama-4						9.1				9.1		
	11kV	F3	Mikocheni									New (2cct)	9.1		491.4
	11kV												9.1		
			Total							**0.0**	**982.8**			**0.0**	**491.4**

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New
Drive Inn						**0.0**	**0.0**			**669.1**	**1047.6**			**0.0**	**723.6**
Drive Inn (New)	33kV	New	Oysterbay SS					New	2.0				2.0		
	33kV	New	N. Msasani SS					New	4.0				4.0		
	33kV	New	Hananasifu SS									New	5.0		
			Total							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1	Msasani-1					New (2cct)	6.1		329.4		9.1		
	11kV		Msasani-2						6.1				9.1		
	11kV	F2	Hananasifu-1					New (2cct)	6.1		329.4		9.1		
	11kV		Hananasifu-2						6.1				9.1		
	11kV	F3	Kinondoni									New	6.1		219.6
			Total							**0.0**	**658.8**			**0.0**	**219.6**
Oysterbay	33kV	New	Drive Inn	Makumbusho				New	2.0				2.0		
	33kV		Makumbusho												
			Total							**0.0**	**0.0**			**0.0**	**0.0**
	11kV								3.5				3.5		
	11kV							Rep	14.5	669.1			14.5		
	11kV								6.1				6.1		
	11kV								5.3				5.3		
			Total							**669.1**	**0.0**			**0.0**	**0.0**
N. Msasani (New)	33kV	New	Makumbusho						4.0				4.0		
			Total												
	11kV	F1	Msasani-1					New (2cct)	3.6		194.4		3.6		
	11kV		Msasani-2						3.6				3.6		
	11kV	F2	Msasani-3					New (2cct)	3.6		194.4		3.6		
	11kV		Msasani-4						3.6				3.6		
	11kV	F3	Msasani-5									New	3.6		129.6
			Total							**0.0**	**388.8**			**0.0**	**129.6**
Hananasif (New)	33kV	New	Makumbusho									New	5.0		
			Total											**0.0**	**0.0**
	11kV	F1	Hananafasi-1									New	5.2		187.2
	11kV	F2	Hananafasi-2									New	5.2		187.2
			Total											**0.0**	**374.4**

Source: JICA Study Team

Table 8-3.5 Construction Cost for distribution line (New and Replacement) (Category-B & C) Kinondoni South Region

Regend= New : New / Extension   Rein : Reinforcement / Improvement   Rep : Replacement / Renew   New : New Line from 132/33kV substation   Substation : Connection change to

Substation	Voltage	Feeder No.	Feeder Name	2020 Rein Rep New	2020 Total (km)	2020 Construction Cost (Thousand USD/km) Rep.	2020 Construction Cost (Thousand USD/km) New	2025 Rein Rep New	2025 Total (km)	2025 Construction Cost (Thousand USD/km) Rep.	2025 Construction Cost (Thousand USD/km) New	2030 Rein Rep New	2030 Total (km)	2030 Construction Cost (Thousand USD/km) Rep.	2030 Construction Cost (Thousand USD/km) New
Kinondoni South Region						**1812.0**	**2538.0**			**0.0**	**5397.5**			**0.0**	**3031.3**
Ubungo						**1812.0**	**2538.0**			**0.0**	**878.4**			**0.0**	**734.4**
Ubungo	33kV	New	Tandale	New	6.0				6.0				6.0		
	33kV	New	Mbezi	New	14.0				14.0				14.0		
	33kV	New	Makongo									New	9.0		
	33kV	New	Mabibo					New	5.0						
	33kV		Wazo2		22.0				22.0				22.0		
	33kV		Nordic	Rep	17.1	906.0			17.1				17.1		
	33kV		Tazara												
	33kV		FZ31		3.8				3.8				3.8		
	33kV		Nordic	Rep	17.1	906.0			17.1				17.1		
	33kV		FZ32		4.6				4.6				4.6		
	33kV		Magomeni/Mlimani City		9.5				9.5				9.5		
	33kV		Wazo1		15.1				15.1				15.1		
	33kV		Tandale		1.5				1.5				1.5		
	33kV		Texile		1.5				1.5				1.5		
			Total			**1812.0**	**0.0**			**0.0**	**0.0**			**0.0**	**0.0**
	11kV	U1	Mandela Road		14.4				14.4				14.4		
	11kV	U2	Ubungo Terminal		7.1				7.1				7.1		
	11kV	U7	NIT		7.8				7.8				7.8		
	11kV	U8	Ubungo												
	11kV	U9	TANESCO		19.1				19.1				19.1		
			Total			**0.0**	**0.0**			**0.0**	**0.0**			**0.0**	**0.0**
Mlimanicity	33kV		Ubungo/Mlimanicity		9.5				9.5				9.5		
	33kV				22.2				22.2				22.2		
			Total			**0.0**	**0.0**			**0.0**	**0.0**			**0.0**	**0.0**
	11kV	K1	Mlimanicity(Ring)												
	11kV	K2	Mlimanicity(Ring)												
	11kV	K7	University	New	21.1		759.6		21.1				21.1		
			Total			**0.0**	**759.6**			**0.0**	**0.0**			**0.0**	**0.0**
Tandale	33kV	New	Ubungo	New	6.0				6.0				6.0		
	33kV		Ubungo		1.5				1.5				1.5		
	33kV		Ilala												
			Total			**0.0**	**0.0**			**0.0**	**0.0**			**0.0**	**0.0**
	11kV	Tan1			3.6				3.6				3.6		
	11kV	Tan2			3.9				3.9				3.9		
	11kV	Tan4			1.9				1.9				1.9		
	11kV	F1	Manzese-1	New	7.1		255.6		7.1				7.1		
	11kV	F2	Manzese-2					New	7.1		255.6		7.1		
	11kV	F3	Kinondoni					New	7.1		255.6		7.1		
			Total			**0.0**	**255.6**			**0.0**	**511.2**			**0.0**	**0.0**
EPZ	33kV		Ubungo		4.6				4.6				4.6		
			Total			**0.0**	**0.0**			**0.0**	**0.0**			**0.0**	**0.0**
	11kV		Private												
			Total			**0.0**	**0.0**			**0.0**	**0.0**			**0.0**	**0.0**
Magomeni	33kV		Ubungo/Mlimanicity		9.5			N. Mburahati				N. Mburahati			
			Total			**0.0**	**0.0**								
	11kV	MG1			5.4										
	11kV	MG2			2.6										
	11kV	MG3			7.3										
	11kV	MG4			2.7										
			Total			**0.0**	**0.0**								
Mburahati	33kV		Ubungo					N. Mburahati				N. Mburahati			
			Total			**0.0**	**0.0**								
	11kV	F1	Kigogo-1	New	14.1		507.6								
	11kV	F2	Kigogo-2	New	14.1		507.6								
	11kV	F3	Kigogo-3	New	14.1		507.6								
			Total			**0.0**	**1522.8**								
Mbezi	33kV		Tegeta		8.4			New Mbezi				New Mbezi			
	33kV	New	Ubungo	New	14.0										
			Total			**0.0**	**0.0**								
	11kV		Kunduchi		21.3										
	11kV		Packers		22.8										
	11kV		Lugalo		16.7										
	11kV		Mwenge		17.9										
			Total			**0.0**	**0.0**								

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New
Makongo	33kV	New	Ubungo									New	9.0		
(New)			**Total**											**0.0**	**0.0**
	11kV	F1	Makongo-1									New	5.1		183.6
	11kV	F2	Makongo-2									New	5.1		183.6
	11kV	F3	Makongo-3									New	5.1		183.6
			Total											**0.0**	**550.8**
Mabibo	33kV	New	Ubungo					New	5.0						
(New)			**Total**							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1	Mabibo-1					New	5.1		183.6		5.1		
	11kV	F2	Mabibo-2					New	5.1		183.6		5.1		
	11kV	F3	Mabibo-3									New	5.1		183.6
			Total							**0.0**	**367.2**			**0.0**	**183.6**
Luguruni						**0.0**	**0.0**			**0.0**	**3374.3**			**0.0**	**1152.1**
Luguruni	33kV	F1	Kiluvya					New	34.1		1398.1		35.0		
(New)	33kV	F2	Msigani-1					Rein	15.0				15.0		
	33kV	F3	Msigani-2					New	20.1		824.1		20.1		
	33kV	F4	Kwembe-1					Rein	20.0				20.0		
	33kV	F5	Kwembe-2					New	28.1		1152.1		28.1		
	33kV	F6	Kwembe-3									New	28.1		1152.1
	33kV	F7	Kibamba					Rein	20.0				20.0		
			Total					0.0		**0.0**	**3374.3**			**0.0**	**1152.1**
N. Mburahati						**0.0**	**0.0**			**0.0**	**1144.8**			**0.0**	**1144.8**
N. Mburahati	33kV	New	Magomeni					New	3.0				3.0		
(New)	33kV	New	N. Magomeni					New	3.0				3.0		
			Total					0.0		**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1	Mburahati					New (2cct)	10.6		572.4		10.6		
	11kV	F2	Kigogo						10.6				10.6		
	11kV	F3	mzimuni									New (2cct)	10.6		572.4
	11kV												10.6		
			Total							**0.0**	**572.4**			**0.0**	**572.4**
Mburahati	33kV		Ubungo	Ubungo											
			Total							**0.0**	**0.0**			**0.0**	**0.0**
	11kV								14.1				14.1		
	11kV								14.1				14.1		
	11kV								14.1				14.1		
			Total							**0.0**	**0.0**			**0.0**	**0.0**
Magomeni	33kV		Ubungo/Mlimanicity	Ubungo					3.0				3.0		
			Total							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	MG1							5.4				5.4		
	11kV	MG2							2.6				2.6		
	11kV	MG3							7.3				7.3		
	11kV	MG4							2.7				2.7		
			Total							**0.0**	**0.0**			**0.0**	**0.0**
N. Magomeni	33kV	New	N. Mburahati SS					New	3.0				3.0		
(New)			**Total**							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1	Ndugumbi-1					New (2cct)	10.6		572.4		10.6		
	11kV	F2	Ndugumbi-2						10.6				10.6		
	11kV	F3	Ndugumbi-3									New (2cct)	10.6		572.4
	11kV												10.6		
			Total							**0.0**	**572.4**			**0.0**	**572.4**

Source: JICA Study Team

Table 8-3.6 Construction Cost for distribution line (New and Replacement) (Category-B & C)

Ilala Region

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km)		Rein Rep New	Total (km)	Construction Cost (Thousand USD/km)		Rein Rep New	Total (km)	Construction Cost (Thousand USD/km)	
						Rep.	New			Rep.	New			Rep.	New
Ilala Region						**0.0**	**1752.2**			**2338.6**	**12040.4**			**0.0**	**10216.1**
New City Center						**0.0**	**630.0**			**1102.6**	**1470.0**			**0.0**	**735.0**
New City Center	33kV		New City Center												
	33kV		Ilala		4.0				4.0				4.0		
	33kV		Sokoine		5.0				5.0				5.0		
	33kV		RMU												
	33kV		Muhimbili		2.1				2.1				2.1		
	33kV		Kariakoo												
	33kV	New	Muhimbili SS	New	2.0				2.0				2.0		
	33kV	New	Sokoine SS									New	2.0		
	33kV	New	Jangwani SS					New	3.0				3.0		
	33kV	New	Mchafukoge SS									New	4.0		
			Total			**0.0**	**0.0**			**0.0**	**0.0**			**0.0**	**0.0**
City Center	33kV		New City Center												
			Total			**0.0**	**0.0**			**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1													
	11kV	F2			5.6				12.2				12.2		
	11kV	F3			1.6				5.6				5.6		
	11kV	F4			2.6				12.9				12.9		
	11kV	F5			2.0				5.3				5.3		
	11kV	F6			8.9			Rep	24.0	1102.6			24.0		
	11kV	F7	Upanga Mashariki									New	3.5		367.5
	11kV	F8			2.8				5.8				5.8		
			Total			**0.0**	**0.0**			**1102.6**	**0.0**			**0.0**	**367.5**
Muhimbili	33kV		New City Center		2.1				2.1				2.1		
	33kV	New	New City Center	New	2.0										
			Total			**0.0**	**0.0**			**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1	Upanga Magharibi-1	New	3.0		315.0		3.0				3.0		
	11kV	F2	Upanga Magharibi-2	New	3.0		315.0		3.0				3.0		
	11kV	New	Upanga Mashariki-1					New	3.5		367.5		3.5		
	11kV	New	Upanga Mashariki-2									New	3.5		367.5
			Total			**0.0**	**630.0**			**0.0**	**367.5**			**0.0**	**367.5**
Sokoine	33kV	1.0	Sokoine SP1	Ilala				Ilala							
	33kV	3.0	SokoineRailway												
	33kV	4.0	RMU												
	33kV	6.0	New City Center										5.0		
	33kV	8.0	Kempinski Hotel												
	33kV	10.0	Sokoine SP-2										8.8		
	33kV	New	New City Center									New	2.0		
			Total											**0.0**	**0.0**
	11kV	PL01	Sokoine-1										0.9		
	11kV	PL02	Sokoine-2												
	11kV	PL04	Sokoine-3										4.4		
	11kV	PL05	Sokoine-4										1.9		
	11kV	PL08	Sokoine-5										0.8		
			Total											**0.0**	**0.0**
Railway	33kV		Kariakoo, Ilala	Ilala				Ilala					3.5		
	33kV		Sokoine										0.0		
			Total											**0.0**	**0.0**
	11kV	F01	Water Front										7.4		
	11kV	F02	Clock Tower										0.0		
	11kV	F03	Sokoine Ohio										2.5		
			Total											**0.0**	**0.0**
Jangwani (New)	33kV	New	New City Center					New	3.0				3.0		
			Total							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1	Jangwani-1					New	3.5		367.5		3.5		
	11kV	F2	Jangwani-2					New	3.5		367.5		3.5		
	11kV	F3	Kisutu					New	3.5		367.5		3.5		
			Total							**0.0**	**1102.5**			**0.0**	**0.0**
Mchafukoge (New)	33kV		New City Center					Ilala					4.0		
			Total												
	11kV	F1	Mchafukoge-1										3.5		
	11kV	F2	Mchafukoge-2										3.5		
	11kV	F3	Gerezeni										3.5		
			Total											**0.0**	**0.0**

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New
Ilala						**0.0**	**0.0**			**392.9**	**2331.0**			**0.0**	**1113.0**
Ilala	33kV	H02	Kariakoo UG1												
	33kV	H05	Kurasini(KR)		7.0				7.0				7.0		
	33kV	H06	Tanzania Oxigen(TOL)		3.0				3.0				3.0		
	33kV	H07	Factory Zone1												
	33kV	H09	Factory Zone2												
	33kV	H17	City Center2		3.5				3.5				3.5		
	33kV	H18	City Center1		3.7				3.7				3.7		
	33kV	H20	Sokoine												
	33kV	H21	Kariakoo		3.5				3.5				3.5		
	33kV	H23	Kariakoo UG2												
	33kV	New	N. Kariakoo									New	2.0		
	33kV	New	Mchafukoge SS					New	4.0						
	33kV	New	Mchikichini SS					New	2.0						
	33kV	New	TOL SS					New	5.0						
			Total			**0.0**	**0.0**			**0.0**	**0.0**			**0.0**	**0.0**
	11kV	K02	Kariakoo												
	11kV	K05	Muhimbili		7.0			Rep	7.0	321.9			7.0		
	11kV	K06	Buguruni Sokoni		9.4				9.4				9.4		
	11kV	K10	Uhuru Road		4.7				4.7				4.7		
	11kV	K13	Nyerere Road/Shaurimoyo		1.5			Rep	1.5	71.0			1.5		
	11kV	K14	Buguruni Reline		6.4				6.4				6.4		
	11kV	K17	Kariakoo												
	11kV	K18	Breweries												
	11kV	K21	Magomeni												
			Total			**0.0**	**0.0**			**392.9**	**0.0**			**0.0**	**0.0**
Kariakoo	33kV		Ilalla, Railway		3.5				3.5				3.5		
	33kV		New City Center												
			Total			**0.0**	**0.0**			**0.0**	**0.0**			**0.0**	**0.0**
	11kV	KAR1			4.8				4.8				4.8		
	11kV	KAR2			2.4				2.4				2.4		
	11kV	KAR3						New	3.5		126.0		3.5		
	11kV	KAR4			3.7				3.7				3.7		
			Total			**0.0**	**0.0**			**0.0**	**126.0**			**0.0**	**0.0**
N. Kariakoo (New)	33kV	New	Ilala									New	2.0		
			Total											**0.0**	**0.0**
	11kV	F1	Kariakoo-1									New	3.5		126.0
	11kV	F2	Kariakoo-2									New	3.5		126.0
	11kV	F3	Gerezani									New	3.5		126.0
			Total											**0.0**	**378.0**
FZI(Buguruni)	33kV		Kipawa		7.4				7.4			N. Ilala			
	33kV		Ilala												
	33kV		FZ II												
	33kV		Tazara												
	33kV		ALAF		8.5				8.5						
			Total			**0.0**	**0.0**			**0.0**	**0.0**				
	11kV				11.5				11.5						
	11kV				9.9				9.9						
	11kV				6.8				6.8						
			Total			**0.0**	**0.0**			**0.0**	**0.0**				
Sokoine	33kV	1.0	Sokoine SP1									NCC			
	33kV	3.0	SokoineRailway												
	33kV	4.0	RMU												
	33kV	6.0	New City Center		5.0				5.0						
	33kV	8.0	Kempinski Hotel												
	33kV	10.0	Sokoine SP-2		8.8				8.8						
			Total			**0.0**	**0.0**			**0.0**	**0.0**				
	11kV	PL01	Sokoine-1		0.9				0.9						
	11kV	PL02	Sokoine-2												
	11kV	PL04	Sokoine-3		4.4				4.4						
	11kV	PL05	Sokoine-4		1.9				1.9						
	11kV	PL08	Sokoine-5		0.8				0.8						
			Total			**0.0**	**0.0**			**0.0**	**0.0**				
Railway	33kV		Kariakoo, Ilala		3.5				3.5			NCC			
	33kV		Sokoine		0.0				0.0						
			Total			**0.0**	**0.0**			**0.0**	**0.0**				
	11kV	F01	Water Front		7.4				7.4						
	11kV	F02	Clock Tower		0.0				0.0						
	11kV	F03	Sokoine Ohio		2.5				2.5						
			Total			**0.0**	**0.0**			**0.0**	**0.0**				

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New
Mchafukoge	33kV	New	Ilala					New	4.0			NCC			
(New)			Total							0.0	0.0				
	11kV	F1	Mchafukoge-1					New	3.5		367.5				
	11kV	F2	Mchafukoge-2					New	3.5		367.5				
	11kV	F3	Mchafukoge-3					New	3.5		367.5				
			Total							0.0	1102.5				
Mchikichini	33kV	New	Ilala					New	2.0			New	4.0		
(New)			Total							0.0	0.0			0.0	0.0
	11kV	F1	Mchikichini-1					New	3.5		367.5		3.5		
	11kV	F2	Mchikichini-2					New	3.5		367.5		3.5		
	11kV	F3	Mchikichini-3					New	3.5		367.5		3.5		
	11kV	F4	Mchikichini-4									New	3.5		367.5
	11kV	F5	Mchikichini-5									New	3.5		367.5
			Total							0.0	1102.5			0.0	735.0
TOL	33kV		Ilala		2.2				2.2			N. Ilala			
	33kV	New	Ilala					New	5.0						
			Total			0.0	0.0			0.0	0.0				
	11kV	TOL1			9.7				9.7						
	11kV	TOL2			7.8				7.8						
	11kV	TOL3			2.0				2.0						
	11kV	TOL4			0.4				0.4						
	11kV	TOL5			5.5				5.5						
			Total			0.0	0.0			0.0	0.0				
N. Ilala						**0.0**	**0.0**			**0.0**	**0.0**			**0.0**	**4564.5**
N. Ilala	33kV	New	FZI(Buguruni)									New	3.0		
(New)	33kV	New	TOL									New	3.0		
	33kV	New	Ilala-1									New	4.5		909.0
	33kV	New	Ilala-2									New	4.5		909.0
	33kV	New	Buguruni									New	4.5		909.0
	33kV														
	33kV														
			Total											0.0	2727.0
	11kV	F1	Ilala-1									New	3.5		367.5
	11kV	F2	Ilala-2									New	3.5		367.5
	11kV	F3	Buguruni									New	3.5		367.5
			Total											0.0	1102.5
FZI(Buguruni)	33kV		Kipawa	Ilala				Ilala					7.4		
	33kV		Ilala												
	33kV		FZ II												
	33kV		Tazara												
	33kV		ALAF										8.5		
	33kV	New	N. Ilala									New	3.0		
			Total											0.0	0.0
	11kV		Vingunguti-1									New	3.5		367.5
	11kV		Vingunguti-2									New	3.5		367.5
	11kV														
			Total											0.0	735.0
TOL	33kV		Ilala	Ilala				Ilala					2.2		
	33kV		Ilala										5.0		
	33kV	New	N. Ilala									New	3.0		
			Total											0.0	0.0
	11kV	TOL1											9.7		
	11kV	TOL2											7.8		
	11kV	TOL3											2.0		
	11kV	TOL4											0.4		
	11kV	TOL5											5.5		
			Total											0.0	0.0
FZII(Gongo'boto)						**0.0**	**1122.2**			**0.0**	**0.0**			**0.0**	**1375.2**
FZII(Gongo'boto)	33kV		Kipawa		99.3				99.3				99.3		
	33kV		Gongo'boto	New (2cct)	18.1		1122.2		18.1				18.1		
	33kV				18.1				18.1				18.1		
	33kV	New	Ukonga									New	4.0		
			Total				1122.2			0.0	0.0			0.0	0.0
	11kV	F22			14.9				14.9				14.9		
	11kV	F23			17.0				17.0				17.0		
	11kV	F24			101.2				101.2				101.2		
	11kV	F25			0.5				0.5				0.5		
			Total				0.0			0.0	0.0			0.0	0.0
Ukonga	33kV	New	FZII(Gongo'boto)									New	4.0		
(New)			Total											0.0	0.0
	11kV	F1	Ukonga-1									New	19.1		687.6
	11kV	F2	Ukonga-2									New	19.1		687.6
			Total											0.0	1375.2

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Feeder Voltage	Feeder No.	Feeder Name	2020 Rein Rep New	2020 Total (km)	2020 Construction Cost (Thousand USD/km) Rep.	2020 New	2025 Rein Rep New	2025 Total (km)	2025 Construction Cost (Thousand USD/km) Rep.	2025 New	2030 Rein Rep New	2030 Total (km)	2030 Construction Cost (Thousand USD/km) Rep.	2030 New
Pugu						**0.0**	**0.0**			**0.0**	**3918.4**			**0.0**	**1316.1**
Pugu (New)	33kV	New	Majohe					New	10.0				10.0		
	33kV		Pugu-1					New (2cct)	9.1		564.2		9.1		
	33kV		Pugu-2						9.1				9.1		
	33kV		Majohe-3					New (2cct)	9.1		564.2		9.1		
	33kV		Majohe-4						9.1				9.1		
	33kV		Msongola									New	32.1		1316.1
			Total							**0.0**	**1128.4**			**0.0**	**1316.1**
	11kV	F1	Pugu-1					New	10.1		363.6		10.1		
	11kV	F2	Pugu-2					New	10.1		363.6		10.1		
			Total							**0.0**	**727.2**			**0.0**	**0.0**
Majohe (New)	33kV	New	Pugu					New	10.0				10.0		
			Total							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1	Majohe-1					New (2cct)	19.1		1031.4		19.1		
	11kV	F2	Majohe-2						19.1				19.1		
	11kV	F3	Pugu-1					New (2cct)	19.1		1031.4		19.1		
	11kV	F4	Pugu-2						19.1				19.1		
			Total							**0.0**	**2062.8**			**0.0**	**0.0**
FZIII(Kipawa)						**0.0**	**0.0**			**843.1**	**579.6**			**0.0**	**455.1**
FZIII(Kipawa)	33kV		Ubungo		30.7				30.7				30.7		
	33kV		FZ I		9.9				9.9				9.9		
	33kV		FZ II		99.3				99.3				99.3		
	33kV		Buguruni		7.4				7.4				7.4		
	33kV		Tandika		10.4				10.4				10.4		
	33kV		Segerea		57.3				57.3				57.3		
	33kV		Chamgombe												
	33kV				44.5				44.5				44.5		
	33kV		Kilawi									New	11.1		455.1
	33kV	New	Tandika	New	1.0				1.0				1.0		
	33kV	New	Kiwalani					New	5.0				5.0		
			Total			**0.0**	**0.0**			**0.0**	**0.0**			**0.0**	**455.1**
	11kV		F32		0.0				0.0				0.0		
	11kV		F33		8.3			Rep	8.3	383.1			8.3		
	11kV		F34		6.3				6.3				6.3		
			Total			**0.0**	**0.0**			**383.1**	**0.0**			**0.0**	**0.0**
Tandika	33kV		Kipawa (FZ-III)		9.0			Mtoni				Mtoni			
	33kV	New	Kipawa (FZ-III)	New	1.0										
			Total			**0.0**	**0.0**								
	11kV	TD2			11.5										
	11kV	TD3			22.9										
	11kV	TD4			16.4										
	11kV	TD5			10.3										
			Total			**0.0**	**0.0**								
Kiwalani (New)	33kV	New	FZIII(Kipawa)					New	5.0				5.0		
			Total							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1	Kiwalani (Existing line)					Rep	5.0	230.0			5.0		
	11kV	F2	Kiwalani (Existing line)					Rep	5.0	230.0			5.0		
	11kV	F3	Kiwalani (New)					New	16.1		579.6		16.1		
			Total							**460.0**	**579.6**			**0.0**	**0.0**
Chamgombe	33kV		Kurasini		13.6			Kurasini				Kurasini			
	33kV		Kipawa (FZ-III)		3.4										
			Total			**0.0**	**0.0**								
	11kV	CG1			2.5										
	11kV	CG2			1.3										
	11kV	CG3			0.4										
	11kV	CG4			4.3										
	11kV	CG5			2.2										
			Total			**0.0**	**0.0**								
Kimanga						**0.0**	**0.0**			**0.0**	**2737.0**			**0.0**	**657.2**
Kimanga (New)	33kV	New	Vingunguti SS					New	8.0				8.0		
	33kV		Kimanga Feeder1					New (2cct)	16.1		998.2		16.1		
	33kV		Kimanga Feeder2						16.1				16.1		
	33kV		Vigunguti1									New (2cct)	10.6		657.2
	33kV		Vigunguti2										10.6		
	33kV														
			Total							**0.0**	**998.2**			**0.0**	**657.2**
	11kV	F1	Kimanga-1					New (2cct)	16.1		869.4		16.1		
	11kV	F2	Kimanga-2						16.1				16.1		
	11kV	F3	Kimanga-3					New (2cct)	16.1		869.4		16.1		
	11kV	F4	Kimanga-4						16.1				16.1		
	11kV	New	Kurasini					New	7.0				7.0		
			Total							**0.0**	**1738.8**			**0.0**	**0.0**

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New
Kivule (S-DSM)						0.0	0.0			0.0	1004.4			0.0	0.0
Kivule (S-DSM)	33kV		Kivule-1					New (2cct)	8.1		502.2		8.1		
(New)	33kV		Kivule-2						8.1				8.1		
	33kV		Kitunda-1					New (2cct)	8.1		502.2		8.1		
	33kV		Kitunda-2						8.1				8.1		
	33kV	New	Kimanga					New	8.0				8.0		
			Total							0.0	1004.4			0.0	0.0

Source: JICA Study Team

Table 8-3.7 Construction Cost for distribution line (New and Replacement) (Category-B & C)

Temeke Region

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New
Temeke Region						**0.0**	**2470.7**			**12818.1**	**20207.6**			**0.0**	**5833.7**
kurasini						**0.0**	**1478.5**			**0.0**	**2589.5**			**0.0**	**945.0**
Kurasini	33kV		Ilala-Kurasini		7.1				7.1				7.1		
	33kV		Ilala		1.5				1.5				1.5		
	33kV		Kigamboni		8.7				8.7				8.7		
	33kV		Chango'mbe		13.6				13.6				13.6		
	33kV		Mbagala		8.9				8.9				8.9		
	33kV		Miburani					New	5.5		1111.0		5.5		
	33kV		Keko					New	5.5		1111.0		5.5		
	33kV		Kurasini	New	5.5		1111.0		5.5				5.5		
	33kV		Chango'mbe-2									New	5.5		577.5
	33kV	New	Kimanga						7.0				7.0		
	33kV	New	N. Kigamboni SS		9.0				9.0				9.0		
			Total			**0.0**	**1111.0**			**0.0**	**2222.0**			**0.0**	**577.5**
	11kV	KR1	Mtoni, Azizi		7.8				7.8				7.8		
	11kV	KR2	Kurasini		14.2				14.2				14.2		
	11kV	KR3	Tandika, Sabasaba		13.5				13.5				13.5		
	11kV	KR4	DSM Port Area		7.7				7.7				7.7		
	11kV		Kurasini-2	New	3.5		367.5		3.5				3.5		
	11kV		Keko					New	3.5		367.5		3.5		
	11kV		Miburani									New	3.5		367.5
			Total			**0.0**	**367.5**			**0.0**	**367.5**			**0.0**	**367.5**
Chamgombe	33kV		Kurasini	FZ III					13.6				13.6		
	33kV		Kipawa (FZ-III)						3.4				3.4		
			Total						**17.0**				**17.0**		
	11kV	CG1							2.5				2.5		
	11kV	CG2							1.3				1.3		
	11kV	CG3							0.4				0.4		
	11kV	CG4							4.3				4.3		
	11kV	CG5							2.2				2.2		
			Total							**0.0**	**0.0**			**0.0**	**0.0**
Kigamboni	33kV		Kurasini	N. Kigamboni				N. Kigamboni				N. Kigamboni			
	33kV		Feeder												
			Total												
	11kV		Feeder												
			Total												
N. Kigamboni (New)	33kV		Kurasini		8.7			N. Kigamboni				N. Kigamboni			
	33kV		Feeder		136.7										
	33kV	New	Kurasini	New	9.0										
			Total			**0.0**	**0.0**								
	11kV		Feeder		16.7										
			Total			**0.0**	**0.0**								
Mtoni						**0.0**	**0.0**			**0.0**	**4489.5**			**0.0**	**0.0**
Motni (New)	33kV	New	Tandika					New	4.0				4.0		
	33kV	New	Temeke					New	5.0				5.0		
	33kV	New	Kijichi					New	7.0				7.0		
	33kV	F1	Mtoni					New	10.1		414.1		10.1		
	33kV	F2	Azimio					New	10.1		414.1		10.1		
	33kV	F3	Kijichi					New	10.1		414.1		10.1		
			Total							**0.0**	**1242.3**			**0.0**	**0.0**
	11kV	F1	Mtoni-1					New	10.1		363.6		10.1		
	11kV	F2	Mtoni-2					New	10.1		363.6		10.1		
	11kV	F3	Azimio-1					New	8.1		291.6		8.1		
	11kV	F4	Azimio-2					New	8.1		291.6		8.1		
	11kV	F5	Sadali-1					New	11.6		417.6		11.6		
	11kV	F6	Sadali-2					New	11.6		417.6		11.6		
			Total							**0.0**	**2145.6**			**0.0**	**0.0**
Tandika	33kV		Kipawa (FZ-III)	FZ III					9.0				9.0		
	33kV		Kipawa (FZ-III)						1.0				1.0		
	33kV	New	Motni					New	4.0				4.0		
			Total							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	TD2							11.5				11.5		
	11kV	TD3							22.9				22.9		
	11kV	TD4							16.4				16.4		
	11kV	TD5							10.3				10.3		
			Total							**0.0**	**0.0**			**0.0**	**0.0**

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew | New : New Line from 132/33kV substation | Substation : Connection change to

Substation	Voltage	Feeder No.	Feeder Name	2020 Rein Rep New	2020 Total (km)	2020 Construction Cost (Thousand USD/km) Rep.	2020 Construction Cost (Thousand USD/km) New	2025 Rein Rep New	2025 Total (km)	2025 Construction Cost (Thousand USD/km) Rep.	2025 Construction Cost (Thousand USD/km) New	2030 Rein Rep New	2030 Total (km)	2030 Construction Cost (Thousand USD/km) Rep.	2030 Construction Cost (Thousand USD/km) New
Temeke	33kV	New	Motni					New	5.0				5.0		
(New)			**Total**							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1	Temeke-1					New	5.1		183.6		5.1		
	11kV	F2	Temeke-2					New	5.1		183.6		5.1		
	11kV	F3	Temeke-3					New	5.1		183.6		5.1		
			Total							**0.0**	**550.8**			**0.0**	**0.0**
Kijichi	33kV	New	Motni					New	7.0				7.0		
(New)			**Total**							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1	Kijichi-1					New	5.1		183.6		5.1		
	11kV	F2	Kijichi-2					New	5.1		183.6		6.0		
	11kV	F3	Kijichi-3					New	5.1		183.6		6.0		
			Total							**0.0**	**550.8**			**0.0**	**0.0**
Buza						**0.0**	**0.0**			**0.0**	**2538.1**			**0.0**	**1223.3**
Buza	33kV	New	Yombo Vituka					New	4.0				4.0		
(New)	33kV		Buza (Existing line)					Rein	5.1				5.1		
	33kV		New Buza					New	10.1		414.1		10.1		
	33kV		Makangarawe(Existing line)					Rein	5.1				5.1		
	33kV		New Makangarawe					New	10.1		414.1		10.1		
	33kV		Yombo Vituka					New	15.1		619.1		15.1		
	33kV		Kilakala									New	12.1		496.1
			Total							**0.0**	**1447.3**			**0.0**	**496.1**
	11kV	F1	Buza-1					Rein	4.1				4.1		
	11kV	F2	Buza-2					Rein	6.1				6.1		
	11kV	F3	Buza-3					New	10.1		363.6		10.1		
	11kV	F4	Makangarawe-1					Rein	6.1				6.1		
	11kV	F5	Makangarawe-2					New	10.1		363.6		10.1		
	11kV	F6	Kilakala-1									New	10.1		363.6
	11kV	F7	Kilakala-2									New	10.1		363.6
			Total							**0.0**	**727.2**			**0.0**	**727.2**
Yombo Vituka	33kV	New	Buza					New	4.0				4.0		
(New)			**Total**							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1	Yombo Vituka-1					Rein	4.1				4.1		
	11kV	F2	Yombo Vituka-2					Rein	6.1				6.1		
	11kV	F3	Yombo Vituka-3						10.1		363.6		10.1		
			Total							**0.0**	**363.6**			**0.0**	**0.0**
Somangila (SE-DSM)						**0.0**	**0.0**			**2453.9**	**3165.2**			**0.0**	**742.1**
Somangila (SE-DSM)	33kV		Somangila (Existing line)					Rep	11.1	588.3			11.1		
(New)	33kV		Somangila (Existing line)					Rep	24.1	1277.3			24.1		
	33kV		Kimbiji (Existing line)					Rep	11.1	588.3			11.1		
	33kV		Somangila-1									New	18.1		742.1
	33kV		Kisarawe II					New	26.1		1070.1		26.1		
	33kV		Pembamna					New	51.1		2095.1		51.1		
			Total							**2453.9**	3165.2			**0.0**	**742.1**
N. Kigamboni						**0.0**	**0.0**			**960.7**	**2830.5**			**0.0**	**701.1**
N. Kigamboni	33kV		Kurasini	Kurasini				Rein	8.7				8.7		
(New)	33kV		Vijibweni (Existing)					Rep	18.1	960.7			18.1		
	33kV		Kigamboni-1					New	17.1		701.1		17.1		
	33kV		Kigamboni-2					New	17.1		701.1		17.1		
	33kV		Kigamboni-3									New	17.1		701.1
	33kV		Tungi					New	17.1		701.1		17.1		
	33kV		Kurasini						9.0				9.0		
			Total							**960.7**	**2103.3**			**0.0**	**701.1**
	11kV		Kigamboni (Existing)					Rein	16.7				16.7		
	11kV		Tungi-1						10.1		363.6		10.1		
	11kV		Tungi-2						10.1		363.6		10.1		
			Total							**0.0**	**727.2**			**0.0**	**0.0**
Kibada						**0.0**	**0.0**			**2665.9**	**0.0**			**0.0**	**0.0**
Kibada	33kV		Kibada (Existing)					Rep	8.1	429.3			8.1		
(New)	33kV		Toangoma (Existing)					Rep	22.1	1171.3			22.1		
	33kV		Mjimwema (Existing)					Rep	20.1	1065.3			20.1		
	33kV														
			Total							**2665.9**	**0.0**			**0.0**	**0.0**

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew | New : New Line from 132/33kV substation | Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New
Mbagala						**0.0**	**992.2**			**6737.6**	**966.3**			**0.0**	**0.0**
Mbagala	33kV	1	Mkuranga		8.9			Rep	8.9	473.7			8.9		
	33kV	2			21.4				21.4				21.4		
	33kV	3			13.2			Rep	13.2	700.4			13.2		
	33kV	4			125.5			Rein	125.5				125.5		
	33kV	5			8.9			Rep	8.9	474.1			8.9		
	33kV		Mbagala Kuu-1	New	13.1		537.1		13.1	694.3			13.1		
	33kV		Toangoma						11.1		455.1		11.1		
	33kV		Kiburugwa	New	11.1		455.1		11.1	588.3			11.1		
	33kV	New	Mbagala II SS					New	4.0				4.0		
	33kV	New	Mbagala II SS									New	4.0		
	33kV	New	Kiburugwa SS					New	4.0				4.0		
	33kV	New	Kiburugwa SS									New	4.0		
			Total			**0.0**	**992.2**			**2342.6**	**455.1**			**0.0**	**0.0**
	11kV	MBF1			46.6			Rep	46.6	2467.5			46.6		
	11kV	MBF2			17.9				17.9				17.9		
	11kV	MBF3			18.2				18.2				18.2		
	11kV	MBF4			36.4			Rep	36.4	1927.5			36.4		
			Total			**0.0**	**0.0**			**4395.0**	**0.0**			**0.0**	**0.0**
Mbagala II	33kV	New	Mbagala					New	4.0				4.0		
	33kV	New	Mbagala									New	4.0		
(New)			**Total**							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1	Mbagala Kuu					New	7.1		255.6		7.1		
			Total							**0.0**	**255.6**			**0.0**	**0.0**
Kiburungwa	33kV	Inter	Mbagala					New	4.0				4.0		
	33kV	Inter	Mbagala									New	4.0		
(New)			**Total**							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1	Kiburungwa					New	7.1		255.6		7.1		
			Total							**0.0**	**255.6**			**0.0**	**0.0**
Mianzini						**0.0**	**0.0**			**0.0**	**3628.5**			**0.0**	**2222.2**
Mianzini	33kV	New	Charambe					New	5.0				5.0		
	33kV	New	Charambe									New	5.0		
	33kV	New	Chamazi					New	10.0				10.0		
	33kV		Chamazi					New	11.1		455.1		11.1		
	33kV		Charambe					New	7.1		291.1		7.1		
	33kV		Mianzini					New	5.1		209.1		5.1		
	33kV		Mkuranga					New	40.1		1644.1		40.1		
	33kV		Tambani					New	25.1		1029.1		25.1		
	33kV		Vikindu									New	29.1		1193.1
	33kV		Vianzi									New	25.1		1029.1
			Total							**0.0**	**3628.5**			**0.0**	**2222.2**
	11kV	F1	Mianzini-1					Rein	5.0				5.0		
	11kV	F2	Mianzi-2					Rein	5.0				5.0		
	11kV	F3													
			Total							**0.0**	**0.0**			**0.0**	**0.0**
Charambe	33kV	New	Mianzini					New	5.0				5.0		
(New)	33kV	New	Mianzini									New	5.0		
			Total							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1	Charambe-1					Rein	5.0				5.0		
	11kV	F2	Charambe-2					Rein	5.0				5.0		
			Total							**0.0**	**0.0**			**0.0**	**0.0**
Chamazi	33kV	New	Mianzini					New	10.0						
(New)			**Total**							**0.0**	**0.0**			**0.0**	**0.0**
	11kV	F1	Chamazi-1					Rein	5.0				5.0		
	11kV	F2	Chamazi-2					Rein	5.0				5.0		
			Total							**0.0**	**0.0**			**0.0**	**0.0**

Source: JICA Study Team

Table 8-3.8 Construction Cost for distribution line (New and Replacement) (Category-B & C)

Coast Region

Regend= New : New / Extension Rein : Reinforcement / Improvement Rep : Replacement / Renew New : New Line from 132/33kV substation Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New
Coast Region						**0.0**	**4848.0**			**0.0**	**23242.9**			**0.0**	**25540.4**
Chalinze						**0.0**	**0.0**			**0.0**	**5990.1**			**0.0**	**3821.2**
Chalinze	33kV		Ngerengere		71.1				71.1				71.1		
	33kV		Lugoba		169.7										
	33kV		Ruvu		81.3				81.3				81.3		
	33kV		Bagamoyo		322.1										
	33kV		Lugoba (Existing)					Rein	80.0				80.0		
	33kV		Lugoba (New)						80.0		3280.0		80.0		
	33kV		Kimange, Msata						66.1		2710.1		66.1		
	33kV		Kiwangwe, Tarawanda									New	66.1		2710.1
	33kV		Magindu									New	27.1		1111.1
			Total			**0.0**	**0.0**			**0.0**	**5990.1**			**0.0**	**3821.2**
Mlandizi						**0.0**	**0.0**			**0.0**	**8458.3**			**0.0**	**3523.4**
Mlandizi	33kV	H0	Upper Luvu		0.5				0.5				0.5		
	33kV	H1	Lower Luvu 1		29.9				29.9				29.9		
	33kV	H3	Chalinze		135.0										
	33kV	H5	Kibaha		133.2										
	33kV	H7	Lower Luvu 2		27.7				27.7				27.7		
	33kV	H8	Zegereni		11.1				11.1				11.1		
	33kV	H9	Kiluwa		0.0				0.0				0.0		
	33kV		Chalinze (Existing)					Rein	68.0				68.0		
	33kV		Chalinze (ENew)					New	68.1		2792.1		68.1		
	33kV		Kibaha (Existing)					Rein	66.0				66.0		
	33kV		Kibaha (New)					New	68.1		2792.1		68.1		
	33kV		Vigwaza, Dutumi					New	70.1		2874.1		70.1		
	33kV		Soga, Mzenga									New	42.1		1726.1
	33kV		Bokomnemela									New	26.1		1070.1
	33kV	New	N. Tumbi SS					New	31.0				31.0		
	33kV	New	N. Tumbi SS									New	31.0		
			Total		**337.4**	**0.0**	**0.0**		**337.4**	**0.0**	**8458.3**		**337.4**	**0.0**	**2796.2**
Tumbi(Kibaha)	33kV	H5	Mlandizi, Kibaha	N. Tumbi				N. Tumbi				N. Tumbi			
	33kV		Kibaha												
	33kV	H3	Chalinze												
	33kV														
			Total												
	11kV		Picha Ya Ndege												
	11kV														
	11kV														
			Total												
N. Tumbi (New)	33kV	H5	Mlandizi, Kibaha		133.2				133.2						
	33kV		Kibaha		0.0				0.0				0.0		
	33kV	H3	Chalinze		0.0				0.0				0.0		
	33kV				133.2				133.2						
	33kV	New	Mlandizi					New	31.0				31.0		
	33kV	New	Mlandizi									New	31.0		
			Total			**0.0**	**0.0**			**0.0**	**0.0**			**0.0**	**0.0**
	11kV		Picha Ya Ndege		9.6				9.6				9.6		
	11kV														
	11kV				8.8				8.8				8.8		
	11kV		Tumbi-1									New	10.1		363.6
	11kV		Tumbi-2									New	10.1		363.6
			Total		**18.4**	**0.0**	**0.0**		**18.4**	**0.0**	**0.0**		**18.4**	**0.0**	**727.2**
Zinga						**0.0**	**4848.0**			**0.0**	**2017.2**			**0.0**	**0.0**
Zinga (New)	33kV		Kerege (Existing line)	Rein	20.0				20.0				20.0		
	33kV		Yombo, Kiromo (Ex. line)	Rein	20.0				20.0				20.0		
	33kV		Fukayosi, Magomeni (Ex. Line)	Rein	40.0				40.0				40.0		
	33kV		Zinga-1	New	8.0		1616.0		8.0				8.0		
	33kV		Zinga-2	New	8.0		1616.0		8.0				8.0		
	33kV		Zinga-3	New	8.0		1616.0		8.0				8.0		
	33kV		Yombo, Kiromo (New)					New	23.1		947.1		23.1		
	33kV		Fukayosi, Magomeni (New)					New	26.1		1070.1		26.1		
			Total			**0.0**	**4848.0**			**0.0**	**2017.2**			**0.0**	**0.0**

Regend= New : New / Extension   Rein : Reinforcement / Improvement   Rep : Replacement / Renew   New : New Line from 132/33kV substation   Substation : Connection change to

Substation	Feeder			2020				2025				2030			
	Voltage	Feeder No.	Feeder Name	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New	Rein Rep New	Total (km)	Construction Cost (Thousand USD/km) Rep.	New
Mkuranga						**0.0**	**0.0**			**0.0**	**6777.3**			**0.0**	**3452.2**
Mkuranga	33kV		Kiparanganda (Existing line)					Rein	20.0				20.0		
(New)	33kV		Mbezi					New	55.1		2259.1		55.1		
	33kV		Shungubweni					New	68.1		2792.1		68.1		
	33kV		Myagawa, Myamato					New	42.1		1726.1		42.1		
	33kV		Panzuo, Mkamba									New	42.1		1726.1
	33kV		Bupu									New	42.1		1726.1
			Total							**0.0**	**6777.3**			**0.0**	**3452.2**
Maneromango						**0.0**	**0.0**			**0.0**	**0.0**			**0.0**	**14743.6**
Maneromango	33kV		Masaki (Existing line)									Rein	40.0		
(New)	33kV		Kurui									New	45.1		1849.1
	33kV		Mafizi									New	70.1		2874.1
	33kV		Cholesamvula									New	61.1		2505.1
	33kV		Vikumbulu									New	67.1		2751.1
	33kV		Marui									New	61.1		2505.1
	33kV		Msimbu									New	55.1		2259.1
			Total											0	14743.6

Source: JICA Study Team

8-4 Implementation Plan of Distribution Lines

8-4-1 Short term plan (by 2020), medium term plan (by 2025), long term plan (by 2030)

(1) Implementation planned by 2020

1) Kinondoni North Region

- Approximate cost: 5.52 million dollars
- Main purpose: Reinforcing the system utilizing existing distribution facilities
- Main contents:
  - ➢ Sub-transmission lines from Tegeta substation to the Bahari Beach and Jangwani Beach substations
  - ➢ Reinforcement of distribution capacity from the Jangwani Beach substation
  - ➢ Reinforcement of distribution network utilizing existing facilities from Makumbusho substation

2) Kinondoni South Region

- Approximate cost: 4.35 million dollars
- Main purpose: Reinforcing the system utilizing existing distribution facilities
- Main contents:
  - ➢ Sub-transmission lines from Ubongo substation to the Tandale and Mbezi substations
  - ➢ Reinforcement of distribution capacity from the Tandale and Mburahati substations
  - ➢ Reinforcement of distribution network utilizing existing facilities from Ubungo substation

3) Ilala Region

- Approximate cost: 1.75 million dollars
- Main purpose: Expansion of distribution network
- Main contents:
  - ➢ Sub-transmission lines from the New City Center substation to the Muhimbili substation
  - ➢ Reinforcement of distribution capacity from the Muhimbili, FZII, FZIII and Tandale substations

4) Temeke Region

- Approximate cost: 2.47 million dollars
- Main purpose: Expansion of distribution network
- Main contents:
  - ➢ Sub-transmission lines from the Kurasini substation to the new N. Kigamboni

substation

- ➢ Reinforcement of distribution network in the Kurasini district
- ➢ Reinforcement of the distribution network from Mbagala substation

5) Coast Region

- Approximate cost: 4.85 million dollars
- Main purpose: Expansion of distribution network
- Main contents:
  - ➢ Distribution network development in the vicinity of Zinga substation utilizing existing distribution facilities
  - ➢ Distribution network development from the Zinga substation to the Zinga district

(2) Implementation planned by 2021-2025

1) Kinondoni North Region

- Approximate cost: 22.40 million dollars
- Main purpose: Renewal of existing distribution facilities, expansion of new distribution networks
- Main contents:
  - ➢ Distribution line replacement (thickening) in the Tegeta substation distribution area, connection switching to other substations
  - ➢ Distribution network development following construction of the new Bunju (N-DSM) substation, the N. Bahari Beach, N. Mbezi, Kawe, Goba and Drive Inn substations.
  - ➢ Sub-transmission lines from the Makumbusho substation to the Mwananyamala and new Kijitonyama substations
  - ➢ Distribution network development in the vicinity of the new Kijitonyama substation
  - ➢ Sub-transmission lines from the Drive Inn substation to the Oyster Bay and N. Msasani substations
  - ➢ Reinforcement of the distribution network in Msasani district

2) Kinondoni South Region

- Approximate cost: 5.40 million dollars
- Main purpose: Renewal of existing distribution facilities, expansion of new distribution networks
- Main contents:
  - ➢ Sub-transmission lines from the Ubungo substation to the new Mabibo substation

- Distribution network development in the vicinity of the Tandale substation and the new Mabibo substation
- Distribution network development following construction of the new Luguruni substation and the N. Mburahati substation

3) Ilala Region

- Approximate cost: 14.38 million dollars
- Main purpose: Renewal of existing distribution facilities, expansion of new distribution networks
- Main contents:
  - Sub-transmission lines from the New City Center substation to the Jangwani Beach substation
  - Distribution line replacement (thickening) in the distribution areas of the City Center and Ilala substations
  - Expansion of distribution network from the Jangwani Beach substation and reinforcement of distribution capacity
  - Sub-transmission lines from the Ilala substation to the new Mchafukoge substation, the new Mchikichini substation and the TOL substation
  - Distribution network development in the vicinity of the new Mchafukoge and Mchikichini substations
  - Distribution network development following construction of the Pugu substation
  - Sub-transmission lines and distribution network development from the Pugu substation to the new Kimanga and Kivule substations

4) Temeke Region

- Approximate cost: 33.03 million dollars
- Main purpose: Renewal of existing distribution facilities, expansion of new distribution networks
- Main contents:
  - Sub-transmission lines from the Kurasini substation to the Kimanga substation
  - Reinforcement of distribution network in the Kurasini ward
  - Distribution network development following construction of the Mtoni, Buza, Somangila (SE-DSM), N. Kigamboni, Kibada and Mianzini substations
  - Distribution line replacement (thickening) and distribution network development in the distribution area of the Mbagala substation
  - Distribution network development following construction of the Mbagala II, Kiburungwa, Charambe and Camazi substations

5) Coast Region

- Approximate cost: 23.24 million dollars
- Main purpose: Renewal of existing distribution facilities, expansion of new distribution networks
- Main contents:
  - ➢ Distribution line replacement (thickening) in the distribution area of the Chalize and Mlandizi substations
  - ➢ Sub-transmission lines from the Mlandizi substation to the new N. Tumbi substation
  - ➢ Distribution network development following construction of the Mkuranga substation
  - ➢ Maintenance of distribution network from the Zinga substation to the Zinga ward

(3) Implementation planned by 2026-2030

1) Kinondoni North Region

- Approximate cost: 9.12 million dollars
- Main purpose: Expansion of new distribution networks, specifically in existing un-electrified areas
- Main contents:
  - ➢ Maintenance of distribution network following construction of the Bunju（N-DSM）and Mbeweni substations
  - ➢ Maintenance of distribution network following construction of the Kunduchi substation
  - ➢ Strengthening of distribution network in the distribution areas of the N. Mbezi, Jangwani Beach, Kawe, Goba substations
  - ➢ Strengthening of distribution network in the distribution areas of the Makumbusho, Kijitonyama, Drive Inn, N. Msasani substations
  - ➢ Sub-transmission lines from the Drive Inn substation to the Hananasifu substation
  - ➢ Maintenance of distribution network following construction of the Hananasifu substation

2) Kinondoni South Region

- Approximate cost: 3.03 million dollars
- Main purpose: Expansion of new distribution networks, specifically in existing un-electrified areas
- Main contents:
  - ➢ Sub-transmission lines from the Makongo substation to the Ubungo substation

- Sub-transmission lines from the New City Center substation to the Sokoine substation
- Sub-transmission lines from the Ilala substation to the N. Kariakoo substation
- Reinforcement of distribution network in the distribution areas of the Makongo, Mabibo, Luguruni, N. Mburahati and N. Magomeni substations

3) Ilala Region

- Approximate cost: 10.21 million dollars
- Main purpose: Expansion of new distribution networks, specifically in existing un-electrified areas
- Main contents:
  - Sub-transmission lines from the New City Center substation to the Sokoine and Mchafukoge substations
  - Reinforcement of distribution network in the distribution areas of the City Center, Muhimbili and Sokoine substations
  - Distribution network development following construction of the N. Kariakoo and N. Ilala substations
  - Reinforcement of distribution network in the distribution areas of the Mchafukoge and Mchikichini substations
  - Reinforcement of distribution network in the distribution areas of the FZ I, FZ II, FZ III, Pugu and Kimanga substations
  - Distribution network development following construction of the new Ukonga substation

4) Temeke Region

- Approximate cost: 5.83 million dollars
- Main purpose: Expansion of new distribution networks, specifically in existing un-electrified areas
- Main contents:
  - Reinforcement of distribution network in the distribution areas of the Kurasini, Buza, Somangila, N. Kigamboni, Mbagala, Mbagala II, Charambe and Mianzi substations

5) Coast Region

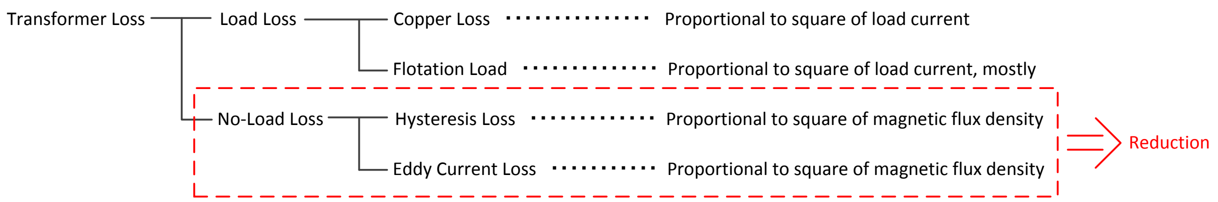
- Approximate cost: 25.54 million dollars
- Main purpose: Expansion of new distribution networks, specifically in existing un-electrified areas
- Main contents:
  - Reinforcement of distribution network in the distribution areas of the Chalize, Mlandizi, N. Tumbi and Mkuranga substations

- Switching from existing facilities and distribution network development following construction of the Maneromango substation

8-4-2 Recommendation to adapt high efficiency transformers (Optional)

High efficiency amorphous transformers using amorphous metal for the iron core are globally acknowledged as having a high energy saving effect, and their use is currently growing more widespread. In March 2008, for example, they were recognized[1] as a CDM (Clean Development Mechanism) for transmission and distribution networks by the United Nations.
While the conventional silicon steel transformers owned and operated by TANESCO are the subjects of this project, a comparison of the energy saving effect and greenhouse gas reduction expected from the installation of amorphous transformers was carried out.

(1) Characteristics of amorphous transformers
Amorphous transformers are able to curb no-load loss, such as hysteresis loss and eddy current, by the use of an amorphous alloy with random atom arrangement structure in the iron core of the transformer. The transformer loss is shown in the below figure, but while the no-load loss is small and constant in comparison to the load loss proportional to the square of the load current, the average lifespan of an amorphous transformer is expected to be the same as that of conventional models at 25-30 years, and the effect of reducing no-load loss during the cumulative operation time of this lifespan is believed to be high.



Source: JICA Study Team

Figure 8-4.1 Transformer loss

In the early development of amorphous transformers, there were demerits such as heavier weight and higher noise levels compared to conventional transformers, but in recent years these issues are progressively improving as development progresses.

(2) Environmental effects
In Tanzania, the United Nations Framework Convention on Climate Change (UNFCCC) is ratified as climate change policy, and following the COP21 Paris agreement, Intended Nationally Determined Contributions (INDCs), the greenhouse gas reduction target of Tanzania, has been submitted to the UNFCCC Secretariat. The target is a reduction of 10-20% by 2030 compared with BAU (Business As Usual). "Promotion of efficient energy supply utilizing science and technology" is listed as one of five reduction commitments for the energy sector, and the introduction of high efficiency transformers is considered to be an effective option.

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[1] UNFCCC（United Nations Framework Convention on Climate Change）AM0067: Methodology for installation of energy efficient transformers in a power distribution grid

The table below shows the amount of greenhouse gas reduction estimated in the master plan, in case an amorphous transformer is used as the distribution transformer.

Table 8-4.1 CO_2 reduction amount (estimated value)

Rating	Operation hour	No-Load loss			Annual loss reduction	Accumulated CO2 loss reduction																
		RGO	AMDT	差																		
k VA	H	W	W	W	kWh	ton/年	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
100	8760	145	75	70	613	0.360	-	42.1	42.1	42.1	42.1	42.1	315.3	315.3	315.3	315.3	315.3	476.6	476.6	476.6	476.6	476.6
200	8760	300	110	190	1,664	0.977	-	324.4	324.4	324.4	324.4	324.4	2,107.4	2,107.4	2,107.4	2,107.4	2,107.4	3,055.1	3,055.1	3,055.1	3,055.1	3,055.1
315	8760	505	200	305	2,672	1.568	-	285.4	285.4	285.4	285.4	285.4	782.6	782.6	782.6	782.6	782.6	2,617.6	2,617.6	2,617.6	2,617.6	2,617.6
500	8760	725	220	505	4,424	2.597	-	262.3	262.3	262.3	262.3	262.3	1,295.8	1,295.8	1,295.8	1,295.8	1,295.8	1,825.5	1,825.5	1,825.5	1,825.5	1,825.5
						Total	-	**914.2**	**914.2**	**914.2**	**914.2**	**914.2**	**4,501.1**	**4,501.1**	**4,501.1**	**4,501.1**	**4,501.1**	**8,927.9**	**8,927.9**	**8,927.9**	**8,927.9**	**8,927.9**

Note: RGO: Regular Grain Oriented
AMDT: Amorphous Metal core Distribution Transformer
Condition: Operation hour: 365days x 24hrs = 8,760hrs
No-Load loss is referred to IEC EN50464-1
No-Load loss for 200kVA is deemed as 250kVA, 315kVA is deemed as 300kVA respectively
CO2 emission factor is :
0.000587 (t-CO2/kWh)

Number of Amorphous transformer to be installed																
k VA	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
100	117	-	-	-	-	759	-	-	-	-	448	-	-	-	-	-
200	332	-	-	-	-	1,825	-	-	-	-	970	-	-	-	-	-
315	182	-	-	-	-	987	-	-	-	-	500	-	-	-	-	-
500	101	-	-	-	-	398	-	-	-	-	204	-	-	-	-	-
Total	732	-	-	-	-	3,969	-	-	-	-	2,122	-	-	-	-	-

Source: JICA Study Team

(3) Effects on cost

Amorphous transformers have a slightly higher initial investment cost than conventional silicon steel transformers (about 1.2 times higher), but because of their energy saving effect, it is possible to recover the higher expense in a few years, enabling for quick recovery of the investment and making the effect of installation high.

Following tables (Table 8-4.2 and Table 8-4.3) show number of transformers to be installed every 5 year, comparison of invest cost between amorphous and silicon transformers and precondition to calculate ecomonic effect such as electricity tariff, financial interest and exchange rate.

Table 8-4.2 Number of transformers and comparison of invest cost between amorphous and silicon transformers

Transformer (k VA)	Assumed quantity		
	2020	2025	2030
100	117	759	448
200	332	1,825	970
315	182	987	500
500	101	398	204
Total	732	3,969	2,122
Cost Difference (Thousand Yen)	108,422	566,986	299,110
Cost Difference (Thousand US$)	968,053	5,062,377	2,670,627

Source: JICA Study Team

Note: Price different of transformers are just an example by study team and different from manufacturers.

Table 8-4.3 Precondition for calculation

Electricity tariff (US$, kWh)	0.136
Financial interest (US%,%)	7%
Exchange rate (Yen/US dollar)	112

Source: JICA Study Team

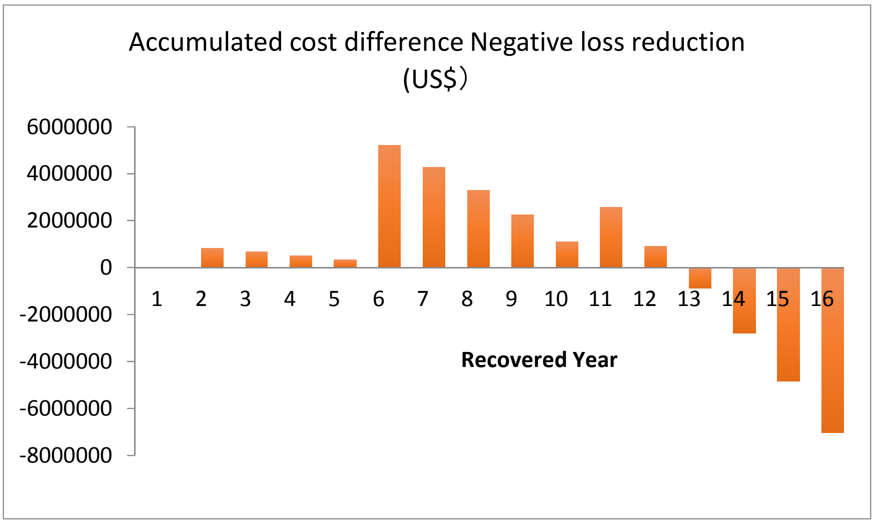
Table 8-4.4 shows price increase by investment of amorphous transformer and annual loss reduction by energy conservation from 2020 to 2035. Because of loss reduction of energy, the capital investment cost could be recovered by 2032 (in 12 years).

Expected lifetime of amorphous transformer is approximately 25 to 30 years and benefit by energy loss reduction will become more than accumulated total cost of transformers. Thus economic effects to adapt amorphous transformers would be high.

Table 8-4.4 Price increase by investment of amorphous transformer and annual loss reduction by energy conservation (2020 – 2035)

Year	Price difference (thousand yen)	Price difference (US dollar)	Annual loss reduction of energy (kWh)	Annual loss reduction of cost (US$)	Interest cost (US$)	Accumulated cost difference Negative loss reduction(US$)
2020	108,422	968,053				
2021			1,557,397	211,806	67,764	824,011
2022			1,557,397	211,806	57,681	669,886
2023			1,557,397	211,806	46,892	504,972
2024			1,557,397	211,806	35,348	328,514
2025	566,986	5,062,377	1,557,397	211,806	22,996	5,202,081
2026			9,458,084	1,286,299	364,146	4,279,927
2027			9,458,084	1,286,299	299,595	3,293,223
2028			9,458,084	1,286,299	230,526	2,237,449
2029			9,458,084	1,286,299	156,621	1,107,771
2030	299,110	2,670,627	9,458,084	1,286,299	77,544	2,569,643
2031			13,585,621	1,847,644	179,875	901,873
2032			13,585,621	1,847,644	63,131	-882,640
2033			13,585,621	1,847,644	-61,785	-2,792,069
2034			13,585,621	1,847,644	-195,445	-4,835,159
2035			13,585,621	1,847,644	-338,461	-7,021,264

Source: JICA Study Team



Source: JICA Study Team

Figure 8-4.2 Recovery of price increase by investment of amorphous transformer and annual loss reduction by energy conservation

8-5 Implementation Plan in Urgency for Transmission Lines, Substations and Distribution Lines

In order to effectively implement the renewal, reinforcement and new construction plans considered to be urgent out of the implementation plans detailed in paragraph 8-2 “Implementation plan for transmission facilities” and in paragraph 8-4 “Implementation plan for distribution facilities”, the following project packages were formulated.

Table 8-5.1 Implementation plan in urgency

Cost Unit: Million USD

No.	Project Package	Major Component	Target Year	Cost (Approx.)
1	Reinforcement of power supply from Kinyerezi power station to Ubungo substation	**Ubungo Substation** ・ 2 x 300MVA, 220/132kV transformers ・ 220kV switchgear expansion (GIS) ・ 132kV switchgear expansion (GIS) **Kinyerezi Power Station** ・ 220kV Switchyard expansion **Transmission Line** ・ Double circuits 220kV transmission line between Kinyerezi and Ubungo	2020	24.0
2	Reinforcement of power supply from Kinyerezi power station to FZ II substation	**Kinyerezi power station** ・ 2 x 200MVA, 132/33kV transformers ・ 220kV switchgear expansion ・ 132kV switchgear expansion **FZ-II substation** ・ 132kV switchgear expansion **Transmission Line** ・ Double circuits of 132kV transmission line between Kinyerezi and FZ-II	2020	18.0
3	Reinforcement of existing power supply facilities in Dar es Salaam (Temeke Region) (*incorporate with emergency components)	**Emergency Replacement and Renewal** ・ Kigamboni substation **Kurasini Substation** ・ 1 x 65 MVA, 132/33kV transformer ・ Upgrade of 1 x 50MVA 132/33kV existing transformer 65MVA ・ 30MVar 33kV Capacitor banks **Mbagala Substation** ・ 1 x 65 MVA, 132/33kV transformer ・ Upgrade of 1 x 50MVA 132/33kV existing transformer to 65MVA ・ 45MVar 33kV Capacitor banks **Distribution Line** ・ Single circuit 33kV line between FZ III substation and Tandika substation ・ Distribution feeders	2020	16.5
4	Reinforcement of existing power supply facilities in Dar es Salaam (Kinondoni North and South Regions)	**Makumbusho Substation** ・ Upgrade of 2 x 45MVA 132/33kV existing transformer to 55MVA ・ 35MVar 33kV Capacitor banks **Tegeta Substation** ・ Upgrade of 1 x 50MVA 132/33kV existing transformer to 65MVA ・ 40MVar 132kV Capacitor banks ・ 20MVar 33kV Capacitor banks **Distribution Line** ・ Single circuit 33kV line between Tegeta substation and Bahari Beach substation ・ Single circuit 33kV line between Tegeta substation and Jangwani Beach substation ・ Single circuit 33kV line between Ubungo substation and Tandale substation ・ Double circuits 33kV line between Ubungo substation and Mbezi substation **Distribution Line**	2020	18.5

No.	Project Package	Major Component	Target Year	Cost (Approx.)
		・ Distribution feeders		
5	Reinforcement of existing power supply facilities in Dar es Salaam (Ilala Region)	**FZ II Substation** ・ 1 x 50 MVA, 132/33kV transformer ・ 15MVar 33kV Capacitor banks **Distribution Line** ・ Single circuit 33kV line between New City Center substation and Muhimbili substation ・ Distribution feeders	2020	9.3
6	Reinforcement of existing power supply facilities in Dar es Salaam (Coast Region) (*incorporate with emergency component)	**Emergency Replacement and Renewal** ・ Tumbi substation **Distribution Line** ・ Single circuit 33kV line between Mlandizi substation and N. Tumbi substation ・ Distribution feeders	2020	9.0
7	Reinforcement of existing 33/11kV substations	**Extension** ・ Jangwani Beach ・ Muhimbili ・ Ilala **Extension and Rehabilitation** ・ Bahari Beach ・ Tandale ・ FZ II ・ Tandika	2020	11.0

Source: JICA Study Team
*Note: Listed in random order

S-1. Power demand forecast

Total Power Demand Forecast without Additional Demand (Ward Base)

			Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Dar es Salaam + Coast + Zanzibar			MW	541.0	618.7	707.9	810.4	928.3	1,064.1	1,174.7	1,297.2	1,433.0	1,583.4	1,750.4	1,911.2	2,086.9	2,279.1	2,489.1	2,718.7
Dar es Salaam		Dar es Salaam Region	MW	458.6	521.6	593.4	674.9	767.7	873.3	960.6	1,056.8	1,162.5	1,278.8	1,406.8	1,540.6	1,687.2	1,847.6	2,023.4	2,215.9
1		Kinondoni Municipal Council	MW	177.8	201.2	227.6	257.6	291.6	329.9	363.2	399.7	440.0	484.3	533.0	586.0	644.2	708.2	778.6	856.0
	(1)	Magomeni	MW	1.6	1.8	2.0	2.3	2.6	2.8	3.1	3.5	3.8	4.2	4.6	5.1	5.6	6.2	6.8	7.6
	(2)	Makurumla	MW	4.3	4.8	5.4	6.0	6.8	7.6	8.3	9.1	10.0	10.9	12.0	13.2	14.6	16.1	17.8	19.6
	(3)	Ndugumbi	MW	2.5	2.8	3.1	3.5	3.9	4.4	4.8	5.3	5.8	6.3	7.0	7.7	8.5	9.4	10.3	11.4
	(4)	Tandale	MW	3.7	4.1	4.6	5.2	5.8	6.6	7.2	7.9	8.6	9.4	10.3	11.4	12.6	13.9	15.4	17.0
	(5)	Mwananyamala	MW	7.2	7.9	8.6	9.4	10.3	11.2	12.3	13.5	14.8	16.3	17.8	19.7	21.9	24.2	26.8	29.7
	(6)	Msasani	MW	7.0	7.6	8.3	9.1	9.9	10.9	11.9	13.1	14.3	15.7	17.3	19.5	22.1	25.0	28.2	31.9
	(7)	Kinondoni	MW	3.0	3.3	3.6	3.9	4.3	4.7	5.2	5.7	6.2	6.8	7.5	8.3	9.2	10.2	11.3	12.5
	(8)	Mzimuni	MW	1.4	1.6	1.8	2.0	2.3	2.6	2.8	3.1	3.4	3.7	4.1	4.5	4.9	5.5	6.0	6.7
	(9)	Kigogo	MW	3.9	4.4	4.9	5.5	6.1	6.9	7.6	8.3	9.1	9.9	10.9	12.0	13.3	14.6	16.2	17.9
	(10)	Mabibo	MW	5.8	6.5	7.3	8.2	9.1	10.3	11.2	12.3	13.5	14.8	16.2	17.9	19.7	21.8	24.1	26.6
	(11)	Manzese	MW	4.8	5.3	6.0	6.7	7.5	8.4	9.2	10.1	11.1	12.1	13.3	14.7	16.2	17.9	19.8	21.9
	(12)	Ubungo	MW	3.8	4.2	4.8	5.3	6.0	6.7	7.3	8.0	8.8	9.6	10.6	11.7	12.9	14.2	15.7	17.4
	(13)	Kibamba	MW	1.9	2.2	2.5	2.7	3.1	3.5	3.8	4.1	4.5	5.0	5.4	6.0	6.6	7.3	8.1	9.0
	(14)	Goba	MW	6.1	6.9	7.9	9.1	10.4	11.8	13.0	14.2	15.6	17.1	18.8	20.3	22.0	23.8	25.7	27.8
	(15)	Kawe	MW	9.5	10.4	11.4	12.5	13.6	14.9	16.3	17.9	19.7	21.6	23.7	26.8	30.3	34.2	38.7	43.8
	(16)	Kunduchi	MW	10.7	12.2	13.9	15.9	18.2	20.8	22.8	25.0	27.5	30.1	33.1	35.8	38.7	41.8	45.3	49.0
	(17)	Mbweni	MW	2.0	2.1	2.3	2.6	2.8	3.1	3.4	3.7	4.0	4.4	4.9	5.5	6.2	7.0	7.9	9.0
	(18)	Bunju	MW	8.6	10.3	12.4	15.0	18.0	21.7	24.2	26.9	30.0	33.4	37.2	40.2	43.5	47.0	50.9	55.0
	(19)	Makuburi	MW	3.9	4.3	4.9	5.5	6.1	6.9	7.5	8.2	9.0	9.9	10.8	12.0	13.2	14.6	16.1	17.8
	(20)	Mburahati	MW	2.3	2.6	2.9	3.2	3.6	4.1	4.5	4.9	5.4	5.9	6.4	7.1	7.9	8.7	9.6	10.6
	(21)	Makumbusho	MW	9.7	10.6	11.6	12.6	13.8	15.1	16.6	18.2	20.0	21.9	24.0	26.3	28.8	31.5	34.5	37.8
	(22)	Sinza	MW	2.7	3.1	3.4	3.9	4.3	4.9	5.3	5.8	6.4	7.0	7.7	8.4	9.3	10.3	11.4	12.6
	(23)	Kijitonyama	MW	8.3	9.0	9.9	10.8	11.8	12.9	14.2	15.5	17.0	18.7	20.5	22.7	25.1	27.8	30.8	34.1
	(24)	kimara	MW	5.2	6.1	7.1	8.3	9.8	11.5	12.7	14.1	15.6	17.4	19.3	21.2	23.4	25.7	28.4	31.2
	(25)	Mikocheni	MW	4.7	5.1	5.6	6.1	6.7	7.3	8.0	8.8	9.7	10.6	11.6	12.9	14.3	15.8	17.5	19.4
	(26)	Mbezi	MW	5.0	5.8	6.8	8.0	9.4	11.0	12.2	13.5	15.0	16.6	18.5	20.3	22.4	24.7	27.2	29.9
	(27)	Hananasif	MW	5.3	5.8	6.3	6.9	7.5	8.2	9.0	9.9	10.9	11.9	13.1	14.5	16.1	17.8	19.7	21.8
	(28)	Saranga	MW	7.0	8.2	9.7	11.3	13.3	15.6	17.3	19.2	21.3	23.6	26.2	28.9	31.8	35.0	38.6	42.5
	(29)	Kwembe	MW	3.8	4.7	5.9	7.2	9.0	11.1	12.5	14.0	15.8	17.8	20.0	22.1	24.3	26.8	29.5	32.5
	(30)	Msigani	MW	3.7	4.4	5.1	6.0	7.0	8.2	9.1	10.2	11.3	12.5	13.9	15.3	16.8	18.5	20.4	22.5
	(31)	Mbezi juu	MW	5.9	6.7	7.7	8.8	10.0	11.5	12.6	13.8	15.1	16.6	18.2	19.7	21.3	23.1	24.9	27.0
	(32)	Makongo	MW	6.2	7.1	8.1	9.3	10.6	12.1	13.3	14.6	16.0	17.6	19.3	20.9	22.6	24.4	26.4	28.6
	(33)	Mabwepande	MW	3.6	4.0	4.3	4.7	5.2	5.6	6.2	6.8	7.5	8.2	9.0	9.9	11.0	12.2	13.5	15.0
	(34)	Wazo	MW	12.9	14.8	16.9	19.3	22.0	25.2	27.6	30.3	33.3	36.5	40.0	43.3	46.8	50.7	54.8	59.3
2		Ilala Municipal Council	MW	167.4	188.0	211.2	237.2	266.5	299.3	327.8	358.9	393.0	430.3	471.2	512.9	558.2	607.5	661.2	719.7
	(1)	Ukonga	MW	3.6	4.1	4.6	5.1	5.8	6.5	7.2	8.1	9.0	10.0	11.2	12.5	14.0	15.6	17.5	19.5
	(2)	Pugu	MW	2.4	3.0	3.7	4.7	5.8	7.2	7.9	8.8	9.7	10.7	11.8	12.9	14.0	15.2	16.5	18.0
	(3)	Msongola	MW	1.2	1.4	1.5	1.7	1.9	2.2	2.4	2.6	2.9	3.2	3.5	3.9	4.4	4.9	5.5	6.2
	(4)	Tabata	MW	3.4	3.8	4.4	5.0	5.7	6.5	7.1	7.8	8.6	9.5	10.4	11.7	13.0	14.6	16.3	18.2
	(5)	Kinyerezi	MW	1.7	2.0	2.2	2.6	2.9	3.3	3.6	4.0	4.4	4.9	5.4	6.0	6.7	7.5	8.4	9.4
	(6)	Ilala	MW	19.0	20.9	23.1	25.5	28.2	31.1	33.7	36.6	39.7	43.1	46.8	51.0	55.7	60.8	66.3	72.4
	(7)	Mchikichini	MW	15.6	17.2	19.0	20.9	23.1	25.5	27.7	30.0	32.6	35.4	38.4	41.9	45.7	49.9	54.4	59.4
	(8)	Vingunguti	MW	11.5	12.7	14.0	15.4	17.0	18.8	20.6	22.6	24.8	27.3	29.9	33.2	36.9	41.0	45.5	50.5
	(9)	Kipawa	MW	8.0	8.8	9.7	10.7	11.8	13.0	14.3	15.7	17.2	18.9	20.7	23.0	25.6	28.4	31.6	35.1
	(10)	Buguruni	MW	7.6	8.4	9.2	10.2	11.2	12.4	13.6	14.9	16.4	18.0	19.7	21.9	24.3	27.0	30.0	33.4
	(11)	Kariakoo	MW	8.4	9.2	10.0	10.9	11.9	13.0	14.6	16.4	18.4	20.7	23.2	26.9	31.1	36.0	41.6	48.1
	(12)	Jangwani	MW	10.8	11.9	13.1	14.5	16.0	17.7	19.2	20.8	22.6	24.5	26.5	27.9	29.4	30.9	32.6	34.3
	(13)	Gerezani	MW	4.4	4.9	5.4	6.0	6.6	7.3	7.9	8.6	9.3	10.1	10.9	11.5	12.1	12.8	13.4	14.1
	(14)	Kisutu	MW	5.1	5.6	6.2	6.8	7.5	8.3	9.0	9.8	10.6	11.5	12.5	13.2	13.8	14.6	15.3	16.1
	(15)	Mchafukoge	MW	6.5	7.2	7.9	8.8	9.7	10.7	11.6	12.6	13.7	14.8	16.1	16.9	17.8	18.7	19.7	20.7
	(16)	Upanga Mashariki	MW	6.8	7.5	8.3	9.2	10.1	11.2	12.1	13.2	14.3	15.5	16.8	17.7	18.6	19.6	20.6	21.7
	(17)	Upanga Magharibi	MW	8.2	9.1	10.0	11.1	12.2	13.5	14.6	15.9	17.2	18.7	20.3	21.3	22.4	23.6	24.9	26.2
	(18)	Kivukoni	MW	4.1	4.5	5.0	5.5	6.1	6.7	7.3	7.9	8.6	9.3	10.1	10.7	11.2	11.8	12.4	13.1
	(19)	Kiwalani	MW	8.9	10.3	11.9	13.9	16.1	18.7	20.6	22.6	24.9	27.4	30.1	32.4	34.8	37.4	40.2	43.2
	(20)	Segerea	MW	3.8	4.5	5.4	6.5	7.8	9.3	10.3	11.3	12.5	13.8	15.2	16.5	17.8	19.3	20.9	22.6
	(21)	Kitunda	MW	6.1	7.1	8.3	9.6	11.2	13.0	14.3	15.7	17.3	19.0	20.9	22.5	24.2	26.0	27.9	30.0
	(22)	Chanika	MW	2.2	2.4	2.7	3.1	3.5	3.9	4.3	4.7	5.2	5.7	6.3	7.1	7.9	8.8	9.9	11.1
	(23)	Kivule	MW	7.7	9.0	10.5	12.1	14.1	16.4	18.0	19.8	21.8	24.0	26.4	28.3	30.5	32.7	35.2	37.8
	(24)	Gongo la Mboto	MW	2.8	3.2	3.6	4.0	4.5	5.1	5.6	6.2	6.8	7.5	8.2	9.2	10.3	11.5	12.9	14.4
	(25)	Majohe	MW	4.0	4.7	5.6	6.7	7.9	9.3	10.3	11.4	12.6	13.9	15.3	16.6	18.0	19.5	21.1	22.9
	(26)	Kimanga	MW	3.6	4.3	5.1	6.1	7.3	8.8	9.7	10.7	11.8	13.0	14.4	15.5	16.8	18.2	19.7	21.3
3		Temeke Municipal Council	MW	113.5	132.2	154.1	179.6	209.3	244.0	269.7	298.1	329.5	364.2	402.6	441.7	484.7	531.8	583.5	640.2
	(1)	Kigamboni	MW	2.5	3.9	6.2	9.6	15.0	23.4	25.8	28.3	31.2	34.3	37.8	41.5	45.6	50.2	55.2	60.7
	(2)	Vijibweni	MW	2.4	2.8	3.2	3.7	4.2	4.9	5.4	5.9	6.5	7.2	7.9	8.5	9.2	9.9	10.7	11.5
	(3)	Kibada	MW	0.7	0.9	1.1	1.3	1.6	2.0	2.2	2.4	2.6	2.9	3.2	3.5	3.9	4.2	4.7	5.1
	(4)	Kisarawe II	MW	0.7	0.8	0.8	0.9	1.0	1.1	1.3	1.4	1.6	1.8	2.1	2.3	2.5	2.7	3.0	3.3
	(5)	Somangila	MW	1.6	1.9	2.2	2.6	3.0	3.6	3.8	4.0	4.2	4.5	4.8	5.2	5.8	6.3	7.0	7.7
	(6)	Kimbiji	MW	0.5	0.6	0.7	0.7	0.8	0.9	1.0	1.1	1.3	1.4	1.6	1.7	1.9	2.1	2.3	2.6
	(7)	Mbagala	MW	4.4	4.8	5.3	5.9	6.6	7.3	8.2	9.2	10.3	11.6	13.0	14.3	15.7	17.3	19.0	20.9
	(8)	Chamazi	MW	5.3	6.1	7.0	8.1	9.3	10.7	11.8	13.0	14.3	15.8	17.3	18.7	20.2	21.8	23.5	25.3
	(9)	Yombo Vituka	MW	6.4	7.4	8.5	9.8	11.3	13.0	14.3	15.7	17.3	19.1	21.0	22.6	24.4	26.3	28.4	30.6
	(10)	Charambe	MW	8.4	9.4	10.4	11.5	12.7	14.1	15.8	17.8	20.0	22.5	25.2	27.8	30.5	33.5	36.9	40.6
	(11)	Toangoma	MW	3.7	4.3	4.9	5.7	6.5	7.5	8.3	9.1	10.0	11.0	12.1	13.3	14.7	16.1	17.7	19.5
	(12)	Miburani	MW	3.7	4.1	4.5	5.0	5.5	6.1	6.9	7.7	8.7	9.8	11.0	12.1	13.3	14.6	16.0	17.6
	(13)	Temeke	MW	2.2	2.4	2.6	2.9	3.2	3.6	4.0	4.5	5.1	5.7	6.4	7.1	7.8	8.6	9.4	10.4
	(14)	Mtoni	MW	4.9	5.7	6.5	7.5	8.7	10.0	11.0	12.1	13.4	14.7	16.2	17.8	19.6	21.5	23.6	26.0
	(15)	Keko	MW	2.9	3.2	3.6	4.0	4.4	4.9	5.5	6.1	6.9	7.7	8.7	9.6	10.5	11.6	12.7	14.0
	(16)	Kurasini	MW	2.2	2.5	2.9	3.3	3.8	4.4	4.9	5.4	5.9	6.5	7.1	7.8	8.6	9.5	10.4	11.5
	(17)	Azimio	MW	6.4	7.3	8.5	9.8	11.3	13.0	14.3	15.7	17.3	19.0	20.9	23.0	25.3	27.8	30.6	33.6
	(18)	Tandika	MW	4.1	4.5	5.0	5.6	6.2	6.8	7.7	8.6	9.7	10.9	12.3	13.5	14.8	16.3	17.9	19.7
	(19)	Sadali	MW	4.4	4.8	5.4	5.9	6.6	7.3	8.2	9.2	10.3	11.6	13.0	14.3	15.8	17.3	19.1	21.0
	(20)	Chang'ombe	MW	1.6	1.8	2.0	2.2	2.4	2.7	3.0	3.4	3.8	4.3	4.8	5.3	5.8	6.4	7.0	7.7
	(21)	Mbagala Kuu	MW	6.2	7.1	8.2	9.5	11.0	12.6	13.9	15.3	16.8	18.5	20.4	22.4	24.6	27.1	29.8	32.7
	(22)	Makangarawe	MW	4.4	5.1	5.9	6.8	7.8	9.0	9.9	10.9	12.0	13.2	14.5	16.0	17.5	19.3	21.2	23.3
	(23)	Pembamnazi	MW	0.8	0.9	1.0	1.1	1.2	1.3	1.5	1.7	1.9	2.1	2.4	2.6	2.9	3.2	3.5	3.8
	(24)	Mjimwema	MW	2.3	2.7	3.1	3.5	4.1	4.7	5.2	5.7	6.3	6.9	7.6	8.3	9.2	10.1	11.1	12.2
	(25)	Tungi	MW	1.9	2.2	2.6	3.0	3.4	3.9	4.3	4.8	5.3	5.8	6.4	7.0	7.7	8.5	9.3	10.2
	(26)	Kijichi	MW	5.7	6.6	7.6	8.8	10.1	11.7	12.9	14.1	15.6	17.1	18.8	20.7	22.8	25.1	27.5	30.3
	(27)	Mianzini	MW	8.3	10.2	12.6	15.4	18.9	23.2	25.5	28.1	30.9	34.0	37.4	41.1	45.2	49.7	54.6	60.1
	(28)	Kiburugwa	MW	6.5	7.5	8.7	10.0	11.6	13.3	14.7	16.1	17.8	19.5	21.5	23.6	26.0	28.6	31.4	34.5
	(29)	Buza	MW	4.6	5.3	6.1	7.0	8.1	9.3	10.2	11.3	12.4	13.6	15.0	16.5	18.1	19.9	21.9	24.1
	(30)	Kilakala	MW	3.7	4.3	5.0	5.7	6.6	7.6	8.4	9.2	10.1	11.1	12.2	13.5	14.8	16.3	17.9	19.7
Pwani		Pwani Region	MW	24.5	30.9	39.0	49.3	62.2	78.6	92.0	107.8	126.3	147.9	173.2	189.9	208.3	228.5	250.6	274.8
1		Bagamoyo District Council	MW	5.7	7.0	8.5	10.4	12.7	15.5	17.6	20.1	22.9	26.1	29.8	32.0	34.3	36.8	39.4	42.3
	(1)	Kiwangwa	MW	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.3	1.3	1.4	1.4	1.5	1.6
	(2)	Msata	MW	0.3	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.8	0.9	1.1	1.1	1.1	1.1	1.1	1.1
	(3)	Miono	MW	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.1	1.2	1.3	1.5	1.5	1.6	1.7	1.8	1.9
	(4)	Mkange	MW	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.8	0.9	0.9	0.9	1.0	1.0	1.0
	(5)	Magomeni	MW	0.5	0.7	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.3	2.5	2.6	2.8	2.9	3.0	3.2
	(6)	Dunda	MW	0.3	0.3	0.4	0.5	0.6	0.8	0.9	1.1	1.2	1.4	1.7	1.9	2.1	2.4	2.7	3.0
	(7)	Kiromo	MW	0.1	0.2	0.2	0.3	0.3	0.4	0.5	0.7	0.9	1.1	1.4	1.6	1.9	2.2	2.6	3.0
	(8)	Zinga	MW	0.2	0.3	0.3	0.4	0.5	0.7	0.8	1.1	1.3	1.7	2.1	2.5	2.9	3.4	3.9	4.6
	(9)	Yombo	MW	0.2	0.2	0.2	0.3	0.4	0.5	0.5	0.6	0.7	0.8	0.9	0.9	1.0	1.1	1.2	1.2
	(10)	Vigwaza	MW	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.3	1.4	1.5	1.6	1.7	1.7	1.8
	(11)	Talawanda	MW	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.8
	(12)	Bwilingu	MW	0.7	0.8	1.0	1.2	1.4	1.7	1.9	2.2	2.4	2.7	3.0	3.2	3.3	3.5	3.7	3.8
	(13)	Lugoba	MW	0.2	0.3	0.3	0.4	0.5	0.6	0.6	0.7	0.8	0.9	1.0	1.0	1.1	1.1	1.2	1.3
	(14)	Ubenazomozi	MW	0.3	0.3	0.4	0.5	0.6	0.8	0.8	0.9	1.1	1.2	1.3	1.4	1.5	1.5	1.6	1.7
	(15)	Mbwewe	MW	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.4	1.5	1.6
	(16)	kibindu	MW	0.3	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.8	0.9	1.0	1.1	1.1	1.1	1.1	1.1
	(17)	Fukayosi	MW	0.2	0.2	0.3	0.3	0.4	0.5	0.5	0.6	0.6	0.7	0.8	0.8	0.9	0.9	1.0	1.0
	(18)	Kerege	MW	0.3	0.4	0.5	0.6	0.8	1.0	1.2	1.4	1.8	2.1	2.6	2.8	3.1	3.5	3.8	4.2
	(19)	Pera	MW	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.1	1.2	1.3	1.3	1.4
	(20)	Msoga	MW	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.6	0.7	0.8	0.9	0.9	1.0	1.0	1.1	1.1
	(21)	Kimange	MW	0.1	0.2	0.2	0.3	0.3	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.8	0.8	0.9	0.9
	(22)	Mandera	MW	0.2	0.2	0.3	0.3	0.4	0.5	0.5	0.6	0.6	0.7	0.8	0.8	0.9	0.9	1.0	1.0

			Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
2		Kibaha District Council	MW	2.6	3.1	3.8	4.7	5.7	7.0	8.0	9.2	10.6	12.2	14.0	15.0	16.0	17.1	18.3	19.6
	(1)	Gwata	MW	0.2	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.9	1.1	1.1	1.2	1.3	1.4	1.5
	(2)	Dutumi	MW	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.5
	(3)	Magindu	MW	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.1	1.2	1.3	1.4
	(4)	Soga	MW	0.2	0.2	0.3	0.3	0.4	0.5	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.2	1.3
	(5)	Kikongo	MW	0.2	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.6	0.7	0.8	0.9	1.0	1.0	1.1	1.2
	(6)	Ruvu	MW	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.8	0.9	1.0
	(7)	Mlandizi	MW	0.6	0.8	0.9	1.2	1.4	1.7	2.0	2.3	2.6	3.0	3.5	3.7	4.0	4.2	4.5	4.8
	(8)	Kwala	MW	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.8	0.9	1.0
	(9)	Kilangalanga	MW	0.4	0.5	0.6	0.7	0.9	1.0	1.2	1.4	1.6	1.8	2.1	2.3	2.4	2.6	2.8	3.0
	(10)	Janga	MW	0.4	0.5	0.6	0.7	0.9	1.1	1.2	1.4	1.6	1.9	2.2	2.3	2.5	2.7	2.9	3.0
	(11)	Bokomnemela	MW	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.6	0.7	0.7	0.8	0.8	0.9	0.9
3		Kisarawe District Council	MW	2.7	3.4	4.2	5.2	6.4	8.0	9.3	11.0	12.9	15.1	17.7	19.3	21.1	23.1	25.3	27.6
	(1)	Kisarawe	MW	0.3	0.4	0.5	0.6	0.8	0.9	1.1	1.3	1.5	1.8	2.1	2.3	2.5	2.7	2.9	3.2
	(2)	Msimbu	MW	0.3	0.4	0.5	0.6	0.7	0.9	1.0	1.2	1.4	1.7	1.9	2.1	2.3	2.5	2.8	3.0
	(3)	Masaki	MW	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.1	1.3	1.4	1.5	1.6	1.8	2.0
	(4)	Kibuta	MW	0.3	0.3	0.4	0.5	0.6	0.8	0.9	1.1	1.3	1.5	1.8	1.9	2.1	2.3	2.5	2.8
	(5)	Marumbo	MW	0.2	0.2	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.8	1.0	1.1	1.2	1.3	1.4	1.5
	(6)	Maneromango	MW	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.9	1.0	1.2	1.4	1.5	1.6	1.8	2.0	2.1
	(7)	Msanga	MW	0.1	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.5
	(8)	Marui	MW	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.7	0.8	0.9	0.9	1.0
	(9)	Cholesamvula	MW	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.1	1.2	1.3	1.4	1.5	1.6
	(10)	Vikumbulu	MW	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.7	0.8	0.9
	(11)	Mafizi	MW	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.8	1.0	1.1	1.2	1.4	1.5	1.6	1.8
	(12)	Kurui	MW	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.7	0.8
	(13)	Mzenga	MW	0.1	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.8	1.0	1.0	1.1	1.2	1.4	1.5
	(14)	Vihingo	MW	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.8	0.8	0.9
	(15)	kiluvya	MW	0.3	0.4	0.4	0.6	0.7	0.9	1.0	1.2	1.4	1.6	1.9	2.1	2.3	2.5	2.7	3.0
4		Mkuranga District Council	MW	5.1	6.9	9.4	12.6	17.0	23.0	27.6	33.0	39.6	47.5	56.9	63.3	70.5	78.5	87.4	97.2
	(1)	Mkuranga	MW	0.6	0.8	1.1	1.5	2.0	2.7	3.2	3.8	4.6	5.5	6.6	7.3	8.2	9.1	10.1	11.3
	(2)	Tambani	MW	0.5	0.6	0.8	1.1	1.5	2.1	2.5	3.0	3.6	4.3	5.2	5.7	6.4	7.1	7.9	8.8
	(3)	Vikindu	MW	0.8	1.1	1.5	2.0	2.7	3.6	4.3	5.2	6.2	7.4	8.9	9.9	11.0	12.2	13.6	15.2
	(4)	Mbezi	MW	0.2	0.2	0.3	0.4	0.6	0.8	1.0	1.2	1.4	1.7	2.0	2.2	2.5	2.7	3.0	3.4
	(5)	Shungubweni	MW	0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.5	0.6	0.8	0.8	0.9	1.1	1.2	1.3
	(6)	Kisiju	MW	0.3	0.4	0.5	0.7	0.9	1.3	1.5	1.8	2.2	2.6	3.1	3.4	3.8	4.3	4.7	5.3
	(7)	Magawa	MW	0.1	0.2	0.2	0.3	0.4	0.6	0.7	0.9	1.0	1.2	1.5	1.7	1.9	2.1	2.3	2.6
	(8)	Kitomondo	MW	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.9	1.0	1.2	1.4	1.5	1.7	1.9	2.1
	(9)	Lukanga	MW	0.2	0.3	0.4	0.6	0.8	1.1	1.3	1.5	1.8	2.2	2.6	2.9	3.3	3.6	4.1	4.5
	(10)	Nyamato	MW	0.3	0.4	0.5	0.7	0.9	1.2	1.5	1.8	2.1	2.5	3.0	3.4	3.7	4.2	4.6	5.2
	(11)	Kimanzichana	MW	0.4	0.6	0.7	1.0	1.4	1.8	2.2	2.6	3.2	3.8	4.6	5.1	5.6	6.3	7.0	7.8
	(12)	Mkamba	MW	0.3	0.5	0.6	0.8	1.1	1.5	1.8	2.1	2.6	3.1	3.7	4.1	4.6	5.1	5.7	6.3
	(13)	Panzuo	MW	0.2	0.2	0.3	0.4	0.6	0.8	0.9	1.1	1.3	1.6	1.9	2.1	2.4	2.7	3.0	3.3
	(14)	Bupu	MW	0.2	0.2	0.3	0.4	0.6	0.7	0.9	1.1	1.3	1.5	1.8	2.1	2.3	2.5	2.8	3.2
	(15)	Mwalusembe	MW	0.3	0.4	0.5	0.7	0.9	1.2	1.4	1.7	2.1	2.5	3.0	3.3	3.7	4.1	4.6	5.1
	(16)	Vianzi	MW	0.2	0.3	0.4	0.6	0.8	1.1	1.3	1.5	1.8	2.2	2.6	2.9	3.2	3.6	4.0	4.5
	(17)	Njia nne	MW	0.2	0.2	0.3	0.4	0.5	0.7	0.8	1.0	1.2	1.4	1.7	1.9	2.1	2.3	2.6	2.9
	(18)	Kiparang'anda	MW	0.2	0.3	0.4	0.6	0.8	1.1	1.3	1.6	1.9	2.3	2.7	3.0	3.4	3.7	4.2	4.6
5		Rufiji District Council	MW	2.3	2.8	3.5	4.4	5.4	6.8	7.9	9.2	10.7	12.4	14.4	16.2	18.3	20.6	23.2	26.1
	(1)	Ikwiriri	MW	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.3	1.5
	(2)	Mgomba	MW	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1
	(3)	Umwe	MW	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.5	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.3
	(4)	Utete	MW	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.6	0.6	0.7
	(5)	Mkongo	MW	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.6
	(6)	Ngorongo	MW	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.3	1.4
	(7)	Mwaseni	MW	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.8
	(8)	Kibiti	MW	0.2	0.2	0.2	0.3	0.4	0.5	0.5	0.6	0.7	0.9	1.0	1.1	1.3	1.4	1.6	1.8
	(9)	Bungu	MW	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.1	1.2	1.4	1.6	1.8	2.0	2.3
	(10)	Mahege	MW	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.6	0.6	0.7
	(11)	Mchukwi	MW	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.5	0.5	0.6	0.7	0.7	0.8
	(12)	Chumbi	MW	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.1	1.2	1.4	1.5	1.7	2.0
	(13)	Mbwara	MW	0.1	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.8	0.9	1.0	1.2
	(14)	Mtunda	MW	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.5	0.5	0.6	0.7	0.8	0.9	1.0
	(15)	Ruaruke	MW	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.8	0.9
	(16)	Salale	MW	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1
	(17)	Mbuchi	MW	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.5	0.5	0.6	0.6	0.7
	(18)	Kiongoroni	MW	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6
	(19)	Maparoni	MW	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.7
	(20)	Chemchem	MW	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.6
	(21)	Ngarambe	MW	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3
	(22)	Dimani	MW	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.7
	(23)	Mtawanya	MW	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.8
	(24)	Mjawa	MW	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.3	1.4
	(25)	Mlanzi	MW	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.6	0.6
	(26)	Mwambao	MW	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.6	0.6
6		Mafia District Council	MW	1.3	1.8	2.4	3.2	4.2	5.7	6.9	8.3	10.0	12.1	14.7	16.5	18.5	20.7	23.2	26.1
	(1)	Kanga	MW	0.1	0.1	0.2	0.3	0.3	0.5	0.6	0.7	0.8	1.0	1.2	1.3	1.5	1.7	1.9	2.1
	(2)	Kirongwe	MW	0.2	0.2	0.3	0.4	0.5	0.7	0.8	1.0	1.2	1.5	1.8	2.0	2.3	2.5	2.9	3.2
	(3)	Baleni	MW	0.2	0.2	0.3	0.4	0.5	0.7	0.9	1.0	1.3	1.5	1.9	2.1	2.3	2.6	2.9	3.3
	(4)	Kilindoni	MW	0.4	0.5	0.7	1.0	1.3	1.7	2.1	2.5	3.1	3.7	4.5	5.0	5.7	6.3	7.1	8.0
	(5)	Miburani	MW	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.9	1.1	1.3	1.5	1.6	1.8	2.1	2.3
	(6)	Kiegeani	MW	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.9	1.1	1.3	1.5	1.6	1.8	2.0	2.3
	(7)	Jibondo	MW	0.1	0.1	0.2	0.3	0.3	0.5	0.6	0.7	0.8	1.0	1.2	1.3	1.5	1.7	1.9	2.1
	(8)	Ndagoni	MW	0.1	0.2	0.3	0.3	0.5	0.6	0.7	0.9	1.1	1.3	1.6	1.8	2.0	2.2	2.5	2.8
7		kibaha Town District Council	MW	4.7	5.7	7.0	8.6	10.4	12.7	14.7	16.9	19.4	22.3	25.7	27.4	29.3	31.4	33.5	35.8
	(1)	Pangani	MW	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.5	1.6	1.7	1.8	1.9
	(2)	Maili Moja	MW	0.8	1.0	1.2	1.4	1.8	2.1	2.5	2.8	3.3	3.8	4.3	4.6	4.9	5.3	5.6	6.0
	(3)	Tumbi	MW	0.4	0.5	0.6	0.8	0.9	1.2	1.3	1.5	1.8	2.0	2.3	2.5	2.7	2.8	3.0	3.2
	(4)	Picha ya Ndege	MW	0.7	0.8	1.0	1.2	1.5	1.8	2.1	2.4	2.7	3.1	3.6	3.8	4.1	4.4	4.7	5.0
	(5)	Mkuza	MW	0.6	0.7	0.8	1.0	1.2	1.5	1.7	2.0	2.3	2.6	3.0	3.2	3.5	3.7	3.9	4.2
	(6)	Kibaha	MW	0.4	0.5	0.6	0.8	1.0	1.2	1.3	1.6	1.8	2.1	2.4	2.5	2.7	2.9	3.1	3.3
	(7)	Msangani	MW	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.3	1.3	1.4	1.5	1.6
	(8)	Kongowe	MW	0.7	0.8	1.0	1.2	1.5	1.8	2.1	2.4	2.8	3.2	3.7	4.0	4.2	4.5	4.8	5.2
	(9)	Misugusugu	MW	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.1	1.2	1.3	1.4	1.5	1.6	1.7
	(10)	Visiga	MW	0.3	0.4	0.5	0.6	0.7	0.9	1.0	1.2	1.3	1.5	1.8	1.9	2.0	2.2	2.3	2.5
	(11)	Mbwawa	MW	0.1	0.2	0.2	0.3	0.3	0.4	0.5	0.5	0.6	0.7	0.8	0.9	0.9	1.0	1.0	1.1
		North Unguja	MW	8.4	9.6	11.0	12.6	14.4	16.4	17.9	19.6	21.4	23.4	25.5	27.1	28.9	30.7	32.7	34.8
		South Unguja	MW	5.0	5.6	6.4	7.2	8.1	9.2	10.0	10.9	11.8	12.8	13.9	14.7	15.6	16.5	17.5	18.5
		Urban West	MW	27.5	31.8	36.7	42.3	48.9	56.4	61.5	67.0	73.1	79.6	86.8	92.3	98.2	104.5	111.1	118.2
		North Pemba	MW	8.9	10.0	11.2	12.6	14.1	15.8	17.1	18.5	19.9	21.5	23.2	24.4	25.7	27.0	28.4	29.8
		South Pemba	MW	8.2	9.1	10.2	11.4	12.8	14.4	15.5	16.7	18.0	19.4	20.9	22.0	23.1	24.2	25.4	26.7
Zanzibar		Zanzibar total	MW	57.9	66.1	75.5	86.2	98.3	112.2	122.0	132.6	144.2	156.7	170.4	180.6	191.5	203.0	215.1	228.0

Total Power Demand Forecast with Additional Demand (Ward Base)

			Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Dar es Salaam + Coast + Zanzibar			MW	541.6	646.8	772.9	924.3	1,106.4	1,325.6	1,439.8	1,564.4	1,700.2	1,848.4	2,010.3	2,173.6	2,350.1	2,541.2	2,747.8	2,971.4
Dar es Salaam		Dar es Salaam Region	MW	459.2	548.2	654.4	781.2	932.6	1,113.3	1,202.6	1,299.1	1,403.3	1,515.8	1,637.4	1,773.4	1,920.7	2,080.3	2,253.0	2,440.2
1		Kinondoni Municipal Council	MW	208.9	243.0	282.6	328.7	382.3	444.6	478.2	514.4	553.2	595.0	640.0	694.5	753.6	817.8	887.4	963.0
	(1)	Magomeni	MW	2.5	2.9	3.4	4.1	4.8	5.7	5.9	6.2	6.4	6.6	6.9	7.6	8.4	9.3	10.3	11.3
	(2)	Makurumla	MW	3.4	4.2	5.1	6.2	7.5	9.1	9.4	9.7	10.1	10.4	10.8	12.0	13.4	15.0	16.7	18.7
	(3)	Ndugumbi	MW	2.0	2.3	2.7	3.2	3.8	4.4	4.7	5.1	5.4	5.8	6.3	7.0	7.8	8.7	9.7	10.8
	(4)	Tandale	MW	5.5	6.2	7.0	7.8	8.8	9.8	10.8	11.8	12.9	14.2	15.5	16.6	17.9	19.2	20.6	22.1
	(5)	Mwananyamala	MW	7.2	7.9	8.6	9.4	10.3	11.2	12.1	12.9	13.9	14.9	16.1	18.0	20.1	22.5	25.2	28.2
	(6)	Msasani	MW	17.4	19.0	20.8	22.7	24.8	27.1	29.8	32.7	35.8	39.3	43.1	46.7	50.5	54.6	59.0	63.8
	(7)	Kinondoni	MW	3.0	3.3	3.6	3.9	4.3	4.7	5.1	5.4	5.8	6.3	6.7	7.5	8.4	9.5	10.6	11.9
	(8)	Mzimuni	MW	1.2	1.4	1.6	1.9	2.2	2.6	2.8	3.0	3.2	3.4	3.6	4.1	4.5	5.1	5.7	6.3
	(9)	Kigogo	MW	3.1	3.6	4.3	5.0	5.9	6.9	7.4	7.9	8.5	9.1	9.8	10.9	12.2	13.6	15.2	17.0
	(10)	Mabibo	MW	4.6	5.4	6.4	7.5	8.8	10.3	11.0	11.8	12.7	13.6	14.6	16.3	18.1	20.3	22.6	25.2
	(11)	Manzese	MW	3.8	4.5	5.2	6.1	7.2	8.4	9.1	9.7	10.4	11.2	12.0	13.4	14.9	16.7	18.6	20.8
	(12)	Ubungo	MW	11.3	12.7	14.3	16.0	17.9	20.1	22.0	24.1	26.4	28.9	31.7	32.3	32.9	33.5	34.1	34.7
	(13)	Kibamba	MW	1.6	1.8	2.1	2.5	2.9	3.5	3.7	4.0	4.3	4.6	4.9	5.5	6.1	6.8	7.6	8.5
	(14)	Goba	MW	3.0	4.3	6.1	8.8	12.5	17.7	18.0	18.2	18.4	18.6	18.8	20.3	22.0	23.8	25.7	27.8
	(15)	Kawe	MW	11.4	12.5	13.7	15.0	16.3	17.9	18.9	20.0	21.2	22.4	23.7	26.8	30.3	34.2	38.7	43.8
	(16)	Kunduchi	MW	16.0	19.4	23.4	28.4	34.4	41.6	44.7	48.0	51.6	55.4	59.5	64.4	69.6	75.3	81.5	88.1
	(17)	Mbweni	MW	1.6	2.1	2.7	3.5	4.7	6.1	6.6	7.0	7.6	8.1	8.7	9.9	11.2	12.6	14.3	16.2
	(18)	Bunju	MW	6.8	8.6	10.9	13.7	17.2	21.7	23.7	25.8	28.1	30.7	33.5	36.6	40.0	43.7	47.8	52.3
	(19)	Makuburi	MW	3.1	3.6	4.3	5.0	5.9	6.9	7.4	7.9	8.5	9.1	9.7	10.9	12.1	13.6	15.1	16.9
	(20)	Mburahati	MW	1.8	2.2	2.5	3.0	3.5	4.1	4.4	4.7	5.0	5.4	5.8	6.5	7.2	8.1	9.0	10.0
	(21)	Makumbusho	MW	9.7	10.6	11.6	12.6	13.8	15.1	16.2	17.4	18.7	20.1	21.6	23.9	26.5	29.3	32.4	35.9
	(22)	Sinza	MW	2.2	2.6	3.0	3.5	4.1	4.9	5.2	5.6	6.0	6.4	6.9	7.7	8.6	9.6	10.7	11.9
	(23)	Kijitonyama	MW	4.1	5.2	6.5	8.2	10.3	12.9	13.9	14.9	16.0	17.2	18.5	20.7	23.1	25.9	29.0	32.4
	(24)	kimara	MW	4.1	5.1	6.2	7.6	9.3	11.5	12.4	13.5	14.7	16.0	17.3	19.3	21.5	23.9	26.6	29.7
	(25)	Mikocheni	MW	16.4	17.9	19.6	21.4	23.4	25.6	27.0	28.6	30.2	31.9	33.7	34.6	35.6	36.6	37.6	38.7
	(26)	Mbezi	MW	4.0	5.3	7.0	9.3	12.4	16.5	17.5	18.6	19.7	20.9	22.2	23.3	24.5	25.7	27.1	28.4
	(27)	Hananasif	MW	5.3	5.8	6.3	6.9	7.5	8.2	8.8	9.5	10.2	11.0	11.8	13.2	14.8	16.5	18.5	20.7
	(28)	Saranga	MW	5.6	6.9	8.4	10.4	12.7	15.6	16.9	18.4	20.0	21.7	23.6	26.3	29.2	32.5	36.2	40.3
	(29)	Kwembe	MW	3.8	4.7	5.9	7.2	9.0	11.1	12.5	14.0	15.8	17.8	20.0	21.8	23.8	26.0	28.3	30.9
	(30)	Msigani	MW	3.3	4.6	6.3	8.7	12.0	16.5	17.3	18.1	19.0	19.9	20.8	20.9	21.0	21.1	21.2	21.4
	(31)	Mbezi juu	MW	5.3	6.2	7.2	8.4	9.8	11.5	12.3	13.2	14.2	15.3	16.4	17.9	19.6	21.4	23.4	25.6
	(32)	Makongo	MW	5.6	6.5	7.6	8.9	10.4	12.1	13.0	14.0	15.1	16.2	17.4	19.0	20.8	22.7	24.8	27.2
	(33)	Mabwepande	MW	3.3	3.6	4.1	4.5	5.1	5.6	6.1	6.5	7.0	7.5	8.1	9.0	10.1	11.3	12.7	14.2
	(34)	Wazo	MW	25.8	27.9	30.1	32.4	35.0	37.8	41.5	45.5	49.9	54.8	60.1	62.1	64.3	66.5	68.8	71.1
2		Ilala Municipal Council	MW	147.5	177.2	213.0	255.9	307.6	369.7	393.5	418.9	445.9	474.6	505.2	544.6	587.2	633.0	682.4	735.7
	(1)	Ukonga	MW	2.9	3.7	4.7	6.0	7.7	9.8	10.4	11.1	11.8	12.6	13.4	14.3	15.3	16.3	17.4	18.6
	(2)	Pugu	MW	2.4	3.5	4.9	7.1	10.1	14.4	15.9	17.6	19.4	21.4	23.6	23.9	24.2	24.6	24.9	25.2
	(3)	Msongola	MW	0.6	0.8	1.0	1.3	1.7	2.2	2.3	2.5	2.7	2.9	3.2	3.6	4.0	4.6	5.2	5.9
	(4)	Tabata	MW	2.7	3.2	3.8	4.6	5.4	6.5	7.0	7.5	8.1	8.7	9.4	10.6	12.0	13.6	15.3	17.3
	(5)	Kinyerezi	MW	1.7	2.3	3.0	3.9	5.1	6.6	6.2	5.8	5.5	5.1	4.8	5.4	6.2	7.0	7.9	8.9
	(6)	Ilala	MW	28.5	31.4	34.7	38.3	42.3	46.6	49.2	51.9	54.7	57.7	60.8	65.3	70.1	75.3	80.9	86.9
	(7)	Mchikichini	MW	7.8	9.9	12.5	15.9	20.1	25.5	27.1	28.8	30.6	32.5	34.5	38.1	42.0	46.4	51.2	56.5
	(8)	Vingunguti	MW	5.8	7.3	9.2	11.7	14.8	18.8	20.2	21.7	23.3	25.0	26.9	30.2	33.9	38.1	42.8	48.0
	(9)	Kipawa	MW	8.0	9.5	11.4	13.7	16.4	19.6	20.5	21.5	22.6	23.7	24.9	27.6	30.7	34.1	37.9	42.1
	(10)	Buguruni	MW	7.6	9.1	10.9	13.0	15.6	18.6	19.5	20.5	21.5	22.6	23.7	25.4	27.2	29.1	31.1	33.4
	(11)	Kariakoo	MW	8.4	10.0	11.8	13.9	16.5	19.5	19.8	20.1	20.3	20.6	20.9	24.4	28.6	33.4	39.1	45.7
	(12)	Jangwani	MW	10.8	11.9	13.1	14.5	16.0	17.7	18.8	19.9	21.2	22.5	23.9	25.4	27.0	28.8	30.6	32.5
	(13)	Gerezani	MW	3.6	4.1	4.7	5.5	6.3	7.3	7.7	8.2	8.7	9.3	9.9	10.5	11.1	11.9	12.6	13.4
	(14)	Kisutu	MW	4.1	4.7	5.4	6.2	7.2	8.3	8.8	9.4	10.0	10.6	11.2	12.0	12.7	13.5	14.4	15.3
	(15)	Mchafukoge	MW	5.2	6.0	7.0	8.0	9.3	10.7	11.4	12.1	12.8	13.6	14.5	15.4	16.4	17.4	18.5	19.7
	(16)	Upanga Mashariki	MW	5.5	6.3	7.3	8.4	9.7	11.2	11.9	12.6	13.4	14.2	15.1	16.1	17.1	18.2	19.4	20.6
	(17)	Upanga Magharibi	MW	6.6	7.6	8.8	10.1	11.7	13.5	14.3	15.2	16.2	17.2	18.2	19.4	20.6	22.0	23.4	24.9
	(18)	Kivukoni	MW	6.2	7.1	8.1	9.3	10.6	12.1	12.1	12.2	12.2	12.2	12.2	12.2	12.3	12.3	12.4	12.4
	(19)	Kiwalani	MW	7.1	9.1	11.6	14.9	19.0	24.3	26.3	28.5	30.9	33.4	36.2	37.1	38.0	39.0	40.0	41.1
	(20)	Segerea	MW	3.0	3.8	4.7	5.9	7.4	9.3	10.1	10.9	11.7	12.7	13.7	15.0	16.4	17.9	19.6	21.5
	(21)	Kitunda	MW	4.9	6.0	7.3	8.8	10.7	13.0	14.0	15.1	16.2	17.5	18.8	20.5	22.2	24.1	26.2	28.5
	(22)	Chanika	MW	1.7	2.0	2.4	2.8	3.3	3.9	4.2	4.5	4.9	5.3	5.7	6.4	7.3	8.2	9.3	10.5
	(23)	Kivule	MW	2.3	3.4	5.1	7.5	11.1	16.4	17.6	19.0	20.5	22.0	23.7	25.8	28.0	30.4	33.1	35.9
	(24)	Gongo la Mboto	MW	4.2	5.1	6.2	7.6	9.2	11.1	11.4	11.6	11.8	12.1	12.3	13.4	14.6	15.9	17.3	18.8
	(25)	Majohe	MW	3.2	4.3	5.8	7.8	10.4	14.0	16.4	19.2	22.4	26.2	30.7	31.0	31.2	31.5	31.7	32.0
	(26)	Kimanga	MW	2.8	3.6	4.5	5.6	7.0	8.8	9.5	10.2	11.1	12.0	12.9	14.1	15.5	16.9	18.5	20.2
3		Temeke Municipal Council	MW	102.9	127.3	157.6	195.1	241.5	299.0	330.3	365.0	403.2	445.5	492.2	534.3	579.9	629.4	683.2	741.5
	(1)	Kigamboni	MW	2.0	3.3	5.4	8.8	14.3	23.4	26.7	30.5	34.8	39.7	45.3	49.0	52.9	57.2	61.8	66.7
	(2)	Vijibweni	MW	2.2	2.8	3.5	4.5	5.8	7.3	8.1	8.9	9.8	10.8	11.9	12.2	12.6	13.0	13.4	13.9
	(3)	Kibada	MW	0.6	0.9	1.2	1.6	2.2	3.0	3.7	4.7	6.0	7.6	9.6	9.7	9.8	10.0	10.1	10.2
	(4)	Kisarawe II	MW	0.6	0.7	0.8	0.9	1.0	1.1	1.3	1.4	1.5	1.7	1.9	2.1	2.3	2.5	2.8	3.1
	(5)	Somangila	MW	9.6	11.1	12.7	14.7	16.9	19.5	20.3	21.2	22.0	22.9	23.9	25.7	27.7	29.8	32.1	34.5
	(6)	Kimbiji	MW	0.3	0.3	0.4	0.5	0.7	0.9	1.0	1.1	1.2	1.3	1.4	1.6	1.8	2.0	2.2	2.4
	(7)	Mbagala	MW	3.9	5.1	6.6	8.6	11.2	14.5	17.7	21.6	26.3	32.0	39.1	41.4	43.9	46.5	49.3	52.3
	(8)	Chamazi	MW	2.6	3.5	4.6	6.1	8.1	10.7	11.6	12.5	13.4	14.5	15.6	17.0	18.6	20.2	22.1	24.1
	(9)	Yombo Vituka	MW	5.7	6.8	8.0	9.4	11.0	13.0	14.0	15.1	16.3	17.5	18.9	20.6	22.4	24.5	26.7	29.1
	(10)	Charambe	MW	7.6	8.6	9.7	11.0	12.5	14.1	15.5	17.1	18.8	20.6	22.7	25.2	28.1	31.2	34.7	38.5
	(11)	Toangoma	MW	1.8	2.4	3.2	4.3	5.7	7.5	8.1	8.7	9.4	10.1	10.9	12.1	13.5	15.0	16.7	18.5
	(12)	Miburani	MW	3.3	3.7	4.2	4.8	5.4	6.1	6.7	7.4	8.2	9.0	9.9	11.0	12.2	13.6	15.1	16.7
	(13)	Temeke	MW	1.9	2.2	2.5	2.8	3.2	3.6	4.0	4.4	4.8	5.3	5.8	6.5	7.2	8.0	8.9	9.8
	(14)	Mtoni	MW	4.4	5.2	6.1	7.2	8.5	10.0	10.8	11.6	12.5	13.5	14.6	16.2	18.0	20.0	22.2	24.7
	(15)	Keko	MW	2.6	3.0	3.4	3.8	4.3	4.9	5.3	5.9	6.5	7.1	7.8	8.7	9.7	10.8	12.0	13.3
	(16)	Kurasini	MW	10.9	12.8	15.0	17.6	20.7	24.3	26.3	28.4	30.6	33.0	35.7	39.2	43.1	47.4	52.1	57.3
	(17)	Azimio	MW	5.7	6.7	7.9	9.4	11.0	13.0	14.0	15.1	16.2	17.5	18.8	20.9	23.3	25.9	28.7	31.9
	(18)	Tandika	MW	3.7	4.2	4.7	5.3	6.0	6.8	7.5	8.3	9.1	10.0	11.0	12.3	13.6	15.1	16.8	18.7
	(19)	Sadali	MW	0.4	0.8	1.3	2.4	4.1	7.3	8.7	10.5	12.6	15.2	18.3	18.6	18.9	19.2	19.6	19.9
	(20)	Chang'ombe	MW	1.4	1.9	2.4	3.2	4.1	5.3	6.0	6.7	7.6	8.5	9.6	9.9	10.3	10.7	11.1	11.5
	(21)	Mbagala Kuu	MW	5.6	6.9	8.6	10.7	13.2	16.4	18.6	21.0	23.8	27.0	30.5	30.7	30.8	30.9	31.0	31.1
	(22)	Makangarawe	MW	2.2	2.9	3.9	5.1	6.8	9.0	9.7	10.4	11.3	12.1	13.1	14.5	16.1	17.9	19.9	22.2
	(23)	Pembamnazi	MW	0.4	0.5	0.6	0.8	1.1	1.3	1.5	1.6	1.8	2.0	2.2	2.4	2.7	3.0	3.3	3.7
	(24)	Mjimwema	MW	2.1	2.4	2.9	3.4	4.0	4.7	5.1	5.4	5.9	6.3	6.8	7.6	8.4	9.4	10.4	11.6
	(25)	Tungi	MW	1.7	2.2	2.8	3.6	4.6	5.9	6.9	8.0	9.4	10.9	12.7	13.2	13.7	14.2	14.8	15.4
	(26)	Kijichi	MW	5.2	6.1	7.2	8.4	9.9	11.7	12.6	13.6	14.6	15.7	17.0	18.9	21.0	23.3	25.9	28.8
	(27)	Mianzini	MW	0.8	1.6	3.2	6.1	11.9	23.2	25.0	26.9	29.0	31.2	33.6	37.4	41.6	46.2	51.3	57.1
	(28)	Kiburugwa	MW	5.9	6.9	8.2	9.6	11.3	13.3	14.4	15.5	16.7	18.0	19.3	21.5	23.9	26.6	29.5	32.8
	(29)	Buza	MW	4.1	4.8	5.7	6.7	7.9	9.3	10.0	10.8	11.6	12.5	13.5	15.0	16.7	18.5	20.6	22.9
	(30)	Kilakala	MW	3.4	3.9	4.6	5.5	6.4	7.6	8.2	8.8	9.5	10.2	11.0	12.2	13.6	15.1	16.8	18.7
Pwani		Pwani Region	MW	24.4	32.4	42.9	56.9	75.5	100.1	115.2	132.7	152.7	175.9	202.5	219.5	238.0	258.0	279.6	303.1
1		Bagamoyo District Council	MW	5.0	6.6	8.5	11.1	14.5	18.8	22.2	26.1	30.8	36.3	42.7	46.3	50.1	54.2	58.7	63.6
	(1)	Kiwangwa	MW	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.3	1.3	1.4	1.4	1.5	1.6
	(2)	Msata	MW	0.3	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.8	0.9	1.1	1.1	1.1	1.1	1.1	1.1
	(3)	Miono	MW	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.1	1.2	1.3	1.5	1.5	1.6	1.7	1.8	1.9
	(4)	Mkange	MW	0.1	0.1	0.2	0.2	0.3	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.8
	(5)	Magomeni	MW	0.5	0.7	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.3	2.5	2.6	2.8	2.9	3.0	3.2
	(6)	Dunda	MW	0.3	0.3	0.4	0.5	0.6	0.8	0.9	1.1	1.2	1.4	1.7	1.9	2.1	2.4	2.7	3.0
	(7)	Kiromo	MW	0.1	0.2	0.3	0.5	0.8	1.3	1.7	2.3	3.1	4.2	5.6	6.1	6.7	7.4	8.1	9.0
	(8)	Zinga	MW	0.2	0.3	0.6	1.0	1.6	2.7	3.5	4.6	6.1	8.1	10.7	11.9	13.3	14.8	16.5	18.4
	(9)	Yombo	MW	0.1	0.1	0.1	0.2	0.3	0.5	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.9	0.9	1.0
	(10)	Vigwaza	MW	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.3	1.4	1.5	1.6	1.7	1.7	1.8
	(11)	Talawanda	MW	0.1	0.1	0.1	0.2	0.3	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6
	(12)	Bwilingu	MW	0.7	0.8	1.0	1.2	1.4	1.7	1.9	2.2	2.4	2.7	3.0	3.2	3.3	3.5	3.7	3.8
	(13)	Lugoba	MW	0.2	0.3	0.3	0.4	0.5	0.6	0.6	0.7	0.8	0.9	1.0	1.0	1.1	1.1	1.2	1.3
	(14)	Ubenazomozi	MW	0.3	0.3	0.4	0.5	0.6	0.8	0.8	0.9	1.1	1.2	1.3	1.4	1.5	1.5	1.6	1.7
	(15)	Mbwewe	MW	0.1	0.2	0.2	0.3	0.5	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.2	1.2	1.3
	(16)	kibindu	MW	0.3	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.8	0.9	1.0	1.1	1.1	1.1	1.1	1.1
	(17)	Fukayosi	MW	0.2	0.2	0.3	0.3	0.4	0.5	0.5	0.6	0.6	0.7	0.8	0.8	0.9	0.9	1.0	1.0
	(18)	Kerege	MW	0.3	0.4	0.6	0.8	1.1	1.5	1.8	2.2	2.6	3.2	3.9	4.4	4.9	5.6	6.3	7.1
	(19)	Pera	MW	0.1	0.1	0.2	0.3	0.4	0.6	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1
	(20)	Msoga	MW	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.6	0.7	0.8	0.9	0.9	1.0	1.0	1.1	1.1
	(21)	Kimange	MW	0.1	0.1	0.1	0.2	0.3	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.7
	(22)	Mandera	MW	0.2	0.2	0.3	0.3	0.4	0.5	0.5	0.6	0.6	0.7	0.8	0.8	0.9	0.9	1.0	1.0

			Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
2		Kibaha District Council	MW	2.6	3.3	4.3	5.6	7.3	9.5	10.7	12.0	13.5	15.2	17.1	18.6	20.3	22.1	24.1	26.3
	(1)	Gwata	MW	0.1	0.1	0.2	0.3	0.4	0.5	0.6	0.6	0.7	0.8	0.8	0.9	1.0	1.0	1.1	1.2
	(2)	Dutumi	MW	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4
	(3)	Magindu	MW	0.1	0.1	0.2	0.3	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.9	0.9	1.0	1.0	1.1
	(4)	Soga	MW	0.1	0.1	0.2	0.2	0.3	0.5	0.5	0.6	0.6	0.7	0.8	0.8	0.9	0.9	1.0	1.1
	(5)	Kikongo	MW	0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.9	0.9
	(6)	Ruvu	MW	0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.8
	(7)	Mlandizi	MW	1.6	1.9	2.4	2.9	3.5	4.3	4.9	5.7	6.5	7.5	8.7	9.6	10.6	11.8	13.1	14.5
	(8)	Kwala	MW	0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.8
	(9)	Kilangalanga	MW	0.2	0.3	0.4	0.5	0.7	1.0	1.2	1.3	1.4	1.5	1.7	1.8	1.9	2.1	2.2	2.4
	(10)	Janga	MW	0.2	0.3	0.4	0.6	0.8	1.1	1.2	1.3	1.4	1.6	1.7	1.9	2.0	2.1	2.3	2.4
	(11)	Bokomnemela	MW	0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8
3		Kisarawe District Council	MW	2.0	2.8	3.9	5.4	7.4	10.3	11.8	13.5	15.5	17.8	20.5	22.4	24.5	26.8	29.3	32.0
	(1)	Kisarawe	MW	0.5	0.7	1.0	1.4	2.0	2.8	3.3	3.8	4.5	5.3	6.2	6.8	7.4	8.1	8.8	9.7
	(2)	Msimbu	MW	0.2	0.2	0.3	0.4	0.6	0.9	1.0	1.1	1.2	1.4	1.6	1.7	1.9	2.0	2.2	2.4
	(3)	Masaki	MW	0.1	0.1	0.2	0.3	0.4	0.6	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.6
	(4)	Kibuta	MW	0.1	0.2	0.3	0.4	0.6	0.8	0.9	1.0	1.1	1.3	1.4	1.5	1.7	1.8	2.0	2.2
	(5)	Marumbo	MW	0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.6	0.7	0.8	0.9	0.9	1.0	1.1	1.2
	(6)	Maneromango	MW	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.9	1.0	1.2	1.4	1.5	1.6	1.8	2.0	2.1
	(7)	Msanga	MW	0.1	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.5
	(8)	Marui	MW	0.1	0.1	0.1	0.1	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.8	0.8
	(9)	Cholesamvula	MW	0.1	0.1	0.2	0.2	0.3	0.5	0.5	0.6	0.7	0.8	0.8	0.9	1.0	1.1	1.2	1.3
	(10)	Vikumbulu	MW	0.0	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.7
	(11)	Mafizi	MW	0.1	0.1	0.2	0.3	0.4	0.5	0.6	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4
	(12)	Kurui	MW	0.0	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6	0.7
	(13)	Mzenga	MW	0.1	0.1	0.1	0.2	0.3	0.4	0.5	0.5	0.6	0.7	0.8	0.8	0.9	1.0	1.1	1.2
	(14)	Vihingo	MW	0.0	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6	0.7	0.7
	(15)	kiluvya	MW	0.3	0.4	0.5	0.7	1.0	1.3	1.5	1.8	2.1	2.4	2.8	3.1	3.4	3.7	4.1	4.4
4		Mkuranga District Council	MW	3.4	5.0	7.4	10.9	16.0	23.5	27.5	32.2	37.7	44.1	51.6	57.2	63.6	70.6	78.3	87.0
	(1)	Mkuranga	MW	0.6	0.8	1.2	1.6	2.3	3.2	3.8	4.6	5.5	6.6	7.9	8.7	9.5	10.4	11.3	12.4
	(2)	Tambani	MW	0.2	0.4	0.6	0.9	1.3	2.1	2.5	3.0	3.6	4.3	5.2	5.7	6.4	7.1	7.9	8.8
	(3)	Vikindu	MW	0.8	1.1	1.5	2.0	2.7	3.6	4.3	5.2	6.2	7.4	8.9	9.9	11.0	12.2	13.6	15.2
	(4)	Mbezi	MW	0.1	0.1	0.2	0.3	0.5	0.8	0.9	1.1	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.7
	(5)	Shungubweni	MW	0.0	0.1	0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.8	0.8	0.9	1.0
	(6)	Kisiju	MW	0.1	0.2	0.3	0.5	0.8	1.3	1.4	1.6	1.9	2.2	2.5	2.8	3.1	3.4	3.8	4.2
	(7)	Magawa	MW	0.1	0.1	0.2	0.3	0.4	0.6	0.7	0.8	0.9	1.0	1.2	1.3	1.5	1.6	1.8	2.0
	(8)	Kitomondo	MW	0.1	0.1	0.1	0.2	0.3	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.4	1.5	1.7
	(9)	Lukanga	MW	0.1	0.2	0.3	0.4	0.7	1.1	1.2	1.4	1.6	1.8	2.1	2.4	2.6	2.9	3.2	3.6
	(10)	Nyamato	MW	0.1	0.2	0.3	0.5	0.8	1.2	1.4	1.6	1.8	2.1	2.4	2.7	3.0	3.3	3.7	4.1
	(11)	Kimanzichana	MW	0.2	0.3	0.5	0.8	1.2	1.8	2.1	2.4	2.8	3.2	3.6	4.1	4.5	5.0	5.6	6.2
	(12)	Mkamba	MW	0.2	0.3	0.4	0.6	1.0	1.5	1.7	2.0	2.3	2.6	3.0	3.3	3.7	4.1	4.5	5.1
	(13)	Panzuo	MW	0.1	0.1	0.2	0.3	0.5	0.8	0.9	1.0	1.2	1.3	1.5	1.7	1.9	2.1	2.4	2.6
	(14)	Bupu	MW	0.1	0.1	0.2	0.3	0.5	0.7	0.9	1.0	1.1	1.3	1.5	1.6	1.8	2.0	2.3	2.5
	(15)	Mwalusembe	MW	0.3	0.4	0.5	0.7	0.9	1.2	1.4	1.7	2.1	2.5	3.0	3.3	3.7	4.1	4.6	5.1
	(16)	Vianzi	MW	0.1	0.2	0.3	0.4	0.7	1.1	1.2	1.4	1.6	1.8	2.1	2.3	2.6	2.9	3.2	3.6
	(17)	Njia nne	MW	0.1	0.1	0.2	0.3	0.4	0.7	0.8	0.9	1.0	1.2	1.4	1.5	1.7	1.9	2.1	2.3
	(18)	Kiparang'anda	MW	0.1	0.2	0.3	0.5	0.7	1.1	1.3	1.4	1.6	1.9	2.2	2.4	2.7	3.0	3.3	3.7
5		Rufiji District Council	MW	1.2	1.7	2.4	3.4	4.8	6.8	7.1	7.5	8.0	8.4	8.9	10.0	11.3	12.7	14.3	16.1
	(1)	Ikwiriri	MW	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.3	1.5
	(2)	Mgomba	MW	0.0	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.5
	(3)	Umwe	MW	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.5	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.3
	(4)	Utete	MW	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.6	0.6	0.7
	(5)	Mkongo	MW	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3
	(6)	Ngorongo	MW	0.0	0.1	0.1	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.6	0.6	0.7
	(7)	Mwaseni	MW	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4
	(8)	Kibiti	MW	0.2	0.2	0.2	0.3	0.4	0.5	0.5	0.6	0.7	0.9	1.0	1.1	1.3	1.4	1.6	1.8
	(9)	Bungu	MW	0.1	0.1	0.2	0.3	0.4	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.8	0.9	1.0	1.1
	(10)	Mahege	MW	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4
	(11)	Mchukwi	MW	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4
	(12)	Chumbi	MW	0.1	0.1	0.2	0.2	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.7	0.8	0.9	1.0
	(13)	Mbwara	MW	0.0	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.6
	(14)	Mtunda	MW	0.0	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5
	(15)	Ruaruke	MW	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4
	(16)	Salale	MW	0.0	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.5
	(17)	Mbuchi	MW	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4
	(18)	Kiongoroni	MW	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3
	(19)	Maparoni	MW	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3
	(20)	Chemchem	MW	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3
	(21)	Ngarambe	MW	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	(22)	Dimani	MW	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3
	(23)	Mtawanya	MW	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.8
	(24)	Mjawa	MW	0.1	0.1	0.1	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.7
	(25)	Mlanzi	MW	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3
	(26)	Mwambao	MW	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3
6		Mafia District Council	MW	0.8	1.2	1.7	2.6	3.8	5.7	6.4	7.2	8.1	9.2	10.4	11.6	13.0	14.6	16.4	18.4
	(1)	Kanga	MW	0.0	0.1	0.1	0.2	0.3	0.5	0.5	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.9	1.1
	(2)	Kirongwe	MW	0.0	0.1	0.1	0.2	0.4	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.1	1.3	1.4	1.6
	(3)	Baleni	MW	0.1	0.1	0.1	0.2	0.4	0.7	0.8	0.8	0.8	0.9	0.9	1.0	1.2	1.3	1.5	1.6
	(4)	Kilindoni	MW	0.4	0.5	0.7	1.0	1.3	1.7	2.1	2.5	3.1	3.7	4.5	5.0	5.7	6.3	7.1	8.0
	(5)	Miburani	MW	0.0	0.1	0.1	0.2	0.3	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.8	0.9	1.0	1.2
	(6)	Kiegeani	MW	0.0	0.1	0.1	0.2	0.3	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.8	0.9	1.0	1.1
	(7)	Jibondo	MW	0.0	0.1	0.1	0.2	0.3	0.5	0.5	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.9	1.0
	(8)	Ndagoni	MW	0.1	0.2	0.3	0.3	0.5	0.6	0.7	0.9	1.1	1.3	1.6	1.8	2.0	2.2	2.5	2.8
7		kibaha Town District Council	MW	9.4	11.5	14.0	17.1	20.9	25.5	29.3	33.7	38.8	44.6	51.4	52.9	54.5	56.2	57.9	59.7
	(1)	Pangani	MW	0.5	0.6	0.7	0.9	1.1	1.4	1.6	1.8	2.1	2.4	2.7	2.8	2.9	3.0	3.1	3.2
	(2)	Maili Moja	MW	1.6	1.9	2.4	2.9	3.5	4.3	4.9	5.7	6.5	7.5	8.6	8.7	8.8	8.9	9.0	9.0
	(3)	Tumbi	MW	0.9	1.0	1.3	1.6	1.9	2.3	2.7	3.1	3.5	4.0	4.7	4.8	5.0	5.2	5.3	5.5
	(4)	Picha ya Ndege	MW	1.3	1.6	2.0	2.4	2.9	3.6	4.1	4.7	5.4	6.3	7.2	7.4	7.7	8.0	8.2	8.5
	(5)	Mkuza	MW	1.1	1.4	1.7	2.0	2.5	3.0	3.5	4.0	4.6	5.3	6.0	6.3	6.5	6.7	6.9	7.2
	(6)	Kibaha	MW	0.9	1.1	1.3	1.6	1.9	2.3	2.7	3.1	3.6	4.1	4.7	4.9	5.1	5.2	5.4	5.6
	(7)	Msangani	MW	0.4	0.5	0.6	0.8	1.0	1.2	1.3	1.5	1.8	2.1	2.4	2.4	2.5	2.6	2.7	2.8
	(8)	Kongowe	MW	1.4	1.7	2.0	2.5	3.0	3.7	4.2	4.9	5.6	6.4	7.4	7.7	7.9	8.2	8.5	8.8
	(9)	Misugusugu	MW	0.4	0.5	0.7	0.8	1.0	1.2	1.4	1.6	1.9	2.1	2.5	2.5	2.6	2.7	2.8	2.9
	(10)	Visiga	MW	0.7	0.8	1.0	1.2	1.4	1.8	2.0	2.3	2.7	3.1	3.6	3.7	3.8	3.9	4.1	4.2
	(11)	Mbwawa	MW	0.3	0.4	0.4	0.5	0.7	0.8	0.9	1.1	1.2	1.4	1.6	1.7	1.7	1.8	1.8	1.9
		North Unguja	MW	8.4	9.6	11.0	12.6	14.4	16.4	17.9	19.6	21.4	23.4	25.5	27.1	28.9	30.7	32.7	34.8
		South Unguja	MW	5.0	5.6	6.4	7.2	8.1	9.2	10.0	10.9	11.8	12.8	13.9	14.7	15.6	16.5	17.5	18.5
		Urban West	MW	27.5	31.8	36.7	42.3	48.9	56.4	61.5	67.0	73.1	79.6	86.8	92.3	98.2	104.5	111.1	118.2
		North Pemba	MW	8.9	10.0	11.2	12.6	14.1	15.8	17.1	18.5	19.9	21.5	23.2	24.4	25.7	27.0	28.4	29.8
		South Pemba	MW	8.2	9.1	10.2	11.4	12.8	14.4	15.5	16.7	18.0	19.4	20.9	22.0	23.1	24.2	25.4	26.7
Zanzibar		Zanzibar total	MW	57.9	66.1	75.5	86.2	98.3	112.2	122.0	132.6	144.2	156.7	170.4	180.6	191.5	203.0	215.1	228.0

Unit: Person

	2015	2020	2025	2030
Dar es Salaam Region	5,101,532	6,955,914	8,313,755	10,188,383
Kinondoni Municipal Council	2,074,782	2,545,358	3,008,291	3,823,792
Magomeni	28,520	30,302	34,858	43,302
Makurumla	74,050	80,693	90,505	112,429
Ndugumbi	43,062	46,925	52,631	65,380
Tandale	64,031	69,776	78,261	97,218
Mwananyamala	59,097	64,399	77,046	106,256
Msasani	57,181	62,310	74,547	114,232
Kinondoni	24,825	27,053	32,365	44,635
Mzimuni	25,114	27,367	30,695	38,130
Kigogo	67,341	73,383	82,306	102,244
Mabibo	100,212	109,202	122,482	152,151
Manzese	82,413	89,806	100,727	125,126
Ubungo	65,474	71,347	80,024	99,408
Kibamba	33,762	36,791	41,265	51,261
Goba	49,874	67,935	81,276	99,636
Kawe	78,448	85,486	102,273	156,719
Kunduchi	87,683	119,437	142,891	175,169
Mbweni	16,091	17,534	20,977	32,145
Bunju	70,407	124,676	160,634	196,919
Makuburi	67,102	73,122	82,014	101,880
Mburahati	39,885	43,463	48,748	60,557
Makumbusho	79,591	86,731	103,764	135,153
Sinza	47,393	51,644	57,924	71,956
Kijitonyama	67,948	74,044	88,584	122,169
kimara	89,508	121,922	145,865	178,814
Mikocheni	38,510	41,965	50,206	69,241
Mbezi	85,811	116,886	139,840	171,428
Hananasif	43,382	47,274	56,558	78,000
Saranga	121,710	165,786	198,342	243,146
Kwembe	66,507	117,769	151,735	186,010
Msigani	64,417	87,745	104,976	128,689
Mbezi juu	48,321	65,819	78,745	96,532
Makongo	51,191	69,730	83,423	102,267
Mabwepande	29,759	32,429	38,797	53,506

	2015	2020	2025	2030
Wazo	106,162	144,607	173,005	212,084
Ilala Municipal Council	1,426,722	1,880,388	2,208,463	2,607,630
Ukonga	93,548	101,941	128,058	168,198
Pugu	57,767	110,162	131,795	150,026
Msongola	28,591	33,104	39,139	51,407
Tabata	87,363	101,150	119,590	157,076
Kinyerezi	44,844	51,922	61,387	80,629
Ilala	36,332	44,540	44,405	43,549
Mchikichini	29,818	36,554	36,444	35,741
Vingunguti	125,005	144,733	171,118	224,755
Kipawa	86,706	100,390	118,691	155,895
Buguruni	82,504	95,525	112,939	148,340
Kariakoo	16,107	18,649	22,049	28,960
Jangwani	20,627	25,287	25,211	20,604
Gerezani	8,505	10,426	10,395	8,495
Kisutu	9,711	11,905	11,869	9,700
Mchafukoge	12,493	15,315	15,269	12,479
Upanga Mashariki	13,053	16,002	15,953	13,038
Upanga Magharibi	15,752	19,310	19,252	15,734
Kivukoni	7,880	9,661	9,632	7,872
Kiwalani	96,188	144,123	172,426	192,159
Segerea	97,383	145,915	174,569	194,548
Kitunda	66,779	100,059	119,708	133,408
Chanika	51,327	59,427	70,261	92,284
Kivule	84,195	126,154	150,928	168,201
Gongo la Mboto	66,990	77,562	91,702	120,446
Majohe	95,433	142,992	171,072	190,650
Kimanga	91,822	137,582	164,600	183,437
Temeke Municipal Council	1,600,029	2,530,169	3,097,002	3,756,961
Kigamboni	35,646	242,771	290,446	356,054
Vijibweni	33,909	50,807	60,784	67,741
Kibada	10,035	20,503	24,529	30,070
Kisarawe II	9,709	11,902	15,821	19,395
Somangila	22,539	36,842	36,730	45,027
Kimbiji	7,494	9,187	12,212	14,970
Mbagala	61,461	75,347	100,159	122,784

	2015	2020	2025	2030
Chamazi	74,398	111,474	133,365	148,628
Yombo Vituka	90,001	134,853	161,336	179,799
Charambe	119,145	146,063	194,163	238,022
Toangoma	52,105	78,072	93,404	114,503
Miburani	51,769	63,465	84,364	103,421
Temeke	30,445	37,324	49,615	60,822
Mtoni	69,404	103,992	124,414	152,518
Keko	41,101	50,386	66,979	82,109
Kurasini	30,616	45,873	54,882	67,279
Azimio	89,806	134,561	160,986	197,350
Tandika	57,848	70,917	94,271	115,566
Sadali	61,552	75,458	100,307	122,966
Chang'ombe	22,561	27,658	36,767	45,072
Mbagala Kuu	87,400	130,956	156,673	192,064
Makangarawe	62,290	93,332	111,660	136,883
Pembamnazi	11,305	13,859	18,423	22,585
Mjimwema	32,481	48,669	58,226	71,379
Tungi	27,328	40,947	48,988	60,054
Kijichi	80,879	121,186	144,984	177,734
Mianzini	117,644	240,372	287,576	352,536
Kiburugwa	92,236	138,202	165,342	202,690
Buza	64,383	96,469	115,413	141,483
Kilakala	52,539	78,722	94,181	115,456
Coast Region	1,164,038	1,312,404	1,435,358	1,586,267
Bagamoyo District Council	328,991	373,057	407,438	447,424
Kiwangwa	15,478	17,411	17,148	16,887
Msata	14,580	14,761	14,358	11,931
Miono	18,049	20,303	19,996	19,692
Mkange	12,761	11,484	12,567	10,442
Magomeni	31,022	34,896	34,368	33,846
Dunda	15,449	19,117	22,821	31,605
Kiromo	7,724	10,427	19,016	31,603
Zinga	11,873	16,027	29,231	48,578
Yombo	8,767	10,848	11,871	13,152
Vigwaza	17,668	19,875	19,574	19,277
Talawanda	9,793	8,813	8,439	8,014

	2015	2020	2025	2030
Bwilingu	37,298	41,957	41,322	40,694
Lugoba	12,121	13,636	13,429	13,225
Ubenazomozi	16,281	18,315	18,038	17,764
Mbwewe	15,396	17,319	17,057	16,798
kibindu	14,509	14,689	14,288	11,873
Fukayosi	9,687	10,897	10,732	10,569
Kerege	19,109	23,646	35,284	44,304
Pera	13,478	15,161	14,932	14,705
Msoga	10,764	12,109	11,925	11,744
Kimange	7,244	10,186	10,032	9,879
Mandera	9,938	11,179	11,010	10,842
Kibaha District Council	74,502	83,808	91,710	101,607
Gwata	5,603	6,303	6,897	7,641
Dutumi	1,923	2,163	2,367	2,622
Magindu	5,296	5,958	6,519	7,223
Soga	5,001	5,626	6,156	6,821
Kikongo	4,497	5,059	5,536	6,133
Ruvu	3,678	4,137	4,527	5,016
Mlandizi	18,377	20,672	22,622	25,063
Kwala	3,684	4,144	4,535	5,025
Kilangalanga	11,235	12,639	13,831	15,323
Janga	11,594	13,042	14,272	15,812
Bokomnemela	3,613	4,065	4,448	4,928
Kisarawe District Council	107,811	121,276	132,712	147,033
Kisarawe	12,562	14,131	15,463	17,132
Msimbu	11,829	13,306	14,561	16,132
Masaki	7,642	8,597	9,408	10,423
Kibuta	10,766	12,111	13,253	14,683
Marumbo	6,029	6,783	7,422	8,223
Maneromango	8,379	9,425	10,314	11,427
Msanga	5,754	6,472	7,082	7,847
Marui	4,025	4,528	4,955	5,489
Cholesamvula	6,432	7,235	7,917	8,771
Vikumbulu	3,447	3,877	4,243	4,701
Mafizi	6,946	7,814	8,551	9,473
Kurui	3,178	3,575	3,912	4,334

	2015	2020	2025	2030
Mzenga	5,792	6,515	7,129	7,899
Vihingo	3,502	3,939	4,311	4,776
kiluvya	11,528	12,968	14,191	15,722
Mkuranga District Council	236,552	266,098	291,189	322,611
Mkuranga	27,427	30,853	33,762	37,406
Tambani	21,439	24,117	26,391	29,239
Vikindu	36,888	41,495	45,408	50,308
Mbezi	8,233	9,262	10,135	11,229
Shungubweni	3,168	3,563	3,899	4,320
Kisiju	12,854	14,459	15,823	17,530
Magawa	6,210	6,985	7,644	8,469
Kitomondo	5,178	5,825	6,374	7,062
Lukanga	10,988	12,361	13,526	14,986
Nyamato	12,558	14,126	15,458	17,126
Kimanzichana	18,937	21,303	23,311	25,827
Mkamba	15,378	17,299	18,930	20,973
Panzuo	8,021	9,023	9,874	10,939
Bupu	7,684	8,644	9,459	10,479
Mwalusembe	12,422	13,973	15,291	16,941
Vianzi	10,892	12,252	13,407	14,854
Njia nne	7,032	7,911	8,656	9,591
Kiparang'anda	11,243	12,647	13,840	15,333
Rufiji District Council	230,560	259,358	283,813	314,439
Ikwiriri	12,946	14,563	15,936	17,656
Mgomba	9,579	10,775	11,791	13,064
Umwe	11,605	13,054	14,285	15,827
Utete	6,237	7,017	7,678	8,507
Mkongo	4,901	5,514	6,034	6,685
Ngorongo	12,676	14,260	15,604	17,288
Mwaseni	6,782	7,629	8,348	9,249
Kibiti	16,083	18,092	19,797	21,934
Bungu	19,864	22,345	24,452	27,090
Mahege	6,333	7,124	7,796	8,637
Mchukwi	7,429	8,357	9,145	10,132
Chumbi	17,333	19,498	21,336	23,639
Mbwara	10,303	11,590	12,682	14,051

	2015	2020	2025	2030
Mtunda	8,632	9,711	10,626	11,773
Ruaruke	7,671	8,629	9,443	10,462
Salale	9,631	10,834	11,855	13,135
Mbuchi	6,393	7,192	7,870	8,719
Kiongoroni	5,195	5,844	6,395	7,085
Maparoni	6,137	6,903	7,554	8,369
Chemchem	5,447	6,127	6,705	7,428
Ngarambe	2,603	2,928	3,204	3,550
Dimani	5,778	6,500	7,112	7,880
Mtawanya	7,186	8,084	8,846	9,800
Mjawa	12,782	14,378	15,734	17,432
Mlanzi	5,535	6,226	6,813	7,549
Mwambao	5,499	6,186	6,769	7,499
Mafia District Council	49,278	55,433	60,659	67,205
Kanga	3,988	4,486	4,909	5,439
Kirongwe	6,050	6,805	7,447	8,250
Baleni	6,229	7,007	7,668	8,495
Kilindoni	15,091	16,975	18,576	20,581
Miburani	4,357	4,901	5,363	5,942
Kiegeani	4,344	4,887	5,348	5,925
Jibondo	3,957	4,451	4,871	5,397
Ndagoni	5,262	5,920	6,478	7,177
kibaha Town District Council	136,345	153,375	167,837	185,948
Pangani	7,246	8,151	8,919	9,881
Maili Moja	22,927	25,791	28,223	31,268
Tumbi	12,362	13,906	15,218	16,860
Picha ya Ndege	19,094	21,479	23,505	26,041
Mkuza	16,057	18,063	19,766	21,899
Kibaha	12,551	14,119	15,450	17,117
Msangani	6,264	7,046	7,711	8,543
Kongowe	19,631	22,083	24,165	26,773
Misugusugu	6,512	7,326	8,016	8,881
Visiga	9,446	10,626	11,628	12,883
Mbwawa	4,253	4,784	5,235	5,800
Zanzibar total	1,439,144	1,678,772	1,836,236	2,023,705

S-2 Transmission system and Substations

Results of Existing Substation Survey

I. Kinondoni North

1) Makumbusho Substation

Date	9 December, 2016	
Location	S. Lat.6°46′39.50″, E. Long. 39°15′00.75″	
Dimensions	Approx.60m×90m	
Voltage Class	132/33/11 kV	
Specifications of Main Equipment	132 kV Bus	Single Bus System,Aluminum pipe (100mm diameter -6t),600 A
	132 kV Bays	4 Bays occupied
	132/33 kV Transformer (2Units)	45 MVA, 132 kV+/-8*1.25%/33 kV YNyn0+d, %Z=11.6 %
	132 kV Circuit Breaker (CB)	145 kV, 3,150 A, 40 kA
	33 kV Switchgear	Indoor, Single Bus System with Bus coupler CB Gas-insulated Switchgear 14 panels Bus rated current:1,600A CB:36 kV, 1,600 A, 25 kA
	33/11 kV Transformer (2 Units)	15 MVA, 33kV+/-8*1.25%/11 kV YNyn0+d, %Z=10.3 %
	11 kV Switchgear	Indoor, Single Bus System with Bus coupler CB Air-insulated Switchgear 9 panels Bus rated current:1,600A CB:12 kV, 1,600 A, 25 kA
Possibility of Expansion within Substation	132 kV Switchyard	The space for 2 x 132 kV bays can be obtained to extend the bus to the direction ofWest side. However, the bus capacity (600 A) should be considered. Additional 132/33 kV Transformer can be installed next to the 33 kV Capacitors.
	33/11kV Switchgear Room	33kV Switchgear ; Enough space available for Expansion 11 kV Switchgear ; Enough space available for Expansion
	Central Control Room	The space for 4 x 33 kV feeders has already been arranged for future.

		New control panel should be installed for new transformers and 11 kV Switchgear bays.
Outside condition of Substation	North side: Area surrounded with trees. South side: Main asphalted road, Direction of 132 kV Transmission Line (both Ubungo overhead line and New City Center with underground cable) West side: Area surrounded with trees. East side: Factory	
Remarks	➢ Key substation for Msasani peninsula which has big demands. ➢ It is impossible to expand the substation outside the boundary. ➢ The reinforcement of the 132 kV bus capacity should be necessary for additional 132 kV transmission lines. ➢ Additional transmission lines shall be by underground cables.	

2) Tegeta Substation

Date	3 December, 2016	
Location	S. Lat. 6°40′30.53″, E. Long. 39°11′8.22″	
Dimensions	Approx.90m×80m	
Voltage Class	132/33 kV	
Specifications of Main Equipment	132 kV Bus	Single Bus System, Single conductor (Judged as 1,250 A)
	132 kV Bays	10 bays occupied
	132/33 kV Transformer (2 Units)	50 MVA, 132 (+8,-12)*1.25%/33 kV YNyn0+d, %Z=12.1%& 12.0% (65 MVA for future ONAF)
	132 kV CB	145 kV, 3,150 A, 40 kA
	33 kV Switchgear	Indoor,Single Bus System with Bus coupler CB Air-insulated Switchgear 12 panels Bus rated current:1,250A CB:36 kV, 1,250 A, 25 kA
Possibility of Expansion within Substation	132 kV Switchyard	2 bays space is available. However, the bus capacity should be considered.
	33 kV Electrical Room	Each 1 panel space can be available.
Outside condition of Substation	North side: Direction of 132 kV Bus expansion, Approx.20m Open space available South side: Direction of 132 kV Bus expansion, Approx. 3m high steep bank and	

	road West side: Direction of the Transmission lines, Additional transmission lines should be recommended by underground cables and overhead line combination. East side: Main direction of the Distribution lines, Open space (Stockyard for Distribution Lines Facilities)
Remarks	➢ Key substation for power supply to Zanzibar Island and DSM city center. ➢ The reinforcement of the 132 kV bus capacity should be necessary for additional 132 kV transmission lines. ➢ The installation of additional transmission lines should be considered for the method of their installation.

3） Bahari Beach Substation

Date	3 December, 2016	
Location	S. Lat. 6°39′30.08″, E. Long. 39°12′10.60″	
Dimensions	Approx.32m×60m There is Open space next to the substation which TANESCO owns the land (approx.40m×60m).	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Bus	Single Bus System, Aluminum Pipe, Judged as 1,250 A
	33 kV Bays	2 bays occupied
	33/11 kV Transformer (1 unit)	15 MVA, 33 kV (+8,-12)*1.25%/11 kV YNyn0+d11, %Z=9.87 %
	33kVCB	36 kV, 1,600 A, 16.5 kA (Equivalent to the ones at Tandale Substation)
	11kV Switchgear	Indoor, Single Bus System Air-insulated Switchgear 8 panels (Future No. 2 transformer bay are used as feeder bay) Bus rated current: Equivalent to 1,250A CB:12 kV, 630 A, 25 kA
Possibility of Expansion within Substation	Outdoor Switchyard	・ The foundation for 2nd 15 MVA transformer has been already constructed. ・ There are spaces for other 33 kV switchgear bays. ・ There is space for new substation within the boundary (south side).
	Electrical Room	There is no space for 11 kV switchgear and control

		panels in the existing Electrical room.
Outside condition of Substation	North side: Open space (with grasses) South side: Open space (with grasses) West side: Direction of the Distribution lines, Asphalted road East side: Open space (with grasses)	
Remarks	Expansion of the substation or new substation construction can be done within the boundary, using south side open space owned by TANESCO.	

4） Jangwani Beach Substation (under construction by Japan’s Grant Aid)

Date	3 December, 2016	
Location	S. Lat. 6°42′12.49″, E. Long. 39°13′18.87″	
Dimensions	Approx.55m×20m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Switchgear	Indoor, Single Bus System with future Bus tie CB SF_6 Gas-insulated Switchgear 3 panels Bus rated current: 1,600 A Bus CB (future): 36 kV, 1,600 A, 25 kA
	33/11 kV Transformer (1 Unit)	15 MVA, 33kV +/-8*1.25%/11 kV YNyn0+d, %Z=8.16%
	11kV Switchgear	Indoor, Single Bus System with future Bus tie CB Air-insulated Switchgear 4 panels Bus rated current: 1,250A Bus CB (future): 12 kV, 1,250 A, 25 kA
Possibility of Expansion within Substation	Transformer Yard	2nd 15 MVA transformer can be installed.
	Electrical Room	The following switchgear bays are considered for future expansion. ・ 33 kV switchgear - 1 x Bus coupler bay - 1 x Transformer bay - 1 x Feeder bay ・ 11 kV Switchgear - 1 x Bus coupler bay - 1 x Transformer bay - 3 x Feeder bay
Outside condition of	North side: Houses South side: Houses	

Substation	West side: Direction of the Transmission lines, Asphalted road East side: Houses	
Remarks	Substation for residential area.	

5) Mbezi Substation

Date	3 December, 2016	
Location	S. Lat. 6°43′34.57″, E. Long. 39°12′49.31″	
Dimensions	Approx.70m×80m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Bus	Single Bus System, Aluminum Pipe, Judged as 1,600 A
	33 kV Bays	4 Bays occupied
	33/11 kV Transformer (2 Units + Spare 1 unit)	15 MVA, 33 kV (+4,-12)*1.25%/11 kV, Dyn1, %Z=10.43% 15 MVA, 33 kV +/-8*1.25%/11 kV YNyn0 (d1), %Z=9.94% Spare unit; 15 MVA, 33 kV (+4,-12)*1.25%/11 kV, Dyn1, %Z=10.27%
	33 kV CB	36 kV, 1,600 A, 25 kA
	11 kV Switchgear	Indoor, Single Bus System with Isolating device Air-insulated Switchgear 5 panels Bus rated current: Judged as 1,250A CB:12 kV, 1,250 A, 25 kA
Possibility of Expansion within Substation	Outdoor Switchyard	・ Existing switchyard Existing switchyard are installed in space of approx.30m×25m with wire netting fence. Electrical room is located next to the existing switchyard. ・ Spare Transformer is placed inside the fence. ・ 33 kV switchgear bay can be installed within the fence. ・ There are space of approx.35m in north side, approx. 30m in west side and approx. 10m in south side. ・ New substation can be constructed using these spaces, which are occupied by broken transformers, cable drums, distribution materials, etc.
	11 kV Electrical Room	・There is one panel space for each side of 11 kV switchgear panel.

		・There is the space (approx. 5mx3m) which floor level is lower than that of the existing panels in the electrical room.
Outside condition of Substation	North side: Houses, Direction of Distribution line at northeast corner South side: Un-asphalted Road, Direction of the Distribution lines West side: Big Buildings East side: Bagamoyo Road (Main asphalted road)	
Remarks	➢ The parallel operation of the transformers cannot be done, due to different kind of Vector group. Since there is only one panel of 11 kV transformer bay, the cable of the 2nd transformer is supposed to be directly connected to one 11 kV feeder panel. ➢ Although there are open spaces for new substation, it is impossible to apply Overhead transmission lines, since the substation is located in residential area and faced on the city main road.	

6) Mikocheni Substation (under construction by TEDAP)

Date	9 December, 2016	
Location	S. Lat. 6°45'45.82", E. Long. 39°14'13.69"	
Dimensions	Approx.39m×51m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Switchgear	Switchgear is supposed to be equivalent to the one in Oysterbay substation;- Indoor, Single Bus System with Bus coupler CB, SF_6 Gas-insulated Switchgear 11 panels Bus rated current:1,250 A Bus CB:36 kV, 1,250 A, 25 kA
	33/11 kV Transformer (2 Units)	15 MVA, 33 kV (+8/-12)*1.25%/11 kV YNyn0d11, %Z=10.03%& 10.16%
	11kV Switchgear	Switchgear is supposed to be equivalent to the one in Oysterbay substation;- Indoor, Single Bus System with Bus coupler CB Air-insulated Switchgear 14 panels Bus rated current: 1,600A Bus CB: 12 kV, 1,600 A, 25 kA
Possibility of Expansion	Transformer Yard	One transformer can be installed, if the temporary equipment for power supply at present is removed.

within Substation	Electrical Room	33/11 kV Switchgear There are enough space for expansion the panels, as same as Oysterbay substation.
Outside condition of Substation	North side: Houses, Un-asphalted road South side: Factory West side: Direction of the Transmission Lines, Un-asphalted Road East side: Buildings	
Remarks	Future expansion can be done only within the boundary.	

7） Msasani Substation (under construction by Japan's Grant Aid)

Date	9 December, 2016	
Location	S. Lat. 6°44'43.26", E. Long. 39°17'3.98"	
Dimensions	Approx.40m×20m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Switchgear	
	Existing (1993)	Outdoor, No 33 kV Bus, Directly connected to 15 MVA Transformer
	Japan's Grant Aid (2017)	Indoor, Single Bus System SF_6 Gas-insulated Switchgear 3 panels Bus rated current: 1,600 A
	33/11 kV Transformer	
	Existing (1993)	15 MVA, 33kV +/-8*1.25%/11 kV YNyn0+d, %Z=7.64%
	Japan's Grant Aid (2017)	15 MVA, 33kV +/-8*1.25%/11 kV YNyn0+d, %Z=8.11%
	11kV Switchgear	
	Existing (1993)	Outdoor, Single Bus System Air-insulated Switchgear 4 panels
	Japan's Grant Aid (2017)	Indoor, Single Bus System with Bus coupler CB One panel was added to the existing air-insulated Switchgear for connection to new switchgear panels. New 5 panels have been added at new electrical building. Bus rated current : 1,250A Bus CB : 12 kV, 1,250 A, 25 kA
Possibility of	Transformer Yard	2nd 15 MVA Transformer has been installed.

Expansion within Substation	Electrical Room	・33 kV Switchgear There are spaces for switchgear expansion. ・11 kV Switchgear There are spaces for switchgear expansion.
Outside condition of Substation	North side: Buildings (TANESCO Training School) South side: Buildings (TANESCO Training School) West side: Another transformer is installed for emergency as of today. East side: Open space	
Remarks	The substation is located within the boundary of TANESCO Training School which is surrounded by un-asphalted roads, and supply the power to residential houses.	

8） Mwananyamala Substation (under construction by Japan's Grant Aid)

Date	9 December, 2016	
Location	S. Lat. 6°47'2.69", E. Long. 39°14'54.73"	
Dimensions	Approx.38m×25m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Switchgear	Indoor, Single Bus System with future Bus coupler CB SF_6 Gas-insulated Switchgear 3 panels Bus rated current: 1,600 A Bus CB (future): 36 kV, 1,600 A, 25 kA
	33/11 kV Transformer (1unit)	15 MVA, 33kV +/-8*1.25%/11 kV YNyn0+d, %Z=8.20%
	11kV Switchgear	Indoor, Single Bus System with future Bus coupler CB Air-insulated Switchgear 4 panels Bus rated current: 1,250A Bus CB (future): 12 kV, 1,250 A, 25 kA
Possibility of Expansion within Substation	Transformer Yard	2nd 15 MVA transformer can be installed.
	Electrical Room	The following switchgear bays are considered for future expansion. ・ 33 kV switchgear - 1 x Bus coupler bay - 1 x Transformer bay - 1 x Feeder bay ・ 11 kV Switchgear - 1 x Bus coupler bay

		- 1 x Transformer bay - 3 x Feeder bay
Outside condition of Substation	North side: Houses South side: Houses West side: Houses East side: Direction of the Transmission Lines, Un-asphalted Road	
Remarks	Future expansion can be done only within the boundary.	

9) Oysterbay Substation (under construction by TEDAP)

Date	9 December, 2016	
Location	S. Lat. 6°46'40.84", E. Long. 39°15'50.67"	
Dimensions	Approx.32m×77m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Switchgear	Indoor, Single Bus System with Bus coupler CB SF_6 Gas-insulated Switchgear 11 panels Bus rated current: Judged as 1,250A, according to Siemens catalogue, type 8DA10. Bus CB: Judged as 36 kV, 1,250 A, 25 kA
	33/11 kV Transformer (1 Unit)	15 MVA, 33kV (+8/-12)*1.25%/11 kV YNyn0d11, %Z=10.06%
	11kV Switchgear	Indoor, Single Bus System with Bus coupler CB Air-insulated Switchgear 14 panels Bus rated current: Judged as 1,600A Bus CB: Judged as 12 kV, 1,600 A, 25 kA
Possibility of Expansion within Substation	Transformer Yard	2nd transformer will be installed right after the taking over of the substation.
	Electrical Room	・33 kV Switchgear Left side of the panels: approx.4.9m open space Right side of the panels: approx.6.7m open space ・11 kV Switchgear Left side of the panels: approx.4.4m open space Right side of the panels: approx.2.7m open space
Outside condition of Substation	North side: Main City Road South side: Un-asphalted Road West side: Main City Road East side: Mobile Phone Company Building (Airtel)	

Remarks	Future expansion can be done only within the boundary.

II. Kinondoni South Area

1） Ubungo Substation

a） 220/132 kV Substation

Date	5 December, 2016	
Location	S. Lat. 6°47′37.30″, E. Long. 39°12′27.10″	
Dimensions	Approx.180m×185m	
Voltage Class	220/132 kV	
Specifications of Main Equipment	220 kV Bus	Single conductor, Double bus system with Bus coupler CB, 2,000 A
	220 kV Bays	6 Bays occupied
	220/132 kV Transformer (2 Units)	150 MVA, 221.25(+6,-10)*1.41%/132 kV YNa0+d11, %Z=9.20% & 9.30%
	132 kV Bus	Double bus system, Aluminum Pipe, Judged as equivalent to 1,250 A
	132 kV Bays	15 Bays occupied
	132 kV CB	145 kV, 3,150 A, 40 kA
	132 kV Switchgear	Outdoor, Double bus system with Bus coupler CB GIS type switchgears are installed in 3 bays out of 15 Bays.
Possibility of Expansion within Substation	220 kV yard	There is one bay space as of today. 300 MVA transformer will be installed at this bay according to TANESCO information. (COD in end of 2018)
	132 kV Switchyard	No space for 132 kV Bus direction. If GIS type switchgear is applied and use one bus out of Double bus, several expansion may be possible. However, bus capacity should be checked at the time of study.
Outside condition of Substation	North side: TANESCO GCC building, TANESCO Head Quarter, Direction of 132 kV overhead line for Makumbusho South side: Houses West side: Direction of 220/132 kV overhead lines, Additional overhead lines may be impossible East side: Nelson-Mandera Road, Direction of 5 x 132 kV overhead lines	
Remarks	➢ Nation’s 220 kV bulk supply substation, which receives Large hydro power	

	plants in the center of the country ➢ Many large thermal power plants are located around the substation. ➢ 132 kV power supply to the main 132 kV substations in Dar es Salaam

b) 132/33/11 kV Substation

Date	6 December, 2016	
Location	S. Lat. 6°47'41.21", E. Long. 39°12'34.70"	
Dimensions	Approx.85m×85m	
Voltage Class	132/33/11 kV	
Specifications of Main Equipment	132/33 kV Transformer (2 Units；T4 & T5)	90/120 MVA (ONAN/ONAF) 132 kV+/-8*1.25%/ 33 kV, YNyn0d11 %Z=13.55% & 13.57%
	33 kV Switchgear	Indoor, Single Bus System with Bus coupler CB SF_6 Gas-insulated Switchgear 32 panels (ABB made 12 panels and Chinese company made 20 panels) Bus rated current:Judged as 2,500 A Bus CB (Chinese made Bus coupler CB):40.5 kV, 2,500 A, 31.5 kA
	33/11 kV Transformer	
	T11	15 MVA, 33kV +/-8*1.25%/11 kV YNyn0+d11, %Z=10.5%
	T12	15/17.5 MVA(ONAN/ONAF), 33kV +/-8*1.25%/11 kV YNyn0+d11, %Z=11.57%
	11 kV Switchgear	Indoor, Single Bus System Air-insulated Switchgear 17 panels (ABB made 13 panels and Chinese company made 4 panels) Bus rated current:Judged as1,250A Bus CB:12 kV, 1,250 A, 25 kA
Possibility of Expansion within Substation	Transformer Yard	There is an open space approx. 30m x 40m, where the spare transformer is placed at present.
	Electrical Room	33 kV Switchgear Right side of the panel; Approx.4m open space 11 kV Switchgear Left side of the panel; Approx.4m open space
Outside	North side: Simbion power plant (Trailer type), Direction of 33/11 kV	

condition of Substation		Distribution lines in northeast corner along the road
	South side:	River (Bank)
	West side:	Songas power plant, Direction of 132 kV underground cable for 132/33 kVTransformers
	East side:	Main City Road, Direction of 33/11 kV Distribution lines
Remarks	➢ 33 kV bulk supply substation	

2) EPZ (Export Processing Zone) Substation

Date	6 December, 2016	
Location	S. Lat. 6°48'20.39", E. Long. 39°12′33.77″	
Dimensions	Approx.40m×45m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Bus	Single Bus System, Aluminum Pipe, Judged as Equivalent to 1,250 A
	33 kV Bays	5 Bays occupied
	33/11 kV Transformer (4 Units)	5 MVA, 33 kV +/-8*1.25%/11 kV, Dyn11, %Z=7.0%
	33 kV CB	36 kV, 1,600 A, 25 kA
	11 kV Switchgear	Indoor, Single Bus System with Bus coupler CB Air-insulated Switchgear 11 panels Bus rated current: Judged as 1,250A CB:12 kV, 1,250 A, 25 kA
Possibility of Expansion within Substation	Transformer Yard	There is an open space Approx.10m between Unit No.4 Transformer and the east side wall.
	Electrical Room	No space available on 11 kV Switchgear
Outside condition of Substation	North side: Open space, Direction of 33 kV Incoming line South side: Asphalted road West side: Factories East side: Asphalted road	
Remarks	➢ This substation is exclusively use for EPZ works. No power supply to the surrounding areas.	

3) Magomeni Substation

Date	6 December, 2016
Location	S. Lat. 6°48'15.65", E. Long. 39°15'15.90"

Dimensions	Approx.10m×40m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Switchgear	Indoor, Single Bus System Air-insulated Switchgear 2 panels
	33/11 kV Transformer (1 Unit)	15 MVA, 33 kV (+8/-12)*1.25%/11 kV YNyn0d11, %Z=9.73%
	11kV Switchgear	Indoor, Single Bus System Air-insulated Switchgear 5 panels Bus rated current:1,600A Bus CB:12 kV, 800 A, 25 kA
Possibility of Expansion within Substation	Transformer Yard	No space available for Unit 2 Transformer at all
	Electrical Room	33 kV Switchgear； There are space for 1 x incoming panel and 1 x transformer panel 11 kV Switchgear； There are spaces for 11 kV several panels
Outside condition of Substation	North side: Un-asphalted road South side: Buildings West side: Buildings East side: Buildings	
Remarks	➢ Very narrow space with one transformer installed. No more expansion space at all.	

4） Mlimani city Substation (facility upgrading by Mlimani city)

Date	7 December, 2016	
Location	S. Lat. 6°46'47.79", E. Long. 39°12'57.87"	
Dimensions	Approx.50m×17m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Switchgear	Indoor, Single Bus System Air-insulated Switchgear 3 panels(1 panel under installation) Bus rated current:1,250 A Bus CB: 36 kV, 3,150 A, 25 kA
	33/11 kV Transformer (2 Units)	7.5 MVA, 33 kV+/-4*2.5%/11 kV Dyn11, %Z=8.55% (Resister grounded at secondary neutral)

		7.5 MVA, 33 kV+/-4*2.5%/11 kV Dyn11, %Z=8.075% (under installation), (Resister grounded at secondary neutral)
	11kV Switchgear	Indoor, Single Bus System with Bus coupler CB Air-insulated Switchgear 8 panels Bus rated current: 1,250A Bus CB:12 kV, 1,250 A, 25 kA
Possibility of Expansion within Substation	Transformer Yard	No space available
	Electrical Room	33/ kV Switchgear There are space for 2 panels 11 kV Switchgear There are space for several panels
Outside condition of Substation	North side: Forest (South of University of Dar es Salaam) South side: Main City Road (Sam Nujoma Road) West side: Forest (South of University of Dar es Salaam), Direction of 33 kV Distribution lines (to University) East side: Ditto (to Mlimani city)	
Remarks	➢ The construction works (upgrading works) are being done by Mlimani city supermarket. This substation supplies the power for Mlimani city supermarket and University of Dar es Salaam only.	

5） Mburahati Substation (under construction by TEDAP)

Date	7 December, 2016	
Location	S. Lat. 6°48'39.79", E. Long. 39°14'40.57"	
Dimensions	Approx.82m×15m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Switchgear	Judges as same switchgear as Oysterbay substation; Indoor,Single Bus System with Bus coupler CB SF_6 Gas-insulated Switchgear 11 panels Bus rated current: 1,250 A Bus CB: 36 kV, 1,250 A, 25 kA
	33/11 kV Transformer (1 unit)	15 MVA, 33 kV (+8/-12)*1.25%/11 kV YNyn0d11, %Z=10.07%
	11kV Switchgear	Judges as same switchgear as Oysterbay substation; Indoor, Single Bus System with Bus coupler CB Air-insulated Switchgear 14 panels

		Bus rated current: 1,600A Bus CB: 12 kV, 1,600 A, 25 kA
Possibility of Expansion within Substation	Transformer Yard	No space available for 2nd Transformer
	Electrical Room	33/11 kV Switchgear It is supposed that there is enough space for switchgear expansion for both switchgears.
Outside condition of Substation	North side: Un-asphalted Road, There is a material stockyard with approx. 15m width between the fence and the road. This area may be used for expansion. South side: Houses (lower place than the substation) West side: Direction of 33 kV Distribution lines, Open space East side: Open space	
Remarks	➢ The site is directly below 132 kV Ubungo - Ilala Transmission lines (between Tower No. 11 and 12). Hence, the site is very narrow rectangular shape.	

6) Tandale Substation

Date	7 December, 2016	
Location	S. Lat. 6°47'29.67", E. Long. 39°14'23.05"	
Dimensions	Approx.73m×39m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Bus	Single Bus System, Aluminum Pipe, Judged as Equivalent to 1,250 A
	33 kV Bays	3 Bays occupied
	33/11 kV Transformer (1 unit)	15 MVA, 33 kV (+8,-12)*1.25%/11 kV YNyn0+d1, %Z=9.90%
	33kV CB	36 kV, 1,600 A, 16.5 kA
	11kV Switchgear	Indoor, Single Bus System Air-insulated Switchgear 6 panels Bus rated current:Judged as 1,250A CB:12 kV, 1,250 A, 25 kA
Possibility of Expansion within Substation	Outdoor Switchyard	・There is a space for 2nd Transformers. ・There are spaces for 33 kV switchgear expansion at both side of the existing switchgears. ・New substation may be constructed using the open space in west side (approx.25m×29m).
	Electrical Room	No space available for 11kV switchgear expansion in

		existing electrical room.
Outside condition of Substation	North side: Houses South side: Direction of 33 kV Distribution lines, Asphalted road West side: Un-asphalted Road East side: Buildings	
Remarks	New substation may be constructed using the open space in west side (approx.25m×29m).	

III. Ilala Area

1) Ilala Substation (under construction by Japan's Grant Aid)

Date	12 December, 2016	
Location	S. Lat. 6°49′16.97″, E. Long. 39°16′06.96″	
Dimensions	Approx.135m×90m	
Voltage Class	132/33/11 kV	
Specifications of Main Equipment	132 kV Bus	Single Bus System, Single conductor (TAL 510mm^2), Equivalent to 1,000 A
	132 kV Bays	7 Bays occupied
	132/33 kV Transformer (4 Units)	60 MVA, 132 kV+/-8*1.25%/33 kV YNyn0+d, %Z=12.60% 60 MVA, 132 kV+/-8*1.25%/33 kV YNyn0d1, %Z=12.40% 60 MVA, 132 kV+/-8*1.25%/33 kV YNyn0d1, %Z=12.35% 60 MVA, 132 kV+/-8*1.25%/33 kV YNyn0+d, %Z=12.60%
	132 kV CB	145 kV, 3,150 A, 40 kA
	33 kV Switchgear	Indoor, Single Bus System with Bus coupler CB Gas-insulated Switchgear 26 panels Bus rated current: 2,500A CB: 36 kV, 2,500 A, 25 kA
	33/11 kV Transformer (3 Units)	15 MVA, 33kV+/-8*1.25%/11 kV YNyn0d11, %Z=9.746% 15 MVA, 33kV+/-8*1.25%/11 kV YNyn0+d, %Z=9.82% 15 MVA, 33kV+/-8*1.25%/11 kV YNyn0+d, %Z=9.91%

	11 kV Switchgear	Indoor, Single Bus System with Bus coupler CB Air-insulated Switchgear 22 panels Bus rated current: 1,600A CB: 12 kV, 1,600 A, 25 kA
Possibility of Expansion within Substation	132 kV Switchyard	132 kV Switchgear ; Space available for 2 x 132 bays on the west side (need expansion of the 132 kV bus). However, the bus capacity (1,000 A) should be considered for bay expansion. 132/33 kV Transformer ; Space available on the north side next to T5 Transformer 33/11 kV Transformer ; Space available if the existing electrical room is removed.
	33/11kV Switchgear Room	33 kV Switchgear Space on the left side; approx.3.7m Space on the right side; approx.4m 11 kV Switchgear ; Space at both sides; approx.7.5m each
	Central Control Room	Enough space for control panels
Outside condition of Substation	North side: School South side: Factory West side: Direction of 132 kV Transmission lines (both of Overhead lines and Cables), Un-asphalted Road East side: Bank (river)	
Remarks	➢ 132 kV bulk supply substation for City center of Dar es Salaam ➢ Increasing 132 kV bus capacity should be necessary for 132 kV bay expansion. If new 132 kV transmission lines are installed, underground cables should be considered.	

2) City Center Substation

a) 132/33 kV Substation (Finland funded project)

Date	10 December, 2016
Location	S. Lat. 6°48'39.19", E. Long. 39°17'8.13"
Dimensions	Approx.52m×55m (33/11 kV including Substation area)

Voltage Class	132/33 kV	
Specifications of Main Equipment	132 kV GIS	Indoor, Single Bus System with Bus coupler CB SF_6 Gas-insulated Switchgear Bus rated current:2,500 A CB:145 kV, 2,500 A, 31.5 kA
	132/33 kV Transformer (2 Units)	37.5/50 MVA(ONAN/ONAF), 132 kV+/-8*1.25%/33 kV YNyn0+d, %Z=9.41%
	33 kV Switchgear	Indoor, Single Bus System with Bus coupler CB SF_6-insulated Switchgear10 panels Bus rated current: 2,000A CB: 36 kV, 1,250 A, 25 kA (short-time; 1 s.)
Possibility of Expansion within Substation	132 kV GIS	Space for 2 bays available
	132/33 kV Transformer	Space available next to T2 Transformer on the south side
	33 kV Switchgear	Left side; approx.3m Right side; approx.2.5m
Outside condition of Substation	North side: Tower Buildings South side: Asphalted road West side: Under Construction of Tower Buildings East side: Main City Road	
Remarks	➢ Dar es Salaam city center substation	

b) 33/11 kV Substation (under construction by TEDAP)

Date	10 December, 2016	
Location	S. Lat. 6°48'39.19", E. Long. 39°17'8.13"	
Dimensions	Approx.31m×33m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Switchgear	Indoor, Single Bus System with Bus coupler CB SF_6Gas-insulated Switchgear 11 panels Bus rated current: Judged as 1,250 A, according to Siemens catalogue, type 8 DA10. Bus CB: Judged as 36 kV, 1,250 A, 25 kA
	33/11 kV Transformer (2 Units)	15 MVA, 33 kV (+8/-12)*1.25%/11 kV YNyn0d11, %Z=9.97% & 9.93%
	11kV Switchgear	Indoor, Single Bus System with Bus coupler CB

		Air-insulated Switchgear 14 panels Bus rated current: Judged as 1,600A Bus CB: Judged as 12 kV, 1,600 A, 25 kA
Possibility of Expansion within Substation	Transformer Yard	One transformer can be installed, if the temporary equipment for power supply at present is removed.
	Electrical Room	33 kV Switchgear ; Left side; approx.5.2m Right side; approx. 6.4m 11 kV Switchgear ; Both sides; approx. 3.5m each
Outside condition of Substation	North side: 132/33 kV Substation side South side: Asphalted road West side: Direction of 33 kV Distribution lines, Asphalted road East side: Under Construction of new Buildings	
Remarks	➢ Dar es Salaam city center substation	

3) FZ-I Substation (Buguruni Substation-under construction by TEDAP)

Date	12 December, 2016	
Location	S. Lat. 6°50'33.49", E. Long. 39°14'45.14"	
Dimensions	Approx.41m×61m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Switchgear	Switchgear is supposed to be equivalent to the one in Oysterbay substation;- Indoor, Single Bus System with Bus coupler CB SF_6 Gas-insulated Switchgear 11 panels Bus rated current: 1,250 A Bus CB: 36 kV, 1,250 A, 25 kA
	33/11 kV Transformer (1 Unit)	15 MVA, 33 kV (+8/-12)*1.25%/11 kV YNyn0d11, %Z=9.88%
	11kV Switchgear	Switchgear is supposed to be equivalent to the one in Oysterbay substation;- Indoor, Single Bus System with Bus coupler CB Air-insulated Switchgear 14 panels Bus rated current: 1,600A Bus CB: 12 kV, 1,600 A, 25 kA
Possibility of	Transformer Yard	One transformer can be installed, if the temporary

Expansion within Substation		equipment for power supply at present is removed.
	Electrical Room	33/11 kV Switchgear There are enough space for expansion the panels, as same as Oysterbay substation.
Outside condition of Substation	North side: Buildings South side: Buildings West side: Asphalted road East side: Buildings	
Remarks	➢ No expansion works can be available for outside the fence, due to the buildings on three directions.	

4) FZ-II Substation (Gongo la mboto Substation-under construction by TEDAP)

Date	12 December, 2016	
Location	S. Lat. 6°53'0.61", E. Long. 39° 8'59.46"	
Dimensions	Approx.80m×48m	
Voltage Class	132/33/11 kV	
Specifications of Main Equipment	132 kV Bus	Double conductors, Single Bus System, 2,000 A, 25 kA-3s.
	132 kV Bays	3 Bays occupied
	132 kV CB	145kV, 1,600 A, 25 kA
	132/33 kV Transformer (1 unit)	No rating plate The ratings described in the drawing submitted by the TEDAP Contractor; 50/50/17 MVA, 132kV +/-8*1.25%/34.7/11 kV YNyn0d11, %Z=15%
	33 kV Switchgear	Switchgear is supposed to be equivalent to the one in Oysterbay substation;- Indoor, Single Bus System with Bus coupler CB SF_6 Gas-insulated Switchgear 11 panels Bus rated current: 1,250 A Bus CB: 36 kV, 1,250 A, 25 kA
	33/11 kV Transformer (1 Unit)	15 MVA, 33 kV (+8/-12)*1.25%/11 kV YNyn0d11, %Z=10.04%
	11kV Switchgear	Switchgear is supposed to be equivalent to the one in Oysterbay substation;- Indoor, Single Bus System with Bus coupler CB

		Air-insulated Switchgear 14 panels Bus rated current: 1,600A Bus CB: 12 kV, 1,600 A, 25 kA
Possibility of Expansion within Substation	132 kV Switchyard	1 x 132 kV bay space for Kinyerezi power plant
	Transformer Yard	132/33 kV Transformer ; Space available for Unit 2, 50 MVA Transformer 33/11 kV Transformer ; One transformer can be installed, if the temporary equipment for power supply at present is removed.
	Electrical Room	Possibility of the expansion of the equipment was not able to confirm due to doors locked.
Outside condition of Substation	North side: Northwest side is occupied by the Factory. Northeast side is stockyard for transmission line materials, which owns by TANESCO. Direction of 132 kV Transmission line from Kinyerezi Power Plant. South side: Un-asphalted road and railways West side: Factory East side: Direction of 132 kV Transmission lines, Un-asphalted road and Open space	
Remarks	➢ 132kV Switchgear for Mbagala substation and FZ-III substation has been already installed, while the transmission line works are not completed yet. ➢ 132 kV Transmission line from Kinyerezi to FZ-II has been completed up to the location of 73 m north of FZ-II substation. ➢ As mentioned above, since the northeast side area is owned by TANESCO, 132 kV bus can be extended, provided that the remaining transmission lines from Kinyerezi do not interfere the expansion of the 132 kV bus.	

5) FZ-III Substation (Kipawa Substation)

Date	12 December, 2016	
Location	S. Lat. 6°51′37.54″, E. Long. 39°12′29.92″	
Dimensions	Approx.58m×158m	
Voltage Class	132/33/11 kV	
Specifications of Main Equipment	132 kV Bus	Single Bus System, Single conductor, Equivalent to1,250 A
	132 kV Bays	4 Bays occupied
	132/33 kV Transformer	90/117 MVA (ONAN/ONAF),

	(2 Units)	132 kV+/-8*1.25%/33 kV YNyn0d11, %Z=12.33%& 12.45% (Replaced in 2012)
	132 kV CB	For Ubungo substation and Transformers; 145 kV, 3,150 A, 31.5 kA For FZ-II substation; 145 kV, 1,600 A, 25 kA
	33 kV Bus	Single Bus System with Bus coupler CB, Aluminum Pipe, 2,500 A
	33 kV Bays	12 Bays occupied
	33 kV CB	36 kV, 2,500 A, 25 kA
	33/11 kV Transformer (2 Units)	15 MVA, 33kV+/-8*1.25%/11 kV YNyn0+d, %Z=9.82% 15 MVA, 33kV+/-10*1.25%/11 kV YNyn0d11, %Z=14.31%(2012) (Not connected to 33 kV Bus yet)
	11 kV Switchgear	Outdoor, Single Bus System Air-insulated Switchgear 6 panels Bus rated current: Judged as 1,250A CB: 12 kV, 600 A, 25 kA
Possibility of Expansion within Substation	132 kV Switchyard	132 kV Switchgear; Since new house is being constructed at the outside of the west side, 132 kV Bus cannot be extended. (Even, the west side fence is made by concrete) 132/33 kV Transformer； There is a space available at the west side of the existing transformers, however, the road for transportation inside the substation should be demolished. 33/11 kV Transformer； There is a space available at the east side of the existing 11 kV Switchgear, however, the buried power cables should be noted.
	33/11 kV Switchgears	33 kV Switchgear; There are vacant bays and un-used switchgear bays. 11 kV Switchgear；

		Since the equipment is made in 1987, the replacement is recommended.
	Central Control Room	No space available
Outside condition of Substation	North side: Direction of 132 kV Transmission lines, Residential area South side: Main City Road West side: Houses East side: Factory(Water)	
Remarks	➢ Substation is located in front of Tanzania International Airport. ➢ There are many factories and works around the substation. Hence, the substation is very important for their power supply. ➢ Although 132 kV switchgear for FZ-II has already installed, the transmission line for FZ-II has not constructed yet.	

6） Kariakoo Substation (under construction by TEDAP)

Date	10 December, 2016	
Location	S. Lat. 6°49'2.02", E. Long. 39°16'43.85"	
Dimensions	Approx.33m×19m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Switchgear	Indoor, Single Bus System with Bus coupler CB SF_6 Gas-insulated Switchgear 9 panels Bus rated current: 1,250 A Bus CB: 36 kV, 1,250 A, 25 kA
	33/11 kV Transformer (2 Units)	15 MVA, 33kV (+4/-12)*1.25%/11 kV Dyn11, %Z=10.45% (under operation) 15 MVA, 33kV (+4/-12)*1.25%/11 kV Dyn11, %Z=9.90%
	11kV Switchgear	・Since one panel has been added to existing outdoor switchgear panel (Japan's Grant Aid in 1999), the existing switchgear is supposed to use after completion of the substation. Outdoor, Single Bus System Air-insulated Switchgear 9 panels ・Newly installed indoor switchgears Indoor, Single Bus System with Bus coupler CB Air-insulated Switchgear 7 panels Bus rated current: 2,000A

		Bus CB: 12 kV, 2,000 A, 44 kA
Possibility of Expansion within Substation	Transformer Yard	Space available inside the substation
	Electrical Room	・33 kV Switchgear No space available ・11 kV Switchgear Right side of the panel: approx. 2.6m with cable pit (3 panels may be able to be installed)
Outside condition of Substation	North side: Ground (Government open space) South side: Asphalted road West side: Asphalted road East side: Square (Government open space)	
Remarks	➢ Existing 15 MVA Transformer under operation at present will be used after completion of the substation. ➢ The substation within downtown. There are many buildings, many apartments, parks, etc.	

7） Muhimbili Substation (under construction by Japan's Grant Aid)

Date	10 December, 2016	
Location	S. Lat. 6°48'22.93", E. Long. 39°16'18.57"	
Dimensions	Approx.30m×25m The site with irregular shape	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Switchgear	Indoor, Single Bus System with future Bus coupler CB SF_6 Gas-insulated Switchgear 3 panels Bus rated current: 1,600 A Bus CB (future): 36 kV, 1,600 A, 25 kA
	33/11 kV Transformer (1 Unit)	15 MVA, 33kV +/-8*1.25%/11 kV YNyn0+d, %Z=8.12%
	11kV Switchgear	Indoor, Single Bus System with future Bus coupler CB Air-insulated Switchgear 4 panels Bus rated current: 1,250A Bus CB (future): 12 kV, 1,250 A, 25 kA
Possibility of Expansion within Substation	Transformer Yard	Space available for future 2nd Transformer. Since the site shape is irregular, the transportation of the transformer should be considered.
	Electrical Room	The following switchgear bays are considered for

		future expansion. ・ 33 kV switchgear - 1 x Bus coupler bay - 1 x Transformer bay - 1 x Feeder bay ・ 11 kV Switchgear - 1 x Bus coupler bay - 1 x Transformer bay 3 x Feeder bay
Outside condition of Substation	North side: Hospital South side: Ground West side: Swamp East side: Hospital and access road to the substation	
Remarks	The substation for Hospital power supply	

8) Railway Substation (under construction of 33 kV Switchgear replacement by Finland fund)

Date	10 December, 2016	
Location	S. Lat. 6°49'18.41", E. Long. 39°17'4.61"	
Dimensions	Approx.21m×15m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Switchgear	Indoor, Single Bus System with Bus coupler CB SF_6-insulated Switchgear 4 panels Bus rated current: 2,000A CB: 36 kV, 1,250 A, 25 kA (Short-time; 1 s.)
	33/11 kV Transformer (1 unit)	15/17.5 MVA (ONAN/ONAF), 33kV (+8/-12)*1.25%/11 kV YNyn0d11, %Z=9.95% @15 MVA
	11kV Switchgear	Indoor, Single Bus System Air-insulated Switchgear 7 panels Bus rated current: 1,250A CB: 12 kV, 1,250 A, 25 kA (Short-time: 3 s.)
Possibility of Expansion within Substation	Transformer Yard	No space available
	Electrical Room	・33 kV Switchgear Both sides for each 2 panels with cable pit ・11 kV Switchgear Both sides for each 1 panel

Outside condition of Substation	North side: Buildings South side: Asphalted road via TTS parking lot West side: Buildings East side: Asphalted road	
Remarks	➢ The substation located within the boundary of TANESCO Training School ➢ No space available for equipment expansion	

9) Sokoine Substation

Date	10 December, 2016	
Location	S. Lat. 6°48'56.27", E. Long. 39°17'33.62"	
Dimensions	Approx.44m×9m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Switchgear	Indoor, Single Bus System with Bus coupler CB SF_6 Gas-insulated Switchgear 10 panels Bus rated current: 1,250 A Bus CB: 36 kV, 1,250 A, 25 kA
	33/11 kV Transformer (2 Units)	15 MVA, 33kV+/-8*1.25%/11 kV YNyn0+d, %Z=7.52% 15 MVA, 33kV +/-8*1.25%/11 kV YNyn0d11, %Z=7.9121%
	11kV Switchgear	Indoor, Single Bus System with Bus coupler CB Air-insulated Switchgear 13panels Bus rated current: 2,000A Bus CB: 12 kV, 2,000 A, 25kA
Possibility of Expansion within Substation	Transformer Yard	No space available
	Electrical Room	No space available for both 33/11 kV Switchgear
Outside condition of Substation	North side: Buildings South side: Buildings West side: MEM East side: Asphalted road	
Remarks	➢ Renewal works by AfDB fund has been completed and commercial operation has been started in end of 2015. ➢ Due to narrow space, no more expansion works can be done.	

IV. Temeke Area

1) Kurasini Substation (under construction by TEDAP)

Date	13 December, 2016	
Location	S. Lat. 6°51'37.54", E. Long. 39°17'15.34"	
Dimensions	Approx.85m×100m	
Voltage Class	132/33/11 kV	
Specifications of Main Equipment	132 kV Bus	Double conductors, Single Bus System, Supposed as 2,000 A
	132 kV Bays	3 Bays occupied
	132 kV CB	145kV, 1,600 A, 25 kA
	132/33 kV Transformer	1 unit of 50 MVA Transformer will be installed.
	33 kV Switchgear	Indoor, Single Bus System with Bus coupler CB SF_6 Gas-insulated Switchgear 10 panels Bus rated current: 1,250 A Bus coupler CB: 36 kV, 1,250 A, 25 kA
	33/11 kV Transformer (2 Units)	15 MVA, 33 kV (+8/-12)*1.25%/11 kV YNyn0d11, %Z=10.00%
	11kV Switchgear	Indoor, Single Bus System with Bus coupler CB Air-insulated Switchgear 9 panels Bus rated current: 1,250A Bus CB: 12 kV, 1,250 A, 26.3 kA
Possibility of Expansion within Substation	132 kV Switchyard	Space available for future 132 kV transmission line
	Transformer Yard	132/33 kV Transformer； Space available for 2nd 50 MVA Transformer 33/11 kV Transformer； Space available if the existing 33 kV outdoor switchgears are removed, after completion of the new substation.
	Electrical Room	Although the space for 2nd 50 MVA Transformer is planned in the transformer yard, there is no space for 33 kV switchgear expansions. If the 11 kV dummy panel can be removed, the 33 kV switchgear panel can be installed.
Outside condition of Substation	North side: Direction of 132 kV Transmission line for Ubungo, Asphalted road South side: Factory West side: Buildings	

<table>
<tr><td></td><td>East side: Direction of 132 kV Transmission lines Mbagala, Un-asphalted road (There is a canal beyond the road → Tall tower is necessary)</td></tr>
<tr><td>Remarks</td><td>➢ As mentioned in “Possibility of Expansion within Substation”, no coordination is taken between 132 kV and 33 kV plan. At the time of the expansion of the substation, well-consideration should be necessary.</td></tr>
</table>

2) Mbagala Substation

a) 132/33 kV Substation (under construction by TEDAP)

<table>
<tr><td>Date</td><td colspan="2">14 December, 2016</td></tr>
<tr><td>Location</td><td colspan="2">S. Lat. 6°55'20.53", E. Long. 39°15'47.12"</td></tr>
<tr><td>Dimensions</td><td colspan="2">Approx.100m×88m</td></tr>
<tr><td>Voltage Class</td><td colspan="2">132/33 kV</td></tr>
<tr><td rowspan="5">Specifications of Main Equipment</td><td>132 kV Bus</td><td>Double conductors, Single Bus System, Judged as 2,000 A</td></tr>
<tr><td>132 kV Bays</td><td>3 Bays occupied</td></tr>
<tr><td>132 kV CB</td><td>145kV, 1,600 A, 25 kA</td></tr>
<tr><td>132/33 kV Transformer</td><td>50 MVA, 132 kV (+/-8*1.25%)/34.7 kV
YNyn0d11, %Z=14.20%</td></tr>
<tr><td>33 kV Switchgear</td><td>Indoor, Single Bus System with Bus coupler CB
SF_6 Gas-insulated Switchgear 14 panels
Bus rated current: 1,250 A
Bus CB: 36 kV, 1,250 A, 25 kA</td></tr>
<tr><td rowspan="3">Possibility of Expansion within Substation</td><td>132 kV Switchyard</td><td>Space available for future 132 kV transmission line</td></tr>
<tr><td>Transformer Yard</td><td>Space available for 2nd 50 MVA Transformer</td></tr>
<tr><td>Electrical Room</td><td>Only 14 panels of 33 kV Switchgear are installed in the Electrical Room. Space available for future expansion.</td></tr>
<tr><td>Outside condition of Substation</td><td colspan="2">North side: Factory
South side: Residential area
West side: Direction of 132 Transmission lines for FZ-II and Kurasini, Un-asphalted road。
East side: Factory</td></tr>
<tr><td>Remarks</td><td colspan="2">➢ 132 kV Bulk supply substation for the south area of Dar es Salaam
➢ The substation will be connected to the existing 33 kV substation by 33 kV underground cables</td></tr>
</table>

b) 33/11 kV Substation (under construction by TEDAP)

Date	14 December, 2016	
Location	S. Lat. 6°55'20.80", E. Long. 39°15'57.57"	
Dimensions	Approx.37m×38m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Bus	Single conductor Single Bus System
	33 kV Bays	3 Bays occupied
	33/11 kV Transformer (2 Units)	15 MVA, 33 kV +/-8*1.25%/11 kV YNyn0+d, %Z=7.37% 15 MVA, 33 kV +/-8*1.25%/11 kV Dyn11, %Z=10.05%
	33kV CB	New CB: 36 kV, 1,250 A, 25 kA for connection between new 132/33 kV substation Existing: 36 kV, 800 A, 12.5 kA
	11kV Switchgear	Outdoor, Single Bus System Air-insulated Switchgear 6 panels Bus rated current: Judged as 1,200A CB: 12 kV, 600 A, 25 kA
Possibility of Expansion within Substation	33 kV Switchyard	There is an open space in direction of 33 kV bus.
	Electrical Room	New control building is very small (2.8m×1.9m).
Outside condition of Substation	North side: Factory (Container yard) South side: Direction of 33 kV underground cables for new 132/33 kV substation, Un-asphalted road West side: Factory (Container yard) East side: Un-asphalted road	
Remarks	➢ Since the vector group of 2 units of 33/11 kV Transformer is different, each transformer operates independently. ➢ 33 kV switchgear expansion is not necessary, because new 33 kV switchgears will be installed in new 132/33 kV substation.	

3) 132 kV New Kigamboni Substation (proposed)

Date	21 December, 2016
Location	S. Lat. 6°54'29.25", E. Long. 39°26'51.54"
Dimensions	Approx.200m×250m
Voltage Class	132/33 kV

Substation Outline	The substation will be constructed in the southeast side of Kigamboni area, cutting-in at 132 kV transmission line between Kurasini and Mbagala. ・ Cutting-in point: S. Lat. 6°54'29.25", E. Long. 39°26'51.54" ・ Length of the line: approx.15～16 km ・ Land: under negotiation ・ Location: Dege Eco Village

4） Chang’ombe Substation (under construction by TEDAP)

Date	13 December, 2016	
Location	S. Lat. 6°50'36.20", E. Long. 39°15'19.09"	
Dimensions	Approx.27m×51m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Bus	Single Bus System, Aluminum Pipe, Judged as Equivalent to 1,250 A
	33 kV Bays	3 Bays occupied
	33/11 kV Transformer (2 Units)	15 MVA, 33 kV (+8,-12)*1.25%/11 kV YNyn0+d1, %Z=9.4% & 9.5634%
	33kV CB	36 kV, 1,600 A, 16.5 kA (Short-time:20 kA-3s) (supposed to be the one in Tandale substation) New CB for new transformer: 36 kV, 1,250 A, 25kA
	11kV Switchgear	・Existing Indoor, Single Bus System Air-insulated Switchgear 8 panels Bus rated current: Judged as 1,250A CB: 12 kV, 1,250 A, 25 kA ・New Indoor, Single Bus System Air-insulated Switchgear 6 panels (1 panel is going to extend) Bus rated current: Judged as 1,250A CB:12 kV, 1,250 A, 26.3 kA
Possibility of Expansion within Substation	33 kV Switchyard	Space available for 1 bay of 33 kV Switchgear No space for additional transformers
	Electrical Room	No space for additional panels
Outside condition of	North side: Factory South side: Direction of the Transmission Lines, Un-asphalted road	

Substation	West side: Factory East side: Container yard
Remarks	➢ Substation for Industrial area

5) Kigamboni Substation

Date	21 December, 2016	
Location	S. Lat. 6°50'34.44", E. Long. 39°19'5.24"	
Dimensions	Approx.68m×27m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Bus	Single conductor, Single Bus System, Judged as 340 A
	33 kV Bays	3 Bays occupied
	33/11 kV Transformer (1 Unit)	5 MVA, 33 kV +/-8*1.25%/11 kV YNyn0+d, %Z=7.30%
	33kV CB	None (foundation only)
	11kV Switchgear	Indoor, Single Bus System Air-insulated Switchgear 4 panels
Possibility of Expansion within Substation	33 kV Switchyard	Enough space available
	Electrical Room	Space available
Outside condition of Substation	North side: Open space South side: Direction of the Transmission Lines, Un-asphalted road West side: Open space East side: Direction to TANESCO Kigamboni Office	
Remarks	➢ The power supply is conducting without Control and Protection, since there is no CB, CT, PT, etc. in the field. ➢ Although the panels for DCC (Distribution Control Center) are installed, the function cannot achieved due to no monitoring facilities. ➢ It is strongly recommended that the substation should be re-constructed to supply power safely.	

6) Tandika Substation

Date	14 December, 2016
Location	S. Lat. 6°51'57.32", E. Long. 39°15'27.22"
Dimensions	Approx.52m×18m
Voltage Class	33/11 kV

Specifications of Main Equipment	33 kV Bus	Single conductor, Single Bus System
	33 kV Bays	3 Bays occupied
	33/11 kV Transformer (1 unit)	15/17.5 MVA (ONAN/ONAF), 33 kV +/-8*1.25%/11 kV YNyn0d11, %Z=9.35%
	33kV CB	36 kV, 1,600 A, 25 kA
	11kV Switchgear	Indoor, Single Bus System Air-insulated Switchgear 6 panels Bus rated current:1,250A CB: 12 kV, 1,250 A, 25 kA
Possibility of Expansion within Substation	33 kV Switchyard	Space available for 2nd Transformer
	Electrical Room	No space available
Outside condition of Substation	North side: Un-asphalted road＋Houses South side: Un-asphalted road West side: Public Buses terminal East side: Un-asphalted road	
Remarks	➢ Although 2nd Transformer can be installed, there is no space for associated switchgears for the transformer. Hence, there is no chance to extend the substation equipment.	

7） TOL(Tanzania Oxygen Limited) Substation

Date	14 December, 2016	
Location	S. Lat. 6°50'3.92", E. Long. 39°16'0.70"	
Dimensions	Approx.18m×41m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Bus	Single Bus System, Aluminum Pipe, 1,000A
	33 kV Bays	3 Bays occupied
	33/11 kV Transformer (1 unit)	15MVA, 33 kV +8,-12*1.25%/11 kV YNyn0+d, %Z=9.16%
	33kV CB	40.5 kV, 1,250 A, 25 kA
	11kV Switchgear	Indoor, Single Bus System Air-insulated Switchgear 7 panels Bus rated current: 1,250A CB: 12 kV, 1,250 A, 25 kA

Possibility of Expansion within Substation	33 kV Switchyard	Space available for 2nd Transformer
	Electrical Room	Space with 2.3m available at the left side of the 11 kV Switchgear
Outside condition of Substation	North side: Open space South side: Area surrounded by trees West side: Parking East side: Buildings	
Remarks	➢ Since the substation is located on the premises of TOL (Tanzania Oxygen Limited), the expansion of the substation may not be achieved.	

V. Coast Area

1） Chalinze Substation

a） 132/33 kV Substation (existing)

Date	16 December, 2016	
Location	S. Lat. 6°38'21.65", E. Long. 38°21'25.64"	
Dimensions	Approx.71m×92m	
Voltage Class	132/33 kV	
Specifications of Main Equipment	132 kV Bus	Single conductor, Single Bus System, Judged as 1,000 A
	132 kV Bays	4 Bays occupied
	132 kV CB	145kV, 3,150/2,500 A, 31.5 kA
	132/33 kV Transformer (1 unit)	45/55 MVA (ONAN/ONAF), 132 kV (+/-8*1.25%)/33 kV YNyn0+d, %Z=12.205% @55MVA
	33 kV Bus	Single conductor, Single Bus System, Judged as 1,000 A
	33 kV Bays	4 Bays occupied
	33 kV CB	36 kV, 1,250 A, 25 kA
Possibility of Expansion within Substation	132 kV Switchyard	132 kV Switchyard
	33 kV yard	132 kV Switchyard
	Electrical Room	No space available in the Electrical Room
Outside condition of Substation	North side: Main City Road (A7) South side: Open space (with grasses) West side: Direction of 132 kV transmission lines for Hale and Morogoro substations, Open space (with grasses)	

	East side: Direction of 132 kV transmission lines for Hale and Mlandizi, Open space (with grasses)
Remarks	➢ To study how to connect with new 400 kV Chalinze substation, since existing substation are approx. 3 km far from new substation.

b) New Chalinze 400 kV Substation (construction schedule)

Date	16 December, 2016
Location	S. Lat. 6°38'38.35", E. Long. 38°23'14.07"
Dimensions	Approx.300m×300m
Voltage Class	400/220/132 kV
Substation Outline	This is the one of the substation which TANESCO plans to construct by Chinese fund. The construction of the substation has not started yet. ・Site: At the tower of No. HS322 of 132 kV transmission line between Ubungo and Chalinze ・Substation configuration: 400 kV: 1-1/2 Bus System 220/132 kV: Double bus system ・Connection: To study how to connect with new 400 kV Chalinze substation, since existing substation are approx. 3 km far from new substation.

2) Mlandizi Substation

Date	16 December, 2016	
Location	S. Lat. 6°42'42.97", E. Long. 38°44'37.74"	
Dimensions	Approx.71m×92m	
Voltage Class	132/33 kV	
Specifications of Main Equipment	132 kV Bus	Single conductor, Single Bus System, Judged as 406 A (Wolf conductor)
	132 kV Bays	4 Bays occupied
	132 kV CB	145kV, 3,150/1,250 A, 40/31.5/25 kA
	132/33 kV Transformer (4 Units)	2×10 MVA, 132 kV (+/-8*1.25%)/33 kV YNyn0+d, %Z=9.7% 1×20 MVA, 132 kV (+/-8*1.25%)/33 kV YNyn0+d, %Z=9.65% 1×15/20 MVA (ONAN/ONAF),

		132 kV (+/-8*1.25%)/33 kV YNyn0d11, %Z=4.74%
	33 kV Bus	Single conductor, Single Bus System, Judged as 1,000 A
	33 kV Bays	11 Bays occupied
	33 kV CB	36 kV, 1,250 A, 25 kA
Possibility of Expansion within Substation	132 kV Switchyard	Space available (approx.47m×50m)
	33 kV Switchyard	No space available
	Electrical Room	Space available for several panels
Outside condition of Substation	North side: Open space (Area surrounded by trees, lower leveled) South side: Open space (Area surrounded by trees) West side: Direction for 132 kV transmission line for Chalinze substation, Open space (with Grasses) East side: Direction for 132 kV transmission line for Ubungo substation, Un-asphalted road	
Remarks	➢ The substation was constructed directly tapped with 132 kV transmission line. This is by emergency measures to supply power. ➢ There is inconsistency between 132 kV bays for installation of the 132 kV equipment like CB, DS, etc. ➢ TANESCO is going to re-construct the substation, cutting-in the 132 kV transmission line in near future.	

3) Zinga 220 kV Substation (construction schedule area)

Date	20 December, 2016
Location	S. Lat. 6°31'0.23", E. Long. 38°57'52.49"
Dimensions	Approx.200m×200m
Voltage Class	220/33 kV
Substation Outline	This is also the one of the substation which TANESCO plans to construct by Chinese fund, same as Chalinze substation. The construction of the substation has not started yet. This substation will be upgraded to 400 kV in accordance with PSMP 2016. ・Site: At the point of approx. 10 km far from Bagamoyo city and along the Bagamoyo road. ・Substation configuration: 220/132 kV: Double bus system

4） Lawer Ruvu Substation

Date	20 December, 2016	
Location	S. Lat. 6°32'51.19", E. Long. 38°49'33.31"	
Dimensions	Approx.34m×34m	
Voltage Class	33/3.3 kV	
Specifications of Main Equipment	33 kV Bus	Single conductor, Single Bus System, Judged as 400A
	33 kV Bays	4 Bays occupied
	33/3.3 kV Transformer (2 Units)	6MVA,33 kV +4,-17*1.25%/3.3 kV Dyn11, %Z=7.15%
	33kV CB	36 kV, 800 A, 25 kA
	3.3 kV Switchgear	Indoor, Single Bus System Air-insulated Switchgear 12 panels
Possibility of Expansion within Substation	33 kV Switchyard	Space available
	Electrical Room	Space available at the right side of the 3.3 kV switchgears
Outside condition of Substation	North side: Cliff South side: Parking lot West side: Open space East side: Open space	
Remarks	➢ This is the exclusive use for DAWASCO factory.	

5） Mbegani Substation

Date	20 December, 2016	
Location	S. Lat. 6°28'30.07", E. Long. 38°58'7.94"	
Dimensions	Approx.7m×18m	
Voltage Class	33/0.2 kV	
Specifications of Main Equipment	33 kV Bus	None
	33/0.2 kV Transformer (1 unit)	No rating plates, 500kVA, 33 kV/200 V (TANESCO's information)
	33 kV CB	Out of order
	200 V AC Distribution Panel	Outdoor, 2 circuits
Possibility of Expansion within	33 kV Switchyard	No space available
	Electrical Room	None

Substation		
Outside condition of Substation	North side: Grasses South side: Grasses West side: Grasses East side: Grasses	
Remarks	➢ This is the exclusive use for the school of FETA (Fishery Education Training Association). ➢ It is better to use pole transformer to supply the power, due to very small load like lightings, air-conditions, etc.	

6） Mwanamakuka Substation

Date	20 December, 2016
Location	S. Lat. 6°26'46.30", E. Long. 38°54'37.67"
Dimensions	Approx.13m×10m
Voltage Class	33 kV
Outside condition of Substation	North side: Grasses South side: Grasses West side: Grasses East side: Grasses
Remarks	➢ All equipment are not used and becomes relay point of the Distribution lines at present. ➢ Pole mounted switch/protection devices, wires etc. are cut-off and left. ➢ There is 11 kV Distribution line, which is not utilized.

7） Tumbi Substation

Date	20 December, 2016	
Location	S. Lat. 6°46'56.32", E. Long. 38°57'46.82"	
Dimensions	Approx.24m×21m	
Voltage Class	33/11 kV	
Specifications of Main Equipment	33 kV Bus	None
	33/11 kV Transformer (2 Units)	1 MVA,33 kV+/-2.5%, +/-5%/11 kV Dyn11, %Z=6.36% 500 kVA, 33 kV+3*2.5%, -2.5%, -5%. -9%/11kV YNyn0, %Z=4.99%
	33kV CB	None, PAS on the pole

	11 kV Bus	Directly connected to Distribution lines from Transformers
	11 kV CB	Load break switches with Fuse
Possibility of Expansion within Substation	33/11 kV Switchyard	132 kV Switchyard
Outside condition of Substation	North side: Grasses South side: 11 kV Direction of the Transmission Lines, Un-asphalted road West side: 33kV Direction of the Transmission Lines, Grasses (levels lower) East side: 33/11 kV Direction of Distribution lines, Grasses (levels higher)	
Remarks	➢ Suitable power supply cannot be achieved, since the Arc-shoots of Load break switches are dropped off. ➢ It is recommended that the suitable substation should be constructed for suitable power supply.	

Electricity Demand Forecast and Required Capacity of Existing 132/33kV Transformer

			Unit		2020											
					Tegeta SS	Ubungo SS	Makumbusho SS	NCC SS	Ilala SS	FZ II SS	FZ III SS	Kurasini SS	Mbagala SS	Mlandizi SS	Chalinze SS	Zinga SS
		Existing Tr Capacity	MVA		100	240	90	100	240	50	234	50		60	55	
		Required Capacity Total	MW	**1,193**	130.6	209.1	104.9	50.6	143.1	59.9	195.6	116.3	122.8	35.6	9.4	14.9
		(Calculated as pf = 0.9)	MVA	**1,325**	**145.1**	**232.4**	**116.5**	**56.2**	**159.0**	**66.6**	**217.3**	**129.2**	**136.4**	**39.6**	**10.4**	**16.5**
DSM		Dar es Salaam Region	MW	1,113												
1		Kinondoni Municipal C	MW	445												
	(1)	Magomeni	MW	5.69	-	1 5.69	-	-	-	-	-	-	-	-	-	-
	(2)	Makurumla	MW	9.10	-	1 9.10	-	-	-	-	-	-	-	-	-	-
	(3)	Ndugumbi	MW	4.41	-	1 4.41	-	-	-	-	-	-	-	-	-	-
	(4)	Tandale	MW	9.84	-	1 9.84	-	-	-	-	-	-	-	-	-	-
	(5)	Mwananyamala	MW	11.22	-	-	1 11.22	-	-	-	-	-	-	-	-	-
	(6)	Msasani	MW	27.13	-	-	1 27.13	-	-	-	-	-	-	-	-	-
	(7)	Kinondoni	MW	4.71	-	-	1 4.71	-	-	-	-	-	-	-	-	-
	(8)	Mzimuni	MW	2.57	-	1 2.57	-	-	-	-	-	-	-	-	-	-
	(9)	Kigogo	MW	6.90	-	1 6.90	-	-	-	-	-	-	-	-	-	-
	(10)	Mabibo	MW	10.26	-	1 10.26	-	-	-	-	-	-	-	-	-	-
	(11)	Manzese	MW	8.44	-	1 8.44	-	-	-	-	-	-	-	-	-	-
	(12)	Ubungo	MW	20.11	-	1 20.11	-	-	-	-	-	-	-	-	-	-
	(13)	Kibamba	MW	3.46	-	1 3.46	-	-	-	-	-	-	-	-	-	-
	(14)	Goba	MW	17.75	1 17.75	-	-	-	-	-	-	-	-	-	-	-
	(15)	Kawe	MW	17.87	-	1 17.87	-	-	-	-	-	-	-	-	-	-
	(16)	Kunduchi	MW	41.61	1 41.61	-	-	-	-	-	-	-	-	-	-	-
	(17)	Mbweni	MW	6.11	1 6.11	-	-	-	-	-	-	-	-	-	-	-
	(18)	Bunju	MW	21.72	1 21.72	-	-	-	-	-	-	-	-	-	-	-
	(19)	Makuburi	MW	6.87	-	1 6.87	-	-	-	-	-	-	-	-	-	-
	(20)	Mburahati	MW	4.08	-	1 4.08	-	-	-	-	-	-	-	-	-	-
	(21)	Makumbusho	MW	15.11	-	-	1 15.11	-	-	-	-	-	-	-	-	-
	(22)	Sinza	MW	4.85	-	1 4.85	-	-	-	-	-	-	-	-	-	-
	(23)	Kijitonyama	MW	12.90	-	-	1 12.90	-	-	-	-	-	-	-	-	-
	(24)	kimara	MW	11.46	-	1 11.46	-	-	-	-	-	-	-	-	-	-
	(25)	Mikocheni	MW	25.58	-	-	1 25.58	-	-	-	-	-	-	-	-	-
	(26)	Mbezi	MW	16.48	-	1 16.48	-	-	-	-	-	-	-	-	-	-
	(27)	Hananasif	MW	8.23	-	-	1 8.23	-	-	-	-	-	-	-	-	-
	(28)	Saranga	MW	15.58	-	1 15.58	-	-	-	-	-	-	-	-	-	-
	(29)	Kwembe	MW	11.07	-	1 11.07	-	-	-	-	-	-	-	-	-	-
	(30)	Msigani	MW	16.49	-	1 16.49	-	-	-	-	-	-	-	-	-	-
	(31)	Mbezi juu	MW	11.46	-	1 11.46	-	-	-	-	-	-	-	-	-	-
	(32)	Makongo	MW	12.15	-	1 12.15	-	-	-	-	-	-	-	-	-	-
	(33)	Mabwepande	MW	5.65	1 5.65	-	-	-	-	-	-	-	-	-	-	-
	(34)	Wazo	MW	37.78	1 37.78	-	-	-	-	-	-	-	-	-	-	-
2		Ilala Municipal Counci	MW	369.65												
	(1)	Ukonga	MW	9.76	-	-	-	-	-	1 9.76	-	-	-	-	-	-
	(2)	Pugu	MW	14.39	-	-	-	-	-	1 14.39	-	-	-	-	-	-
	(3)	Msongola	MW	2.16	-	-	-	-	-	0.5 1.08	-	-	0.5 1.08	-	-	-
	(4)	Tabata	MW	6.45	-	-	-	-	-	-	1 6.45	-	-	-	-	-
	(5)	Kinyerezi	MW	6.63	-	-	-	-	-	-	1 6.63	-	-	-	-	-
	(6)	Ilala	MW	46.64	-	-	-	-	1 46.64	-	-	-	-	-	-	-
	(7)	Mchikichini	MW	25.52	-	-	-	-	1 25.52	-	-	-	-	-	-	-
	(8)	Vingunguti	MW	18.80	-	-	-	-	-	-	1 18.80	-	-	-	-	-
	(9)	Kipawa	MW	19.56	-	-	-	-	-	-	1 19.56	-	-	-	-	-
	(10)	Buguruni	MW	18.61	-	-	-	-	1 18.61	-	-	-	-	-	-	-
	(11)	Kariakoo	MW	19.53	-	-	-	-	1 19.53	-	-	-	-	-	-	-
	(12)	Jangwani	MW	17.65	-	-	-	1 17.65	-	-	-	-	-	-	-	-
	(13)	Gerezani	MW	7.28	-	-	-	-	1 7.28	-	-	-	-	-	-	-
	(14)	Kisutu	MW	8.31	-	-	-	1 8.31	-	-	-	-	-	-	-	-
	(15)	Mchafukoge	MW	10.69	-	-	-	-	1 10.69	-	-	-	-	-	-	-
	(16)	Upanga Mashariki	MW	11.17	-	-	-	1 11.17	-	-	-	-	-	-	-	-
	(17)	Upanga Magharibi	MW	13.48	-	-	-	1 13.48	-	-	-	-	-	-	-	-
	(18)	Kivukoni	MW	12.14	-	-	-	-	1 12.14	-	-	-	-	-	-	-
	(19)	Kiwalani	MW	24.34	-	-	-	-	-	-	1 24.34	-	-	-	-	-
	(20)	Segerea	MW	9.31	-	-	-	-	-	-	1 9.31	-	-	-	-	-
	(21)	Kitunda	MW	13.00	-	-	-	-	-	-	1 13.00	-	-	-	-	-
	(22)	Chanika	MW	3.88	-	-	-	-	-	1 3.88	-	-	-	-	-	-
	(23)	Kivule	MW	16.39	-	-	-	-	-	-	1 16.39	-	-	-	-	-
	(24)	Gongo la Mboto	MW	11.15	-	-	-	-	-	1 11.15	-	-	-	-	-	-
	(25)	Majohe	MW	14.01	-	-	-	-	-	1 14.01	-	-	-	-	-	-
	(26)	Kimanga	MW	8.78	-	-	-	-	-	-	1 8.78	-	-	-	-	-
3		Temeke Municipal Cou	MW	298.99												
	(1)	Kigamboni	MW	23.41	-	-	-	-	-	-	-	1 23.41	-	-	-	-
	(2)	Vijibweni	MW	7.35	-	-	-	-	-	-	-	1 7.35	-	-	-	-
	(3)	Kibada	MW	2.97	-	-	-	-	-	-	-	1 2.97	-	-	-	-
	(4)	Kisarawe II	MW	1.15	-	-	-	-	-	-	-	1 1.15	-	-	-	-
	(5)	Somangila	MW	19.54	-	-	-	-	-	-	-	1 19.54	-	-	-	-
	(6)	Kimbiji	MW	0.89	-	-	-	-	-	-	-	1 0.89	-	-	-	-
	(7)	Mbagala	MW	14.53	-	-	-	-	-	-	-	-	1 14.53	-	-	-
	(8)	Chamazi	MW	10.75	-	-	-	-	-	-	-	-	1 10.75	-	-	-
	(9)	Yombo Vituka	MW	13.00	-	-	-	-	-	-	1 13.00	-	-	-	-	-
	(10)	Charambe	MW	14.08	-	-	-	-	-	-	-	-	1 14.08	-	-	-
	(11)	Toangoma	MW	7.53	-	-	-	-	-	-	-	0.5 3.76	0.5 3.76	-	-	-
	(12)	Miburani	MW	6.12	-	-	-	-	-	-	0.6 3.67	0.4 2.45	-	-	-	-
	(13)	Temeke	MW	3.60	-	-	-	-	-	-	-	1 3.60	-	-	-	-
	(14)	Mtoni	MW	10.03	-	-	-	-	-	-	-	1 10.03	-	-	-	-
	(15)	Keko	MW	4.86	-	-	-	-	-	-	-	1 4.86	-	-	-	-
	(16)	Kurasini	MW	24.33	-	-	-	-	-	-	-	1 24.33	-	-	-	-
	(17)	Azimio	MW	12.97	-	-	-	-	-	-	1 12.97	-	-	-	-	-
	(18)	Tandika	MW	6.84	-	-	-	-	-	-	1 6.84	-	-	-	-	-
	(19)	Sadali	MW	7.28	-	-	-	-	-	-	1 7.28	-	-	-	-	-
	(20)	Chang'ombe	MW	5.33	-	-	-	-	0.5 2.67	-	0.5 2.67	-	-	-	-	-
	(21)	Mbagala Kuu	MW	16.42	-	-	-	-	-	-	-	-	1 16.42	-	-	-
	(22)	Makangarawe	MW	9.00	-	-	-	-	-	-	1 9.00	-	-	-	-	-
	(23)	Pembamnazi	MW	1.34	-	-	-	-	-	-	-	1 1.34	-	-	-	-
	(24)	Mjimwema	MW	4.69	-	-	-	-	-	-	-	1 4.69	-	-	-	-
	(25)	Tungi	MW	5.92	-	-	-	-	-	-	-	1 5.92	-	-	-	-
	(26)	Kijichi	MW	11.69	-	-	-	-	-	-	-	-	1 11.69	-	-	-
	(27)	Mianzini	MW	23.18	-	-	-	-	-	-	-	-	1 23.18	-	-	-
	(28)	Kiburugwa	MW	13.33	-	-	-	-	-	-	-	-	1 13.33	-	-	-
	(29)	Buza	MW	9.30	-	-	-	-	-	-	1 9.30	-	-	-	-	-
	(30)	Kilakala	MW	7.59	-	-	-	-	-	-	1 7.59	-	-	-	-	-
Pwani		Pwani Region	MW	99.74												
1		Bagamoyo District Cou	MW	25.14												
	(1)	Kiwangwa	MW	0.72	-	-	-	-	-	-	-	-	-	-	1 0.72	-
	(2)	Msata	MW	0.61	-	-	-	-	-	-	-	-	-	-	1 0.61	-
	(3)	Miono	MW	0.84	-	-	-	-	-	-	-	-	-	-	1 0.84	-
	(4)	Mkange	MW	0.48	-	-	-	-	-	-	-	-	-	-	-	-
	(5)	Magomeni	MW	1.45	-	-	-	-	-	-	-	-	-	-	-	1 1.45
	(6)	Dunda	MW	0.79	-	-	-	-	-	-	-	-	-	-	-	1 0.79
	(7)	Kiromo	MW	1.30	-	-	-	-	-	-	-	-	-	-	-	1 1.30
	(8)	Zinga	MW	2.66	-	-	-	-	-	-	-	-	-	-	-	1 2.66
	(9)	Yombo	MW	6.75	-	-	-	-	-	-	-	-	-	-	-	1 6.75
	(10)	Vigwaza	MW	0.82	-	-	-	-	-	-	-	-	-	1 0.82	-	-
	(11)	Talawanda	MW	0.37	-	-	-	-	-	-	-	-	-	-	1 0.37	-
	(12)	Bwilingu	MW	1.74	-	-	-	-	-	-	-	-	-	-	1 1.74	-
	(13)	Lugoba	MW	0.57	-	-	-	-	-	-	-	-	-	-	1 0.57	-
	(14)	Ubenazomozi	MW	0.76	-	-	-	-	-	-	-	-	-	-	1 0.76	-
	(15)	Mbwewe	MW	0.72	-	-	-	-	-	-	-	-	-	-	1 0.72	-
	(16)	kibindu	MW	0.61	-	-	-	-	-	-	-	-	-	-	-	-
	(17)	Fukayosi	MW	0.45	-	-	-	-	-	-	-	-	-	-	-	1 0.45
	(18)	Kerege	MW	1.47	-	-	-	-	-	-	-	-	-	-	-	1 1.47
	(19)	Pera	MW	0.63	-	-	-	-	-	-	-	-	-	-	1 0.63	-
	(20)	Msoga	MW	0.50	-	-	-	-	-	-	-	-	-	-	1 0.50	-
	(21)	Kimange	MW	0.42	-	-	-	-	-	-	-	-	-	-	1 0.42	-
	(22)	Mandera	MW	0.46	-	-	-	-	-	-	-	-	-	-	1 0.46	-
2		Kibaha District Counci	MW	9.54												
	(1)	Gwata	MW	0.52	-	-	-	-	-	-	-	-	-	-	1 0.52	-
	(2)	Dutumi	MW	0.18	-	-	-	-	-	-	-	-	-	1 0.18	-	-
	(3)	Magindu	MW	0.49	-	-	-	-	-	-	-	-	-	-	1 0.49	-
	(4)	Soga	MW	0.47	-	-	-	-	-	-	-	-	-	1 0.47	-	-
	(5)	Kikongo	MW	0.42	-	-	-	-	-	-	-	-	-	1 0.42	-	-
	(6)	Ruvu	MW	0.34	-	-	-	-	-	-	-	-	-	1 0.34	-	-
	(7)	Mlandizi	MW	4.29	-	-	-	-	-	-	-	-	-	1 4.29	-	-
	(8)	Kwala	MW	0.34	-	-	-	-	-	-	-	-	-	1 0.34	-	-
	(9)	Kilangalanga	MW	1.05	-	-	-	-	-	-	-	-	-	1 1.05	-	-
	(10)	Janga	MW	1.08	-	-	-	-	-	-	-	-	-	1 1.08	-	-
	(11)	Bokomnemela	MW	0.34	-	-	-	-	-	-	-	-	-	1 0.34	-	-
3		Kisarawe District Cour	MW	10.25												
	(1)	Kisarawe	MW	2.79	-	-	-	-	-	1 2.79	-	-	-	-	-	-
	(2)	Msimbu	MW	0.87	-	-	-	-	-	-	-	-	-	-	-	-
	(3)	Masaki	MW	0.57	-	-	-	-	-	1 0.57	-	-	-	-	-	-
	(4)	Kibuta	MW	0.80	-	-	-	-	-	1 0.80	-	-	-	-	-	-
	(5)	Marumbo	MW	0.45	-	-	-	-	-	1 0.45	-	-	-	-	-	-
	(6)	Maneromango	MW	0.62	-	-	-	-	-	1 0.62	-	-	-	-	-	-
	(7)	Msanga	MW	0.43	-	-	-	-	-	1 0.43	-	-	-	-	-	-
	(8)	Marui	MW	0.30	-	-	-	-	-	-	-	-	-	-	-	-
	(9)	Cholesamvula	MW	0.48	-	-	-	-	-	-	-	-	-	-	-	-
	(10)	Vikumbulu	MW	0.25	-	-	-	-	-	-	-	-	-	-	-	-
	(11)	Mafizi	MW	0.51	-	-	-	-	-	-	-	-	-	-	-	-
	(12)	Kurui	MW	0.23	-	-	-	-	-	-	-	-	-	-	-	-
	(13)	Mzenga	MW	0.43	-	-	-	-	-	-	-	-	-	1 0.43	-	-
	(14)	Vihingo	MW	0.26	-	-	-	-	-	-	-	-	-	1 0.26	-	-
	(15)	kiluvya	MW	1.28	-	-	-	-	-	-	-	-	-	1 1.28	-	-
4		Mkuranga District Cou	MW	21.15												
	(1)	Mkuranga	MW	3.20	-	-	-	-	-	-	-	-	1 3.20	-	-	-
	(2)	Tambani	MW	1.67	-	-	-	-	-	-	-	-	1 1.67	-	-	-
	(3)	Vikindu	MW	4.31	-	-	-	-	-	-	-	-	1 4.31	-	-	-
	(4)	Mbezi	MW	0.64	-	-	-	-	-	-	-	-	-	-	-	-
	(5)	Shungubweni	MW	0.25	-	-	-	-	-	-	-	-	-	-	-	-
	(6)	Kisiju	MW	1.00	-	-	-	-	-	-	-	-	-	-	-	-
	(7)	Magawa	MW	0.48	-	-	-	-	-	-	-	-	-	-	-	-
	(8)	Kitomondo	MW	0.40	-	-	-	-	-	-	-	-	1 0.40	-	-	-
	(9)	Lukanga	MW	0.85	-	-	-	-	-	-	-	-	-	-	-	-
	(10)	Nyamato	MW	0.98	-	-	-	-	-	-	-	-	-	-	-	-
	(11)	Kimanzichana	MW	1.47	-	-	-	-	-	-	-	-	1 1.47	-	-	-
	(12)	Mkamba	MW	1.20	-	-	-	-	-	-	-	-	-	-	-	-
	(13)	Panzuo	MW	0.62	-	-	-	-	-	-	-	-	-	-	-	-
	(14)	Bupu	MW	0.60	-	-	-	-	-	-	-	-	-	-	-	-
	(15)	Mwalusembe	MW	1.21	-	-	-	-	-	-	-	-	1 1.21	-	-	-
	(16)	Vianzi	MW	0.85	-	-	-	-	-	-	-	-	1 0.85	-	-	-
	(17)	Njia nne	MW	0.55	-	-	-	-	-	-	-	-	-	-	-	-
	(18)	Kiparang'anda	MW	0.87	-	-	-	-	-	-	-	-	1 0.87	-	-	-
5		Rufiji District Council	MW	4.17												
6		Mafia District Council	MW	4.00												
7		kibaha Town District C	MW	25.48												
	(1)	Pangani	MW	1.35	-	-	-	-	-	-	-	-	-	1 1.35	-	-
	(2)	Maili Moja	MW	4.28	-	-	-	-	-	-	-	-	-	1 4.28	-	-
	(3)	Tumbi	MW	2.31	-	-	-	-	-	-	-	-	-	1 2.31	-	-
	(4)	Picha ya Ndege	MW	3.57	-	-	-	-	-	-	-	-	-	1 3.57	-	-
	(5)	Mkuza	MW	3.00	-	-	-	-	-	-	-	-	-	1 3.00	-	-
	(6)	Kibaha	MW	2.35	-	-	-	-	-	-	-	-	-	1 2.35	-	-
	(7)	Msangani	MW	1.17	-	-	-	-	-	-	-	-	-	-	-	-
	(8)	Kongowe	MW	3.67	-	-	-	-	-	-	-	-	-	1 3.67	-	-
	(9)	Misugusugu	MW	1.22	-	-	-	-	-	-	-	-	-	1 1.22	-	-
	(10)	Visiga	MW	1.77	-	-	-	-	-	-	-	-	-	1 1.77	-	-
	(11)	Mbwawa	MW	0.79	-	-	-	-	-	-	-	-	-	1 0.79	-	-
Zanzibar		Zanzibar total	MW	112.25												

Note: The wards of orange colored above apply 11kV distribution system and others apply 33kV.

Electricity Demand Forecast and Required Capacity of 132/33kV Transforme

			Unit		2025																													
					Tegeta SS	Bunju SS (N-DSM)	N. Bahari Beach SS	N. Mbezi SS	Kawe SS	Goba SS	Ubungo SS	Makumbusho SS	Drive Inn SS	NCC SS	Lugurni SS (W-DSM)	N. Mburahati SS	Ilala SS	FZ II SS	Pugu SS	FZ III SS	Kimanga SS	Kivule SS (S-DSM)	Kurasini SS	Mtoni SS	Buza SS	Somangila SS (SE-DSM)	N. Kigamboni SS	Kibada SS	Mbagala SS	Mianzini SS	Mlandizi SS	Chalinze SS	Zinga SS	Mkuranga SS
		Existing Tr Capacity	MVA		100						180	90		100			240	50		234			50						50		60	55		
		Required Capacity Total	MW	**1,819**	60.1	50.3	59.5	33.0	34.7	64.3	125.4	79.5	44.4	68.5	48.6	43.1	181.2	37.6	66.2	84.1	44.7	42.6	53.2	90.4	85.7	29.3	69.9	21.8	65.2	96.3	62.2	14.3	35.7	27.5
		(Calculated as pf = 0.9)	MVA	**2,021**	**66.7**	**55.9**	**66.2**	**36.6**	**38.6**	**71.4**	**139.3**	**88.3**	**49.3**	**76.1**	**54.0**	**47.9**	**201.3**	**41.7**	**73.5**	**93.5**	**49.6**	**47.3**	**59.1**	**100.4**	**95.2**	**32.6**	**77.7**	**24.3**	**72.5**	**107.0**	**69.1**	**15.9**	**39.7**	**30.6**
DSM		Dar es Salaam Region	MW	1,637																														
1		Kinondoni Municipal	MW	640																														
	(1)	Magomeni	MW	6.91	-	-	-	-	-	-	-	-	-	-	-	1 6.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(2)	Makurumla	MW	10.76	-	-	-	-	-	-	-	-	-	-	-	1 10.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(3)	Ndugumbi	MW	6.26	-	-	-	-	-	-	-	-	-	-	-	1 6.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(4)	Tandale	MW	15.50	-	-	-	-	-	-	1 15.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(5)	Mwananyamala	MW	16.05	-	-	-	-	-	-	-	1 16.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(6)	Msasani	MW	43.14	-	-	-	-	-	-	-	0.4 17.26	0.6 25.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(7)	Kinondoni	MW	6.74	-	-	-	-	-	-	-	-	1 6.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(8)	Mzimuni	MW	3.65	-	-	-	-	-	-	-	-	-	-	-	1 3.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(9)	Kigogo	MW	9.78	-	-	-	-	-	-	-	-	-	-	-	1 9.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(10)	Mabibo	MW	14.56	-	-	-	-	-	-	1 14.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(11)	Manzese	MW	11.97	-	-	-	-	-	-	1 11.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(12)	Ubungo	MW	31.71	-	-	-	-	-	-	1 31.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(13)	Kibamba	MW	4.90	-	-	-	-	-	-	-	-	-	-	1 4.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(14)	Goba	MW	18.81	-	-	-	-	-	1 18.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(15)	Kawe	MW	23.67	-	-	-	0.7 16.57	0.3 7.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(16)	Kunduchi	MW	59.54	-	-	1 59.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(17)	Mbweni	MW	8.74	-	1 8.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(18)	Bunju	MW	33.47	-	1 33.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(19)	Makuburi	MW	9.75	-	-	-	-	-	-	1 9.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(20)	Mburahati	MW	5.79	-	-	-	-	-	-	-	-	-	-	-	1 5.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(21)	Makumbusho	MW	21.62	-	-	-	-	-	-	-	1 21.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(22)	Sinza	MW	6.89	-	-	-	-	-	-	1 6.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(23)	Kijitonyama	MW	18.46	-	-	-	-	0.4 7.38	-	-	0.6 11.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(24)	kimara	MW	17.34	-	-	-	-	-	0.4 6.94	0.6 10.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(25)	Mikocheni	MW	33.70	-	-	-	-	0.6 20.22	-	-	0.4 13.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(26)	Mbezi	MW	22.16	-	-	-	-	-	1 22.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(27)	Hananasif	MW	11.78	-	-	-	-	-	-	-	-	1 11.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(28)	Saranga	MW	23.58	-	-	-	-	-	0.4 9.43	0.6 14.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(29)	Kwembe	MW	20.04	-	-	-	-	-	-	-	-	-	-	1 20.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(30)	Msigani	MW	20.80	-	-	-	-	-	-	-	-	-	-	1 20.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(31)	Mbezi juu	MW	16.41	-	-	-	1 16.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(32)	Makongo	MW	17.38	-	-	-	-	-	0.4 6.95	0.6 10.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(33)	Mabwepande	MW	8.08	-	1 8.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(34)	Wazo	MW	60.07	1 60.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2		Ilala Municipal Counc	MW	505.20																														
	(1)	Ukonga	MW	13.41	-	-	-	-	-	-	-	-	-	-	-	-	-	1 13.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(2)	Pugu	MW	23.65	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 11.82	0.5 11.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(3)	Msongola	MW	3.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 1.58	-	-	-	-	-	-	-	-	-	-	0.5 1.58	-	-	-	-
	(4)	Tabata	MW	9.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 9.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(5)	Kinyerezi	MW	4.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 4.82	-	-	-	-	-	-	-	-	-	-	-	-	-
	(6)	Ilala	MW	60.79	-	-	-	-	-	-	-	-	-	-	-	-	1 60.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(7)	Mchikichini	MW	34.54	-	-	-	-	-	-	-	-	-	-	-	-	1 34.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(8)	Vingunguti	MW	26.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 26.91	-	-	-	-	-	-	-	-	-	-	-	-	-
	(9)	Kipawa	MW	24.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 24.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(10)	Buguruni	MW	23.68	-	-	-	-	-	-	-	-	-	-	-	-	1 23.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(11)	Kariakoo	MW	20.90	-	-	-	-	-	-	-	-	-	-	-	-	1 20.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(12)	Jangwani	MW	23.89	-	-	-	-	-	-	-	-	-	1 23.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(13)	Gerezani	MW	9.85	-	-	-	-	-	-	-	-	-	-	-	-	1 9.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(14)	Kisutu	MW	11.25	-	-	-	-	-	-	-	-	-	1 11.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(15)	Mchafukoge	MW	14.47	-	-	-	-	-	-	-	-	-	-	-	-	1 14.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(16)	Upanga Mashariki	MW	15.12	-	-	-	-	-	-	-	-	-	1 15.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(17)	Upanga Magharibi	MW	18.25	-	-	-	-	-	-	-	-	-	1 18.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(18)	Kivukoni	MW	12.17	-	-	-	-	-	-	-	-	-	-	-	-	1 12.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(19)	Kiwalani	MW	36.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 36.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(20)	Segerea	MW	13.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 13.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(21)	Kitunda	MW	18.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 18.82	-	-	-	-	-	-	-	-	-	-	-	-
	(22)	Chanika	MW	5.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 5.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(23)	Kivule	MW	23.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 23.73	-	-	-	-	-	-	-	-	-	-	-	-
	(24)	Gongo la Mboto	MW	12.34	-	-	-	-	-	-	-	-	-	-	-	-	-	1 12.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(25)	Majohe	MW	30.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 30.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(26)	Kimanga	MW	12.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 12.93	-	-	-	-	-	-	-	-	-	-	-	-	-
3		Temeke Municipal Co	MW	492.24																														
	(1)	Kigamboni	MW	45.30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 45.30	-	-	-	-	-	-	-
	(2)	Vijibweni	MW	11.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 11.85	-	-	-	-	-	-	-
	(3)	Kibada	MW	9.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 9.57	-	-	-	-	-	-
	(4)	Kisarawe II	MW	1.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.85	-	-	-	-	-	-	-	-
	(5)	Somangila	MW	23.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 23.87	-	-	-	-	-	-	-	-
	(6)	Kimbiji	MW	1.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.43	-	-	-	-	-	-	-	-
	(7)	Mbagala	MW	39.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 19.53	-	-	-	0.5 19.53	-	-	-	-	-
	(8)	Chamazi	MW	15.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 15.60	-	-	-	-
	(9)	Yombo Vituka	MW	18.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 18.87	-	-	-	-	-	-	-	-	-
	(10)	Charambe	MW	22.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 22.71	-	-	-	-
	(11)	Toangoma	MW	10.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 5.46	0.5 5.46	-	-	-	-	-
	(12)	Miburani	MW	9.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 4.93	0.5 4.93	-	-	-	-	-	-	-	-	-	-
	(13)	Temeke	MW	5.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 5.80	-	-	-	-	-	-	-	-	-	-
	(14)	Mtoni	MW	14.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 14.55	-	-	-	-	-	-	-	-	-	-
	(15)	Keko	MW	7.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 7.84	-	-	-	-	-	-	-	-	-	-	-
	(16)	Kurasini	MW	35.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 35.67	-	-	-	-	-	-	-	-	-	-	-
	(17)	Azimio	MW	18.83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 18.83	-	-	-	-	-	-	-	-	-	-
	(18)	Tandika	MW	11.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 11.03	-	-	-	-	-	-	-	-	-	-
	(19)	Sadali	MW	18.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 18.25	-	-	-	-	-	-	-	-	-	-
	(20)	Chang'ombe	MW	9.56	-	-	-	-	-	-	-	-	-	-	-	-	0.5 4.78	-	-	-	-	-	0.5 4.78	-	-	-	-	-	-	-	-	-	-	-
	(21)	Mbagala Kuu	MW	30.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 30.55	-	-	-	-	-
	(22)	Makangarawe	MW	13.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 13.06	-	-	-	-	-	-	-	-	-
	(23)	Pembamnazi	MW	2.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.16	-	-	-	-	-	-	-	-
	(24)	Mjimwema	MW	6.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 6.81	-	-	-	-	-	-
	(25)	Tungi	MW	12.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 12.74	-	-	-	-	-	-	-
	(26)	Kijichi	MW	16.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 16.96	-	-	-	-	-	-	-	-	-	-
	(27)	Mianzini	MW	33.64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 33.64	-	-	-	-
	(28)	Kiburugwa	MW	19.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 9.67	-	-	-	0.5 9.67	-	-	-	-	-
	(29)	Buza	MW	13.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 13.50	-	-	-	-	-	-	-	-	-
	(30)	Kilakala	MW	11.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 11.02	-	-	-	-	-	-	-	-	-
Pwani		Pwani Region	MW	202.37																														
1		Bagamoyo District Co	MW	49.27																														
	(1)	Kiwangwa	MW	1.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.25	-	-
	(2)	Msata	MW	1.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.05	-	-
	(3)	Miono	MW	1.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.46	-	-
	(4)	Mkange	MW	0.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(5)	Magomeni	MW	2.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.51	-
	(6)	Dunda	MW	1.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.67	-
	(7)	Kiromo	MW	5.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 5.56	-
	(8)	Zinga	MW	10.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 10.69	-
	(9)	Yombo	MW	8.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 8.68	-
	(10)	Vigwaza	MW	1.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.43	-	-	-
	(11)	Talawanda	MW	0.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.49	-	-
	(12)	Bwilingu	MW	2.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.42	-	-
	(13)	Lugoba	MW	0.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.79	-	-
	(14)	Ubenazomozi	MW	1.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.06	-	-
	(15)	Mbwewe	MW	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.00	-	-
	(16)	kibindu	MW	0.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(17)	Fukayosi	MW	0.63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.63	-
	(18)	Kerege	MW	3.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 3.87	-
	(19)	Pera	MW	0.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.87	-	-
	(20)	Msoga	MW	0.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.87	-	-
	(21)	Kimange	MW	0.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.59	-	-
	(22)	Mandera	MW	0.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.81	-	-
2		Kibaha District Counc	MW	17.11																														
	(1)	Gwata	MW	0.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.84	-	-
	(2)	Dutumi	MW	0.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.29	-	-	-
	(3)	Magindu	MW	0.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.80	-	-
	(4)	Soga	MW	0.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.75	-	-	-
	(5)	Kikongo	MW	0.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.68	-	-	-
	(6)	Ruvu	MW	0.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.55	-	-	-
	(7)	Mlandizi	MW	8.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 8.65	-	-	-
	(8)	Kwala	MW	0.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.56	-	-	-
	(9)	Kilangalanga	MW	1.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.69	-	-	-
	(10)	Janga	MW	1.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.75	-	-	-
	(11)	Bokomnemela	MW	0.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.54	-	-	-
3		Kisarawe District Cou	MW	20.48																														
	(1)	Kisarawe	MW	6.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 6.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(2)	Msimbu	MW	1.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(3)	Masaki	MW	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(4)	Kibuta	MW	1.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(5)	Marumbo	MW	0.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(6)	Maneromango	MW	1.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(7)	Msanga	MW	0.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(8)	Marui	MW	0.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(9)	Cholesamvula	MW	0.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(10)	Vikumbulu	MW	0.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(11)	Mafizi	MW	0.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(12)	Kurui	MW	0.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(13)	Mzenga	MW	0.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.76	-	-	-
	(14)	Vihingo	MW	0.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.46	-	-	-
	(15)	kiluvya	MW	2.84	-	-	-	-	-	-	-	-	-	-	1 2.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4		Mkuranga District Cou	MW	50.24																														
	(1)	Mkuranga	MW	6.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 6.60	-	-	-	-
	(2)	Tambani	MW	5.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 5.16	-	-	-	-
	(3)	Vikindu	MW	8.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 8.87	-	-	-	-
	(4)	Mbezi	MW	1.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.58
	(5)	Shungubweni	MW	0.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.61
	(6)	Kisiju	MW	2.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.47
	(7)	Magawa	MW	1.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.19
	(8)	Kitomondo	MW	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.00
	(9)	Lukanga	MW	2.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.11
	(10)	Nyamato	MW	2.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.42
	(11)	Kimanzichana	MW	3.64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 3.64
	(12)	Mkamba	MW	2.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.96
	(13)	Panzuo	MW	1.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.54
	(14)	Bupu	MW	1.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.48
	(15)	Mwalusembe	MW	2.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.99
	(16)	Vianzi	MW	2.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.10	-	-	-	-
	(17)	Njia nne	MW	1.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.35
	(18)	Kiparang'anda	MW	2.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.16
5		Rufiji District Council	MW	8.69																														
6		Mafia District Council	MW	10.37																														
7		kibaha Town District (	MW	46.22																														
	(1)	Pangani	MW	2.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.46	-	-	-
	(2)	Maili Moja	MW	7.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 7.77	-	-	-
	(3)	Tumbi	MW	4.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 4.19	-	-	-
	(4)	Picha ya Ndege	MW	6.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 6.47	-	-	-
	(5)	Mkuza	MW	5.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 5.44	-	-	-
	(6)	Kibaha	MW	4.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 4.25	-	-	-
	(7)	Msangani	MW	2.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.12	-
	(8)	Kongowe	MW	6.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 6.65	-	-	-
	(9)	Misugusugu	MW	2.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.21	-	-	-
	(10)	Visiga	MW	3.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 3.20	-	-	-
	(11)	Mbwawa	MW	1.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.44	-	-	-
Zanzibar		Zanzibar total	MW	170.39																														

Electricity Demand Forecast and Required Capacity of 132/33kV Transformers

		Unit		Tegeta SS	Bunju SS (N-DSM)	N. Bahari Beach SS	N. Mbezi SS	Kawe SS	Goba SS	Ubungo SS	Makumbusho SS	Drive Inn SS	NCC SS	Luguruni SS (W-DSM)	N. Mburahati SS	Ilala SS	N. Ilala SS	FZ II SS	Pugu SS	FZ III SS	Kimanga SS	Kivule SS (S-DSM)	Kurasini SS	Mtoni SS	Buza SS	Somangila SS (SE-DSM)	N. Kigamboni SS	Kibada SS	Mbagala SS	Mianzini SS	Mlandizi SS	Chalinze SS	Zinga SS	Mkuranga SS	Maneromango SS
				2030																															
	Existing Tr Capacity	MVA		100						180	90		100			240		50	50	234			50						50		60	55			
	Required Capacity Total	MW	2,707	71.1	82.7	88.1	56.3	49.3	95.2	190.0	124.6	70.9	125.4	65.2	74.2	159.0	82.6	49.9	67.7	121.9	77.2	64.4	84.7	142.2	135.4	43.7	95.9	31.1	82.9	161.4	75.9	19.4	56.6	47.0	15.2
	(Calculated as pf = 0.9)	MVA	3,008	79.0	91.8	97.9	62.5	54.8	105.7	211.1	138.4	78.7	139.4	72.4	82.4	176.7	91.7	55.5	75.2	135.5	85.7	71.6	94.2	158.0	150.5	48.6	106.6	34.5	92.1	179.4	84.3	21.5	62.8	52.3	16.9
DSM	Dar es Salaam Region	MW	2,440																																
1	Kinondoni Municipal C	MW	963																																
(1)	Magomeni	MW	11.34	-	-	-	-	-	-	-	-	-	-	-	1 11.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(2)	Makurumla	MW	18.66	-	-	-	-	-	-	-	-	-	-	-	1 18.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(3)	Ndugumbi	MW	10.85	-	-	-	-	-	-	-	-	-	-	-	1 10.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(4)	Tandale	MW	22.07	-	-	-	-	-	-	1 22.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(5)	Mwananyamala	MW	28.21	-	-	-	-	-	-	-	1 28.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(6)	Msasani	MW	63.85	-	-	-	-	-	-	-	0.4 25.54	0.6 38.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(7)	Kinondoni	MW	11.85	-	-	-	-	-	-	-	-	1 11.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(8)	Mzimuni	MW	6.33	-	-	-	-	-	-	-	-	-	-	-	1 6.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(9)	Kigogo	MW	16.97	-	-	-	-	-	-	-	-	-	-	-	1 16.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(10)	Mabibo	MW	25.25	-	-	-	-	-	-	1 25.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(11)	Manzese	MW	20.76	-	-	-	-	-	-	1 20.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(12)	Ubungo	MW	34.73	-	-	-	-	-	-	1 34.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(13)	Kibamba	MW	8.51	-	-	-	-	-	-	-	-	-	-	1 8.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(14)	Goba	MW	27.85	-	-	-	-	-	1 27.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(15)	Kawe	MW	43.80	-	-	-	0.7 30.66	0.3 13.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(16)	Kunduchi	MW	88.12	-	-	1 88.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(17)	Mbweni	MW	16.17	-	1 16.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(18)	Bunju	MW	52.28	-	1 52.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(19)	Makuburi	MW	16.91	-	-	-	-	-	-	1 16.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(20)	Mburahati	MW	10.05	-	-	-	-	-	-	-	-	-	-	-	1 10.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(21)	Makumbusho	MW	35.88	-	-	-	-	-	-	-	1 35.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(22)	Sinza	MW	11.94	-	-	-	-	-	-	1 11.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(23)	Kijitonyama	MW	32.44	-	-	-	-	0.4 12.97	-	-	0.6 19.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(24)	kimara	MW	29.67	-	-	-	-	-	0.4 11.87	0.6 17.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(25)	Mikocheni	MW	38.70	-	-	-	-	0.6 23.22	-	-	0.4 15.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(26)	Mbezi	MW	28.45	-	-	-	-	-	1 28.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(27)	Hananasif	MW	20.71	-	-	-	-	-	-	-	-	1 20.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(28)	Saranga	MW	40.35	-	-	-	-	-	0.4 16.14	0.6 24.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(29)	Kwembe	MW	30.86	-	-	-	-	-	-	-	-	-	-	1 30.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(30)	Msigani	MW	21.35	-	-	-	-	-	-	-	-	-	-	1 21.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(31)	Mbezi juu	MW	25.63	-	-	-	1 25.63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(32)	Makongo	MW	27.15	-	-	-	-	-	0.4 10.86	0.6 16.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(33)	Mabwepande	MW	14.21	-	1 14.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(34)	Wazo	MW	71.13	1 71.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Ilala Municipal Counci	MW	735.67																																
(1)	Ukonga	MW	18.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 18.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(2)	Pugu	MW	25.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 12.59	0.5 12.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(3)	Msongola	MW	5.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 2.93	-	-	-	-	-	-	-	-	-	-	0.5 2.93	-	-	-	-	-
(4)	Tabata	MW	17.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 17.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(5)	Kinyerezi	MW	8.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 8.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(6)	Ilala	MW	86.88	-	-	-	-	-	-	-	-	-	-	-	-	0.5 43.44	0.5 43.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(7)	Mchikichini	MW	56.45	-	-	-	-	-	-	-	-	-	-	-	-	1 56.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(8)	Vingunguti	MW	48.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 48.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(9)	Kipawa	MW	42.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 42.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(10)	Buguruni	MW	33.36	-	-	-	-	-	-	-	-	-	-	-	-	-	1 33.36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(11)	Kariakoo	MW	45.74	-	-	-	-	-	-	-	-	-	-	-	-	1 45.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(12)	Jangwani	MW	32.54	-	-	-	-	-	-	-	-	-	1 32.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(13)	Gerezani	MW	13.42	-	-	-	-	-	-	-	-	-	-	-	-	1 13.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(14)	Kisutu	MW	15.32	-	-	-	-	-	-	-	-	-	1 15.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(15)	Mchafukoge	MW	19.71	-	-	-	-	-	-	-	-	-	1 19.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(16)	Upanga Mashariki	MW	20.59	-	-	-	-	-	-	-	-	-	1 20.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(17)	Upanga Magharibi	MW	24.85	-	-	-	-	-	-	-	-	-	1 24.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(18)	Kivukoni	MW	12.43	-	-	-	-	-	-	-	-	-	1 12.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(19)	Kiwalani	MW	41.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 41.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(20)	Segerea	MW	21.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 21.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(21)	Kitunda	MW	28.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 28.50	-	-	-	-	-	-	-	-	-	-	-	-	-
(22)	Chanika	MW	10.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 10.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(23)	Kivule	MW	35.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 35.93	-	-	-	-	-	-	-	-	-	-	-	-	-
(24)	Gongo la Mboto	MW	18.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 18.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(25)	Majohe	MW	32.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 32.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(26)	Kimanga	MW	20.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 20.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	Temeke Municipal Cou	MW	741.51																																
(1)	Kigamboni	MW	66.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 66.74	-	-	-	-	-	-	-	-
(2)	Vijibweni	MW	13.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 13.85	-	-	-	-	-	-	-	-
(3)	Kibada	MW	10.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 10.25	-	-	-	-	-	-	-
(4)	Kisarawe II	MW	3.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 3.14	-	-	-	-	-	-	-	-	-
(5)	Somangila	MW	34.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 34.53	-	-	-	-	-	-	-	-	-
(6)	Kimbiji	MW	2.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.42	-	-	-	-	-	-	-	-	-
(7)	Mbagala	MW	52.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 26.15	-	-	-	0.5 26.15	-	-	-	-	-	-
(8)	Chamazi	MW	24.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 24.06	-	-	-	-	-
(9)	Yombo Vituka	MW	29.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 29.11	-	-	-	-	-	-	-	-	-	-
(10)	Charambe	MW	38.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 38.53	-	-	-	-	-
(11)	Toangoma	MW	18.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 9.27	0.5 9.27	-	-	-	-	-	-
(12)	Miburani	MW	16.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 8.37	0.5 8.37	-	-	-	-	-	-	-	-	-	-	-
(13)	Temeke	MW	9.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 9.85	-	-	-	-	-	-	-	-	-	-	-
(14)	Mtoni	MW	24.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 24.69	-	-	-	-	-	-	-	-	-	-	-
(15)	Keko	MW	13.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 13.29	-	-	-	-	-	-	-	-	-	-	-	-
(16)	Kurasini	MW	57.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 57.32	-	-	-	-	-	-	-	-	-	-	-	-
(17)	Azimio	MW	31.95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 31.95	-	-	-	-	-	-	-	-	-	-	-
(18)	Tandika	MW	18.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 18.71	-	-	-	-	-	-	-	-	-	-	-
(19)	Sadali	MW	19.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 19.91	-	-	-	-	-	-	-	-	-	-	-
(20)	Chang'ombe	MW	11.52	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 5.76	-	-	-	-	-	0.5 5.76	-	-	-	-	-	-	-	-	-	-	-	-
(21)	Mbagala Kuu	MW	31.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 31.09	-	-	-	-	-	-
(22)	Makangarawe	MW	22.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 22.16	-	-	-	-	-	-	-	-	-	-
(23)	Pembamnazi	MW	3.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 3.66	-	-	-	-	-	-	-	-	-
(24)	Mjimwema	MW	11.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 11.56	-	-	-	-	-	-	-
(25)	Tungi	MW	15.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 15.35	-	-	-	-	-	-	-	-
(26)	Kijichi	MW	28.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 28.77	-	-	-	-	-	-	-	-	-	-	-
(27)	Mianzini	MW	57.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 57.07	-	-	-	-	-
(28)	Kiburugwa	MW	32.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 16.41	-	-	-	0.5 16.41	-	-	-	-	-	-
(29)	Buza	MW	22.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 22.90	-	-	-	-	-	-	-	-	-	-
(30)	Kilakala	MW	18.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 18.69	-	-	-	-	-	-	-	-	-	-
Pwani	Pwani Region	MW	303.46																																
1	Bagamoyo District Cou	MW	75.07																																
(1)	Kiwangwa	MW	1.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.60	-	-	-
(2)	Msata	MW	1.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.13	-	-	-
(3)	Miono	MW	1.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.86	-	-	-
(4)	Mkange	MW	0.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(5)	Magomeni	MW	3.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 3.20	-	-
(6)	Dunda	MW	2.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.99	-	-
(7)	Kiromo	MW	8.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 8.97	-	-
(8)	Zinga	MW	18.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 18.38	-	-
(9)	Yombo	MW	12.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 12.44	-	-
(10)	Vigwaza	MW	1.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.82	-	-	-	-
(11)	Talawanda	MW	0.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.61	-	-	-
(12)	Bwilingu	MW	3.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 3.85	-	-	-
(13)	Lugoba	MW	1.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.25	-	-	-
(14)	Ubenazomozi	MW	1.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.68	-	-	-
(15)	Mbwewe	MW	1.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.27	-	-	-
(16)	kibindu	MW	1.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(17)	Fukayosi	MW	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.00	-	-
(18)	Kerege	MW	7.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 7.12	-	-
(19)	Pera	MW	1.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.11	-	-	-
(20)	Msoga	MW	1.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.11	-	-	-
(21)	Kimange	MW	0.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.75	-	-	-
(22)	Mandera	MW	1.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.03	-	-	-
2	Kibaha District Counci	MW	23.14																																
(1)	Gwata	MW	1.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.10	-	-	-
(2)	Dutumi	MW	0.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.38	-	-	-	-
(3)	Magindu	MW	1.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.04	-	-	-
(4)	Soga	MW	0.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.99	-	-	-	-
(5)	Kikongo	MW	0.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.89	-	-	-	-
(6)	Ruvu	MW	0.72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.72	-	-	-	-
(7)	Mlandizi	MW	12.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 12.07	-	-	-	-
(8)	Kwala	MW	0.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.73	-	-	-	-
(9)	Kilangalanga	MW	2.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.21	-	-	-	-
(10)	Janga	MW	2.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.29	-	-	-	-
(11)	Bokomnemela	MW	0.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.71	-	-	-	-
3	Kisarawe District Coun	MW	31.09																																
(1)	Kisarawe	MW	9.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 9.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(2)	Msimbu	MW	2.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.27
(3)	Masaki	MW	1.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.47
(4)	Kibuta	MW	2.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.07
(5)	Marumbo	MW	1.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.16
(6)	Maneromango	MW	2.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.15
(7)	Msanga	MW	1.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.47
(8)	Marui	MW	0.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.77
(9)	Cholesamvula	MW	1.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.24
(10)	Vikumbulu	MW	0.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.66
(11)	Mafizi	MW	1.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.34
(12)	Kurui	MW	0.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.61
(13)	Mzenga	MW	1.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.11	-	-	-	-
(14)	Vihingo	MW	0.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 0.67	-	-	-	-
(15)	kiluvya	MW	4.43	-	-	-	-	-	-	-	-	-	-	1 4.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Mkuranga District Cou	MW	85.86																																
(1)	Mkuranga	MW	11.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 11.27	-	-	-	-	-
(2)	Tambani	MW	8.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 8.81	-	-	-	-	-
(3)	Vikindu	MW	15.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 15.16	-	-	-	-	-
(4)	Mbezi	MW	2.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.71	-
(5)	Shungubweni	MW	1.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.04	-
(6)	Kisiju	MW	4.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 4.23	-
(7)	Magawa	MW	2.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.04	-
(8)	Kitomondo	MW	1.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.70	-
(9)	Lukanga	MW	3.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 3.61	-
(10)	Nyamato	MW	4.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 4.13	-
(11)	Kimanzichana	MW	6.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 6.23	-
(12)	Mkamba	MW	5.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 5.06	-
(13)	Panzuo	MW	2.64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.64	-
(14)	Bupu	MW	2.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.53	-
(15)	Mwalusembe	MW	5.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 5.11	-
(16)	Vianzi	MW	3.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 3.58	-	-	-	-	-
(17)	Njia nne	MW	2.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.31	-
(18)	Kiparang'anda	MW	3.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 3.70	-
5	Rufiji District Council	MW	16.14																																
6	Mafia District Council	MW	18.42																																
7	kibaha Town District C	MW	53.75																																
(1)	Pangani	MW	2.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.86	-	-	-	-
(2)	Maili Moja	MW	9.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 9.04	-	-	-	-
(3)	Tumbi	MW	4.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 4.87	-	-	-	-
(4)	Picha ya Ndege	MW	7.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 7.53	-	-	-	-
(5)	Mkuza	MW	6.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 6.33	-	-	-	-
(6)	Kibaha	MW	4.95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 4.95	-	-	-	-
(7)	Msangani	MW	2.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.47	-	-
(8)	Kongowe	MW	7.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 7.74	-	-	-	-
(9)	Misugusugu	MW	2.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 2.57	-	-	-	-
(10)	Visiga	MW	3.72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 3.72	-	-	-	-
(11)	Mbwawa	MW	1.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 1.68	-	-	-	-
Zanzibar	Zanzibar total	MW	228.05																																

Electricity Demand Forecast and Required Capacity of 33/11kV Transformers

			Unit	2020												
					Tegeta SS	Ubungo SS	Makumbusho SS	NCC SS	Ilala SS	FZ II SS	FZ III SS	Kurasini SS	Mbagala SS	Mlandizi SS	Chalinze SS	Zinga SS
	Required Capacity Total		MW	**827**	47.7	134.6	104.9	50.6	143.1	54.3	115.5	68.7	105.0	2.3	0.0	0.0
	(Calculated as pf = 0.9)		MVA	**919**	**53.0**	**149.6**	**116.5**	**56.2**	**159.0**	**60.3**	**128.3**	**76.3**	**116.7**	**2.6**	**0.0**	**0.0**
DSM		Dar es Salaam Region	MW	1,113												
1		Kinondoni Municipal C	MW	445												
	(1)	Magomeni	MW	5.69	-	1 5.69	-	-	-	-	-	-	-	-	-	-
	(2)	Makurumla	MW	9.10	-	1 9.10	-	-	-	-	-	-	-	-	-	-
	(3)	Ndugumbi	MW	4.41	-	1 4.41	-	-	-	-	-	-	-	-	-	-
	(4)	Tandale	MW	9.84	-	1 9.84	-	-	-	-	-	-	-	-	-	-
	(5)	Mwananyamala	MW	11.22	-	-	1 11.22	-	-	-	-	-	-	-	-	-
	(6)	Msasani	MW	27.13	-	-	1 27.13	-	-	-	-	-	-	-	-	-
	(7)	Kinondoni	MW	4.71	-	-	1 4.71	-	-	-	-	-	-	-	-	-
	(8)	Mzimuni	MW	2.57	-	1 2.57	-	-	-	-	-	-	-	-	-	-
	(9)	Kigogo	MW	6.90	-	1 6.90	-	-	-	-	-	-	-	-	-	-
	(10)	Mabibo	MW	10.26	-	1 10.26	-	-	-	-	-	-	-	-	-	-
	(11)	Manzese	MW	8.44	-	1 8.44	-	-	-	-	-	-	-	-	-	-
	(12)	Ubungo	MW	20.11	-	1 20.11	-	-	-	-	-	-	-	-	-	-
	(13)	Kibamba	MW	3.46	-	-1 -	-	-	-	-	-	-	-	-	-	-
	(14)	Goba	MW	17.75	-1 -	-	-	-	-	-	-	-	-	-	-	-
	(15)	Kawe	MW	17.87	-	1 17.87	-	-	-	-	-	-	-	-	-	-
	(16)	Kunduchi	MW	41.61	1 41.61	-	-	-	-	-	-	-	-	-	-	-
	(17)	Mbweni	MW	6.11	1 6.11	-	-	-	-	-	-	-	-	-	-	-
	(18)	Bunju	MW	21.72	-1 -	-	-	-	-	-	-	-	-	-	-	-
	(19)	Makuburi	MW	6.87	-	1 6.87	-	-	-	-	-	-	-	-	-	-
	(20)	Mburahati	MW	4.08	-	1 4.08	-	-	-	-	-	-	-	-	-	-
	(21)	Makumbusho	MW	15.11	-	-	1 15.11	-	-	-	-	-	-	-	-	-
	(22)	Sinza	MW	4.85	-	1 4.85	-	-	-	-	-	-	-	-	-	-
	(23)	Kijitonyama	MW	12.90	-	-	1 12.90	-	-	-	-	-	-	-	-	-
	(24)	kimara	MW	11.46	-	-1 -	-	-	-	-	-	-	-	-	-	-
	(25)	Mikocheni	MW	25.58	-	-	1 25.58	-	-	-	-	-	-	-	-	-
	(26)	Mbezi	MW	16.48	-	-1 -	-	-	-	-	-	-	-	-	-	-
	(27)	Hananasif	MW	8.23	-	-	1 8.23	-	-	-	-	-	-	-	-	-
	(28)	Saranga	MW	15.58	-	-1 -	-	-	-	-	-	-	-	-	-	-
	(29)	Kwembe	MW	11.07	-	-1 -	-	-	-	-	-	-	-	-	-	-
	(30)	Msigani	MW	16.49	-	-1 -	-	-	-	-	-	-	-	-	-	-
	(31)	Mbezi juu	MW	11.46	-	1 11.46	-	-	-	-	-	-	-	-	-	-
	(32)	Makongo	MW	12.15	-	1 12.15	-	-	-	-	-	-	-	-	-	-
	(33)	Mabwepande	MW	5.65	-1 -	-	-	-	-	-	-	-	-	-	-	-
	(34)	Wazo	MW	37.78	-1 -	-	-	-	-	-	-	-	-	-	-	-
2		Ilala Municipal Council	MW	369.65												
	(1)	Ukonga	MW	9.76	-	-	-	-	-	1 9.76	-	-	-	-	-	-
	(2)	Pugu	MW	14.39	-	-	-	-	-	1 14.39	-	-	-	-	-	-
	(3)	Msongola	MW	2.16	-	-	-	-	-	0.5 1.08	-	-	0.5 1.08	-	-	-
	(4)	Tabata	MW	6.45	-	-	-	-	-	-	-1 -	-	-	-	-	-
	(5)	Kinyerezi	MW	6.63	-	-	-	-	-	-	-1 -	-	-	-	-	-
	(6)	Ilala	MW	46.64	-	-	-	-	1 46.64	-	-	-	-	-	-	-
	(7)	Mchikichini	MW	25.52	-	-	-	-	1 25.52	-	-	-	-	-	-	-
	(8)	Vingunguti	MW	18.80	-	-	-	-	-	-	1 18.80	-	-	-	-	-
	(9)	Kipawa	MW	19.56	-	-	-	-	-	-	-1 -	-	-	-	-	-
	(10)	Buguruni	MW	18.61	-	-	-	-	1 18.61	-	-	-	-	-	-	-
	(11)	Kariakoo	MW	19.53	-	-	-	-	1 19.53	-	-	-	-	-	-	-
	(12)	Jangwani	MW	17.65	-	-	-	1 17.65	-	-	-	-	-	-	-	-
	(13)	Gerezani	MW	7.28	-	-	-	-	1 7.28	-	-	-	-	-	-	-
	(14)	Kisutu	MW	8.31	-	-	-	1 8.31	-	-	-	-	-	-	-	-
	(15)	Mchafukoge	MW	10.69	-	-	-	-	1 10.69	-	-	-	-	-	-	-
	(16)	Upanga Mashariki	MW	11.17	-	-	-	1 11.17	-	-	-	-	-	-	-	-
	(17)	Upanga Magharibi	MW	13.48	-	-	-	1 13.48	-	-	-	-	-	-	-	-
	(18)	Kivukoni	MW	12.14	-	-	-	-	1 12.14	-	-	-	-	-	-	-
	(19)	Kiwalani	MW	24.34	-	-	-	-	-	-	1 24.34	-	-	-	-	-
	(20)	Segerea	MW	9.31	-	-	-	-	-	-	-1 -	-	-	-	-	-
	(21)	Kitunda	MW	13.00	-	-	-	-	-	-	-1 -	-	-	-	-	-
	(22)	Chanika	MW	3.88	-	-	-	-	-	1 3.88	-	-	-	-	-	-
	(23)	Kivule	MW	16.39	-	-	-	-	-	-	-1 -	-	-	-	-	-
	(24)	Gongo la Mboto	MW	11.15	-	-	-	-	-	1 11.15	-	-	-	-	-	-
	(25)	Majohe	MW	14.01	-	-	-	-	-	1 14.01	-	-	-	-	-	-
	(26)	Kimanga	MW	8.78	-	-	-	-	-	-	-1 -	-	-	-	-	-
3		Temeke Municipal Cou	MW	298.99												
	(1)	Kigamboni	MW	23.41	-	-	-	-	-	-	-	1 23.41	-	-	-	-
	(2)	Vijibweni	MW	7.35	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(3)	Kibada	MW	2.97	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(4)	Kisarawe II	MW	1.15	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(5)	Somangila	MW	19.54	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(6)	Kimbiji	MW	0.89	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(7)	Mbagala	MW	14.53	-	-	-	-	-	-	-	-	1 14.53	-	-	-
	(8)	Chamazi	MW	10.75	-	-	-	-	-	-	-	-	1 10.75	-	-	-
	(9)	Yombo Vituka	MW	13.00	-	-	-	-	-	-	1 13.00	-	-	-	-	-
	(10)	Charambe	MW	14.08	-	-	-	-	-	-	-	-	1 14.08	-	-	-
	(11)	Toangoma	MW	7.53	-	-	-	-	-	-	-	-0.5 -	-0.5 -	-	-	-
	(12)	Miburani	MW	6.12	-	-	-	-	-	-	0.6 3.67	0.4 2.45	-	-	-	-
	(13)	Temeke	MW	3.60	-	-	-	-	-	-	-	1 3.60	-	-	-	-
	(14)	Mtoni	MW	10.03	-	-	-	-	-	-	-	1 10.03	-	-	-	-
	(15)	Keko	MW	4.86	-	-	-	-	-	-	-	1 4.86	-	-	-	-
	(16)	Kurasini	MW	24.33	-	-	-	-	-	-	-	1 24.33	-	-	-	-
	(17)	Azimio	MW	12.97	-	-	-	-	-	-	1 12.97	-	-	-	-	-
	(18)	Tandika	MW	6.84	-	-	-	-	-	-	1 6.84	-	-	-	-	-
	(19)	Sadali	MW	7.28	-	-	-	-	-	-	1 7.28	-	-	-	-	-
	(20)	Chang'ombe	MW	5.33	-	-	-	-	0.5 2.67	-	0.5 2.67	-	-	-	-	-
	(21)	Mbagala Kuu	MW	16.42	-	-	-	-	-	-	-	-	1 16.42	-	-	-
	(22)	Makangarawe	MW	9.00	-	-	-	-	-	-	1 9.00	-	-	-	-	-
	(23)	Pembamnazi	MW	1.34	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(24)	Mjimwema	MW	4.69	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(25)	Tungi	MW	5.92	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(26)	Kijichi	MW	11.69	-	-	-	-	-	-	-	-	1 11.69	-	-	-
	(27)	Mianzini	MW	23.18	-	-	-	-	-	-	-	-	1 23.18	-	-	-
	(28)	Kiburugwa	MW	13.33	-	-	-	-	-	-	-	-	1 13.33	-	-	-
	(29)	Buza	MW	9.30	-	-	-	-	-	-	1 9.30	-	-	-	-	-
	(30)	Kilakala	MW	7.59	-	-	-	-	-	-	1 7.59	-	-	-	-	-
Pwani		Pwani Region	MW	99.74												
1		Bagamoyo District Cou	MW	25.14												
	(1)	Kiwangwa	MW	0.72	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(2)	Msata	MW	0.61	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(3)	Miono	MW	0.84	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(4)	Mkange	MW	0.48	-	-	-	-	-	-	-	-	-	-	-	-
	(5)	Magomeni	MW	1.45	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(6)	Dunda	MW	0.79	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(7)	Kiromo	MW	1.30	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(8)	Zinga	MW	2.66	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(9)	Yombo	MW	6.75	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(10)	Vigwaza	MW	0.82	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(11)	Talawanda	MW	0.37	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(12)	Bwilingu	MW	1.74	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(13)	Lugoba	MW	0.57	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(14)	Ubenazomozi	MW	0.76	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(15)	Mbwewe	MW	0.72	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(16)	kibindu	MW	0.61	-	-	-	-	-	-	-	-	-	-	-	-
	(17)	Fukayosi	MW	0.45	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(18)	Kerege	MW	1.47	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(19)	Pera	MW	0.63	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(20)	Msoga	MW	0.50	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(21)	Kimange	MW	0.42	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(22)	Mandera	MW	0.46	-	-	-	-	-	-	-	-	-	-	-1 -	-
2		Kibaha District Council	MW	9.54												
	(1)	Gwata	MW	0.52	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(2)	Dutumi	MW	0.18	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(3)	Magindu	MW	0.49	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(4)	Soga	MW	0.47	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(5)	Kikongo	MW	0.42	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(6)	Ruvu	MW	0.34	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(7)	Mlandizi	MW	4.29	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(8)	Kwala	MW	0.34	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(9)	Kilangalanga	MW	1.05	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(10)	Janga	MW	1.08	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(11)	Bokomnemela	MW	0.34	-	-	-	-	-	-	-	-	-	-1 -	-	-
3		Kisarawe District Coun	MW	10.25												
	(1)	Kisarawe	MW	2.79	-	-	-	-	-	-1 -	-	-	-	-	-	-
	(2)	Msimbu	MW	0.87	-	-	-	-	-	-	-	-	-	-	-	-
	(3)	Masaki	MW	0.57	-	-	-	-	-	-1 -	-	-	-	-	-	-
	(4)	Kibuta	MW	0.80	-	-	-	-	-	-1 -	-	-	-	-	-	-
	(5)	Marumbo	MW	0.45	-	-	-	-	-	-1 -	-	-	-	-	-	-
	(6)	Maneromango	MW	0.62	-	-	-	-	-	-1 -	-	-	-	-	-	-
	(7)	Msanga	MW	0.43	-	-	-	-	-	-1 -	-	-	-	-	-	-
	(8)	Marui	MW	0.30	-	-	-	-	-	-	-	-	-	-	-	-
	(9)	Cholesamvula	MW	0.48	-	-	-	-	-	-	-	-	-	-	-	-
	(10)	Vikumbulu	MW	0.25	-	-	-	-	-	-	-	-	-	-	-	-
	(11)	Mafizi	MW	0.51	-	-	-	-	-	-	-	-	-	-	-	-
	(12)	Kurui	MW	0.23	-	-	-	-	-	-	-	-	-	-	-	-
	(13)	Mzenga	MW	0.43	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(14)	Vihingo	MW	0.26	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(15)	kiluvya	MW	1.28	-	-	-	-	-	-	-	-	-	-1 -	-	-
4		Mkuranga District Cour	MW	21.15												
	(1)	Mkuranga	MW	3.20	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(2)	Tambani	MW	1.67	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(3)	Vikindu	MW	4.31	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(4)	Mbezi	MW	0.64	-	-	-	-	-	-	-	-	-	-	-	-
	(5)	Shungubweni	MW	0.25	-	-	-	-	-	-	-	-	-	-	-	-
	(6)	Kisiju	MW	1.00	-	-	-	-	-	-	-	-	-	-	-	-
	(7)	Magawa	MW	0.48	-	-	-	-	-	-	-	-	-	-	-	-
	(8)	Kitomondo	MW	0.40	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(9)	Lukanga	MW	0.85	-	-	-	-	-	-	-	-	-	-	-	-
	(10)	Nyamato	MW	0.98	-	-	-	-	-	-	-	-	-	-	-	-
	(11)	Kimanzichana	MW	1.47	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(12)	Mkamba	MW	1.20	-	-	-	-	-	-	-	-	-	-	-	-
	(13)	Panzuo	MW	0.62	-	-	-	-	-	-	-	-	-	-	-	-
	(14)	Bupu	MW	0.60	-	-	-	-	-	-	-	-	-	-	-	-
	(15)	Mwalusembe	MW	1.21	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(16)	Vianzi	MW	0.85	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(17)	Njia nne	MW	0.55	-	-	-	-	-	-	-	-	-	-	-	-
	(18)	Kiparang'anda	MW	0.87	-	-	-	-	-	-	-	-	-1 -	-	-	-
5		Rufiji District Council	MW	4.17												
6		Mafia District Council	MW	4.00												
7		kibaha Town District C	MW	25.48												
	(1)	Pangani	MW	1.35	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(2)	Maili Moja	MW	4.28	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(3)	Tumbi	MW	2.31	-	-	-	-	-	-	-	-	-	1 2.31	-	-
	(4)	Picha ya Ndege	MW	3.57	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(5)	Mkuza	MW	3.00	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(6)	Kibaha	MW	2.35	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(7)	Msangani	MW	1.17	-	-	-	-	-	-	-	-	-	-	-	-
	(8)	Kongowe	MW	3.67	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(9)	Misugusugu	MW	1.22	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(10)	Visiga	MW	1.77	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(11)	Mbwawa	MW	0.79	-	-	-	-	-	-	-	-	-	-1 -	-	-
Zanzibar		Zanzibar total	MW	112.25												

Note: The wards of orange colored above apply 11kV distribution system and others apply 33kV.

Electricity Demand Forecast and Required Capacity of 33/11kV Transforme

			Unit		2025																													
					Tegeta SS	Bunju SS (N-DSM)	N. Bahari Beach SS	N. Mbezi SS	Kawe SS	Goba SS	Ubungo SS	Makumbusho SS	Drive Inn SS	NCC SS	Lugurni SS (W-DSM)	N. Mburahati SS	Ilala SS	FZ II SS	Pugu SS	FZ III SS	Kimanga SS	Kivule SS (S-DSM)	Kurasini SS	Mtoni SS	Buza SS	Somangila SS (SE-DSM)	N. Kigamboni SS	Kibada SS	Mbagala SS	Mianzini SS	Mlandizi SS	Chalinze SS	Zinga SS	Mkuranga SS
		Required Capacity Total	MW	1,216	0.0	8.7	59.5	33.0	34.7	0.0	100.8	79.5	44.4	68.5	0.0	43.1	181.2	37.6	49.8	36.2	26.9	0.0	53.2	90.4	85.7	0.0	45.3	0.0	59.7	73.5	4.2	0.0	0.0	0.0
		(Calculated as pf = 0.9)	MVA	1,351	0.0	9.7	66.2	36.6	38.6	0.0	112.0	88.3	49.3	76.1	0.0	47.9	201.3	41.7	55.3	40.2	29.9	0.0	59.1	100.4	95.2	0.0	50.3	0.0	66.4	81.7	4.7	0.0	0.0	0.0
DSM		Dar es Salaam Region	MW	1,637																														
1		Kinondoni Municipal (	MW	640																														
	(1)	Magomeni	MW	6.91	-	-	-	-	-	-	-	-	-	-	-	1 6.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(2)	Makurumla	MW	10.76	-	-	-	-	-	-	-	-	-	-	-	1 10.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(3)	Ndugumbi	MW	6.26	-	-	-	-	-	-	-	-	-	-	-	1 6.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(4)	Tandale	MW	15.50	-	-	-	-	-	-	1 15.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(5)	Mwananyamala	MW	16.05	-	-	-	-	-	-	-	1 16.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(6)	Msasani	MW	43.14	-	-	-	-	-	-	-	0.4 17.26	0.6 25.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(7)	Kinondoni	MW	6.74	-	-	-	-	-	-	-	-	1 6.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(8)	Mzimuni	MW	3.65	-	-	-	-	-	-	-	-	-	-	-	1 3.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(9)	Kigogo	MW	9.78	-	-	-	-	-	-	-	-	-	-	-	1 9.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(10)	Mabibo	MW	14.56	-	-	-	-	-	-	1 14.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(11)	Manzese	MW	11.97	-	-	-	-	-	-	1 11.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(12)	Ubungo	MW	31.71	-	-	-	-	-	-	1 31.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(13)	Kibamba	MW	4.90	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(14)	Goba	MW	18.81	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(15)	Kawe	MW	23.67	-	-	-	0.7 16.57	0.3 7.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(16)	Kunduchi	MW	59.54	-	-	1 59.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(17)	Mbweni	MW	8.74	-	1 8.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(18)	Bunju	MW	33.47	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(19)	Makuburi	MW	9.75	-	-	-	-	-	-	1 9.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(20)	Mburahati	MW	5.79	-	-	-	-	-	-	-	-	-	-	-	1 5.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(21)	Makumbusho	MW	21.62	-	-	-	-	-	-	-	1 21.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(22)	Sinza	MW	6.89	-	-	-	-	-	-	1 6.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(23)	Kijitonyama	MW	18.46	-	-	-	-	0.4 7.38	-	-	0.6 11.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(24)	kimara	MW	17.34	-	-	-	-	-	-0 -	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(25)	Mikocheni	MW	33.70	-	-	-	-	0.6 20.22	-	-	0.4 13.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(26)	Mbezi	MW	22.16	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(27)	Hananasif	MW	11.78	-	-	-	-	-	-	-	-	1 11.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(28)	Saranga	MW	23.58	-	-	-	-	-	-0 -	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(29)	Kwembe	MW	20.04	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(30)	Msigani	MW	20.80	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(31)	Mbezi juu	MW	16.41	-	-	-	1 16.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(32)	Makongo	MW	17.38	-	-	-	-	-	-0 -	0.6 10.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(33)	Mabwepande	MW	8.08	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(34)	Wazo	MW	60.07	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2		Ilala Municipal Counc	MW	505.20																														
	(1)	Ukonga	MW	13.41	-	-	-	-	-	-	-	-	-	-	-	-	-	1 13.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(2)	Pugu	MW	23.65	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 11.82	0.5 11.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(3)	Msongola	MW	3.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 1.58	-	-	-	-	-	-	-	-	-	-	0.5 1.58	-	-	-	-
	(4)	Tabata	MW	9.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(5)	Kinyerezi	MW	4.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-
	(6)	Ilala	MW	60.79	-	-	-	-	-	-	-	-	-	-	-	-	1 60.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(7)	Mchikichini	MW	34.54	-	-	-	-	-	-	-	-	-	-	-	-	1 34.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(8)	Vingunguti	MW	26.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 26.91	-	-	-	-	-	-	-	-	-	-	-	-	-
	(9)	Kipawa	MW	24.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(10)	Buguruni	MW	23.68	-	-	-	-	-	-	-	-	-	-	-	-	1 23.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(11)	Kariakoo	MW	20.90	-	-	-	-	-	-	-	-	-	-	-	-	1 20.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(12)	Jangwani	MW	23.89	-	-	-	-	-	-	-	-	-	1 23.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(13)	Gerezani	MW	9.85	-	-	-	-	-	-	-	-	-	-	-	-	1 9.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(14)	Kisutu	MW	11.25	-	-	-	-	-	-	-	-	-	1 11.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(15)	Mchafukoge	MW	14.47	-	-	-	-	-	-	-	-	-	-	-	-	1 14.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(16)	Upanga Mashariki	MW	15.12	-	-	-	-	-	-	-	-	-	1 15.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(17)	Upanga Magharibi	MW	18.25	-	-	-	-	-	-	-	-	-	1 18.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(18)	Kivukoni	MW	12.17	-	-	-	-	-	-	-	-	-	-	-	-	1 12.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(19)	Kiwalani	MW	36.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 36.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(20)	Segerea	MW	13.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(21)	Kitunda	MW	18.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-
	(22)	Chanika	MW	5.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 5.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(23)	Kivule	MW	23.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-
	(24)	Gongo la Mboto	MW	12.34	-	-	-	-	-	-	-	-	-	-	-	-	-	1 12.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(25)	Majohe	MW	30.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 30.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(26)	Kimanga	MW	12.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-
3		Temeke Municipal Co	MW	492.24																														
	(1)	Kigamboni	MW	45.30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 45.30	-	-	-	-	-	-	-
	(2)	Vijibweni	MW	11.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-
	(3)	Kibada	MW	9.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-
	(4)	Kisarawe II	MW	1.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-
	(5)	Somangila	MW	23.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-
	(6)	Kimbiji	MW	1.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-
	(7)	Mbagala	MW	39.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 19.53	-	-	-	0.5 19.53	-	-	-	-	-
	(8)	Chamazi	MW	15.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 15.60	-	-	-	-
	(9)	Yombo Vituka	MW	18.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 18.87	-	-	-	-	-	-	-	-	-
	(10)	Charambe	MW	22.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 22.71	-	-	-	-
	(11)	Toangoma	MW	10.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-1 -	-	-	-	-	-
	(12)	Miburani	MW	9.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 4.93	0.5 4.93	-	-	-	-	-	-	-	-	-	-
	(13)	Temeke	MW	5.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 5.80	-	-	-	-	-	-	-	-	-	-
	(14)	Mtoni	MW	14.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 14.55	-	-	-	-	-	-	-	-	-	-
	(15)	Keko	MW	7.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 7.84	-	-	-	-	-	-	-	-	-	-	-
	(16)	Kurasini	MW	35.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 35.67	-	-	-	-	-	-	-	-	-	-	-
	(17)	Azimio	MW	18.83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 18.83	-	-	-	-	-	-	-	-	-	-
	(18)	Tandika	MW	11.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 11.03	-	-	-	-	-	-	-	-	-	-
	(19)	Sadali	MW	18.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 18.25	-	-	-	-	-	-	-	-	-	-
	(20)	Chang'ombe	MW	9.56	-	-	-	-	-	-	-	-	-	-	-	-	0.5 4.78	-	-	-	-	-	0.5 4.78	-	-	-	-	-	-	-	-	-	-	-
	(21)	Mbagala Kuu	MW	30.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 30.55	-	-	-	-	-
	(22)	Makangarawe	MW	13.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 13.06	-	-	-	-	-	-	-	-	-
	(23)	Pembamnazi	MW	2.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-
	(24)	Mjimwema	MW	6.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-
	(25)	Tungi	MW	12.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-
	(26)	Kijichi	MW	16.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 16.96	-	-	-	-	-	-	-	-	-	-
	(27)	Mianzini	MW	33.64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 33.64	-	-	-	-
	(28)	Kiburugwa	MW	19.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 9.67	-	-	-	0.5 9.67	-	-	-	-	-
	(29)	Buza	MW	13.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 13.50	-	-	-	-	-	-	-	-	-
	(30)	Kilakala	MW	11.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 11.02	-	-	-	-	-	-	-	-	-
Pwani		Pwani Region	MW	202.37																														
1		Bagamoyo District Co	MW	49.27																														
	(1)	Kiwangwa	MW	1.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(2)	Msata	MW	1.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(3)	Miono	MW	1.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(4)	Mkange	MW	0.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(5)	Magomeni	MW	2.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(6)	Dunda	MW	1.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(7)	Kiromo	MW	5.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(8)	Zinga	MW	10.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(9)	Yombo	MW	8.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(10)	Vigwaza	MW	1.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(11)	Talawanda	MW	0.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(12)	Bwilingu	MW	2.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(13)	Lugoba	MW	0.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(14)	Ubenazomozi	MW	1.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(15)	Mbwewe	MW	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(16)	kibindu	MW	0.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(17)	Fukayosi	MW	0.63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(18)	Kerege	MW	3.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(19)	Pera	MW	0.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(20)	Msoga	MW	0.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(21)	Kimange	MW	0.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(22)	Mandera	MW	0.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
2		Kibaha District Counc	MW	17.11																														
	(1)	Gwata	MW	0.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(2)	Dutumi	MW	0.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(3)	Magindu	MW	0.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(4)	Soga	MW	0.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(5)	Kikongo	MW	0.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(6)	Ruvu	MW	0.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(7)	Mlandizi	MW	8.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(8)	Kwala	MW	0.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(9)	Kilangalanga	MW	1.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(10)	Janga	MW	1.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(11)	Bokomnemela	MW	0.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
3		Kisarawe District Cou	MW	20.48																														
	(1)	Kisarawe	MW	6.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(2)	Msimbu	MW	1.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(3)	Masaki	MW	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(4)	Kibuta	MW	1.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(5)	Marumbo	MW	0.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(6)	Maneromango	MW	1.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(7)	Msanga	MW	0.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(8)	Marui	MW	0.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(9)	Cholesamvula	MW	0.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(10)	Vikumbulu	MW	0.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(11)	Mafizi	MW	0.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(12)	Kurui	MW	0.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(13)	Mzenga	MW	0.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(14)	Vihingo	MW	0.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(15)	kiluvya	MW	2.84	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4		Mkuranga District Cou	MW	50.24																														
	(1)	Mkuranga	MW	6.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(2)	Tambani	MW	5.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(3)	Vikindu	MW	8.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(4)	Mbezi	MW	1.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(5)	Shungubweni	MW	0.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(6)	Kisiju	MW	2.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(7)	Magawa	MW	1.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(8)	Kitomondo	MW	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(9)	Lukanga	MW	2.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(10)	Nyamato	MW	2.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(11)	Kimanzichana	MW	3.64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(12)	Mkamba	MW	2.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(13)	Panzuo	MW	1.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(14)	Bupu	MW	1.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(15)	Mwalusembe	MW	2.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(16)	Vianzi	MW	2.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(17)	Njia nne	MW	1.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(18)	Kiparang'anda	MW	2.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
5		Rufiji District Council	MW	8.69																														
6		Mafia District Council	MW	10.37																														
7		kibaha Town District (	MW	46.22																														
	(1)	Pangani	MW	2.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(2)	Maili Moja	MW	7.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(3)	Tumbi	MW	4.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 4.19	-	-	-
	(4)	Picha ya Ndege	MW	6.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(5)	Mkuza	MW	5.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(6)	Kibaha	MW	4.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(7)	Msangani	MW	2.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(8)	Kongowe	MW	6.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(9)	Misugusugu	MW	2.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(10)	Visiga	MW	3.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(11)	Mbwawa	MW	1.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
Zanzibar		Zanzibar total	MW	170.39																														

Electricity Demand Forecast and Required Capacity of 33/11kV Transformers

2030

			Unit		Tegeta SS	Bunju SS (N-DSM)	N. Bahari Beach SS	N. Mbezi SS	Kawe SS	Goba SS	Ubungo SS	Makumbusho SS	Drive Inn SS	NCC SS	Lugurni SS (W-DSM)	N. Mburahati SS	Ilala SS	N. Ilala SS	FZ II SS	Pugu SS	FZ III SS	Kimanga SS	Kivule SS (S-DSM)	Kurasini SS	Mtoni SS	Buza SS	Somangila SS (SE-DSM)	N. Kigamboni SS	Kibada SS	Mbagala SS	Mianzini SS	Mlandizi SS	Chalinze SS	Zinga SS	Mkuranga SS	Maneromango SS
		Required Capacity Total	MW	1,822	0.0	16.2	88.1	56.3	49.3	0.0	147.9	124.6	70.9	125.4	0.0	74.2	159.0	82.6	49.9	58.0	41.1	48.0	0.0	84.7	142.2	135.4	0.0	66.7	0.0	73.7	122.6	4.9	0.0	0.0	0.0	0.0
		(Calculated as pf = 0.9)	MVA	**2,024**	**0.0**	**18.0**	**97.9**	**62.5**	**54.8**	**0.0**	**164.4**	**138.4**	**78.7**	**139.4**	**0.0**	**82.4**	**176.7**	**91.7**	**55.5**	**64.5**	**45.6**	**53.3**	**0.0**	**94.2**	**158.0**	**150.5**	**0.0**	**74.2**	**0.0**	**81.8**	**136.2**	**5.4**	**0.0**	**0.0**	**0.0**	**0.0**
DSM		Dar es Salaam Region	MW	2,440																																
1		Kinondoni Municipal C	MW	963																																
	(1)	Magomeni	MW	11.34	-	-	-	-	-	-	-	-	-	-	-	1 11.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(2)	Makurumla	MW	18.66	-	-	-	-	-	-	-	-	-	-	-	1 18.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(3)	Ndugumbi	MW	10.85	-	-	-	-	-	-	-	-	-	-	-	1 10.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(4)	Tandale	MW	22.07	-	-	-	-	-	-	1 22.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(5)	Mwananyamala	MW	28.21	-	-	-	-	-	-	-	1 28.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(6)	Msasani	MW	63.85	-	-	-	-	-	-	-	0.4 25.54	0.6 38.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(7)	Kinondoni	MW	11.85	-	-	-	-	-	-	-	-	1 11.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(8)	Mzimuni	MW	6.33	-	-	-	-	-	-	-	-	-	-	-	1 6.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(9)	Kigogo	MW	16.97	-	-	-	-	-	-	-	-	-	-	-	1 16.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(10)	Mabibo	MW	25.25	-	-	-	-	-	-	1 25.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(11)	Manzese	MW	20.76	-	-	-	-	-	-	1 20.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(12)	Ubungo	MW	34.73	-	-	-	-	-	-	1 34.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(13)	Kibamba	MW	8.51	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(14)	Goba	MW	27.85	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(15)	Kawe	MW	43.80	-	-	-	0.7 30.66	0.3 13.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(16)	Kunduchi	MW	88.12	-	-	1 88.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(17)	Mbweni	MW	16.17	-	1 16.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(18)	Bunju	MW	52.28	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(19)	Makuburi	MW	16.91	-	-	-	-	-	-	1 16.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(20)	Mburahati	MW	10.05	-	-	-	-	-	-	-	-	-	-	-	1 10.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(21)	Makumbusho	MW	35.88	-	-	-	-	-	-	-	1 35.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(22)	Sinza	MW	11.94	-	-	-	-	-	-	1 11.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(23)	Kijitonyama	MW	32.44	-	-	-	-	0.4 12.97	-	-	0.6 19.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(24)	kimara	MW	29.67	-	-	-	-	-	-0.4 -	-0.6 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(25)	Mikocheni	MW	38.70	-	-	-	-	0.6 23.22	-	-	0.4 15.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(26)	Mbezi	MW	28.45	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(27)	Hananasif	MW	20.71	-	-	-	-	-	-	-	-	1 20.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(28)	Saranga	MW	40.35	-	-	-	-	-	-0.4 -	-0.6 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(29)	Kwembe	MW	30.86	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(30)	Msigani	MW	21.35	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(31)	Mbezi juu	MW	25.63	-	-	-	1 25.63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(32)	Makongo	MW	27.15	-	-	-	-	-	-0.4 -	0.6 16.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(33)	Mabwepande	MW	14.21	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(34)	Wazo	MW	71.13	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2		Ilala Municipal Counci	MW	735.67																																
	(1)	Ukonga	MW	18.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 18.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(2)	Pugu	MW	25.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 12.59	0.5 12.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(3)	Msongola	MW	5.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 2.93	-	-	-	-	-	-	-	-	-	-	0.5 2.93	-	-	-	-	-
	(4)	Tabata	MW	17.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(5)	Kinyerezi	MW	8.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(6)	Ilala	MW	86.88	-	-	-	-	-	-	-	-	-	-	-	-	0.5 43.44	0.5 43.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(7)	Mchikichini	MW	56.45	-	-	-	-	-	-	-	-	-	-	-	-	1 56.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(8)	Vingunguti	MW	48.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 48.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(9)	Kipawa	MW	42.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(10)	Buguruni	MW	33.36	-	-	-	-	-	-	-	-	-	-	-	-	-	1 33.36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(11)	Kariakoo	MW	45.74	-	-	-	-	-	-	-	-	-	-	-	-	1 45.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(12)	Jangwani	MW	32.54	-	-	-	-	-	-	-	-	-	1 32.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(13)	Gerezani	MW	13.42	-	-	-	-	-	-	-	-	-	-	-	-	1 13.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(14)	Kisutu	MW	15.32	-	-	-	-	-	-	-	-	-	1 15.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(15)	Mchafukoge	MW	19.71	-	-	-	-	-	-	-	-	-	1 19.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(16)	Upanga Mashariki	MW	20.59	-	-	-	-	-	-	-	-	-	1 20.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(17)	Upanga Magharibi	MW	24.85	-	-	-	-	-	-	-	-	-	1 24.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(18)	Kivukoni	MW	12.43	-	-	-	-	-	-	-	-	-	1 12.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(19)	Kiwalani	MW	41.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 41.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(20)	Segerea	MW	21.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(21)	Kitunda	MW	28.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-
	(22)	Chanika	MW	10.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 10.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(23)	Kivule	MW	35.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-
	(24)	Gongo la Mboto	MW	18.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 18.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(25)	Majohe	MW	32.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 32.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(26)	Kimanga	MW	20.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3		Temeke Municipal Cou	MW	741.51																																
	(1)	Kigamboni	MW	66.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 66.74	-	-	-	-	-	-	-	-
	(2)	Vijibweni	MW	13.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-
	(3)	Kibada	MW	10.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-
	(4)	Kisarawe II	MW	3.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-
	(5)	Somangila	MW	34.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-
	(6)	Kimbiji	MW	2.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-
	(7)	Mbagala	MW	52.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 26.15	-	-	-	0.5 26.15	-	-	-	-	-	-
	(8)	Chamazi	MW	24.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 24.06	-	-	-	-	-
	(9)	Yombo Vituka	MW	29.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 29.11	-	-	-	-	-	-	-	-	-	-
	(10)	Charambe	MW	38.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 38.53	-	-	-	-	-
	(11)	Toangoma	MW	18.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.5 -	-0.5 -	-	-	-	-	-	-
	(12)	Miburani	MW	16.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 8.37	0.5 8.37	-	-	-	-	-	-	-	-	-	-	-
	(13)	Temeke	MW	9.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 9.85	-	-	-	-	-	-	-	-	-	-	-
	(14)	Mtoni	MW	24.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 24.69	-	-	-	-	-	-	-	-	-	-	-
	(15)	Keko	MW	13.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 13.29	-	-	-	-	-	-	-	-	-	-	-	-
	(16)	Kurasini	MW	57.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 57.32	-	-	-	-	-	-	-	-	-	-	-	-
	(17)	Azimio	MW	31.95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 31.95	-	-	-	-	-	-	-	-	-	-	-
	(18)	Tandika	MW	18.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 18.71	-	-	-	-	-	-	-	-	-	-	-
	(19)	Sadali	MW	19.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 19.91	-	-	-	-	-	-	-	-	-	-	-
	(20)	Chang'ombe	MW	11.52	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 5.76	-	-	-	-	-	0.5 5.76	-	-	-	-	-	-	-	-	-	-	-	-
	(21)	Mbagala Kuu	MW	31.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 31.09	-	-	-	-	-	-
	(22)	Makangarawe	MW	22.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 22.16	-	-	-	-	-	-	-	-	-	-
	(23)	Pembamnazi	MW	3.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-
	(24)	Mjimwema	MW	11.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-
	(25)	Tungi	MW	15.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-
	(26)	Kijichi	MW	28.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 28.77	-	-	-	-	-	-	-	-	-	-	-
	(27)	Mianzini	MW	57.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 57.07	-	-	-	-	-
	(28)	Kiburugwa	MW	32.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5 16.41	-	-	-	0.5 16.41	-	-	-	-	-	-
	(29)	Buza	MW	22.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 22.90	-	-	-	-	-	-	-	-	-	-
	(30)	Kilakala	MW	18.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 18.69	-	-	-	-	-	-	-	-	-	-
Pwani		Pwani Region	MW	303.46																																
1		Bagamoyo District Cou	MW	75.07																																
	(1)	Kiwangwa	MW	1.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(2)	Msata	MW	1.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(3)	Miono	MW	1.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(4)	Mkange	MW	0.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(5)	Magomeni	MW	3.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(6)	Dunda	MW	2.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(7)	Kiromo	MW	8.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(8)	Zinga	MW	18.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(9)	Yombo	MW	12.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(10)	Vigwaza	MW	1.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(11)	Talawanda	MW	0.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(12)	Bwilingu	MW	3.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(13)	Lugoba	MW	1.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(14)	Ubenazomozi	MW	1.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(15)	Mbwewe	MW	1.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(16)	kibindu	MW	1.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(17)	Fukayosi	MW	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-1 -	-	-
	(18)	Kerege	MW	7.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(19)	Pera	MW	1.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(20)	Msoga	MW	1.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(21)	Kimange	MW	0.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(22)	Mandera	MW	1.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
2		Kibaha District Counci	MW	23.14																																
	(1)	Gwata	MW	1.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(2)	Dutumi	MW	0.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(3)	Magindu	MW	1.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-
	(4)	Soga	MW	0.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(5)	Kikongo	MW	0.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(6)	Ruvu	MW	0.72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(7)	Mlandizi	MW	12.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(8)	Kwala	MW	0.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(9)	Kilangalanga	MW	2.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(10)	Janga	MW	2.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(11)	Bokomnemela	MW	0.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
3		Kisarawe District Cour	MW	31.09																																
	(1)	Kisarawe	MW	9.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(2)	Msimbu	MW	2.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(3)	Masaki	MW	1.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(4)	Kibuta	MW	2.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(5)	Marumbo	MW	1.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(6)	Maneromango	MW	2.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(7)	Msanga	MW	1.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(8)	Marui	MW	0.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(9)	Cholesamvula	MW	1.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(10)	Vikumbulu	MW	0.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(11)	Mafizi	MW	1.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(12)	Kurui	MW	0.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -
	(13)	Mzenga	MW	1.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(14)	Vihingo	MW	0.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(15)	kiluvya	MW	4.43	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4		Mkuranga District Cou	MW	85.86																																
	(1)	Mkuranga	MW	11.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-
	(2)	Tambani	MW	8.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-
	(3)	Vikindu	MW	15.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-
	(4)	Mbezi	MW	2.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(5)	Shungubweni	MW	1.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(6)	Kisiju	MW	4.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(7)	Magawa	MW	2.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(8)	Kitomondo	MW	1.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(9)	Lukanga	MW	3.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(10)	Nyamato	MW	4.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(11)	Kimanzichana	MW	6.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(12)	Mkamba	MW	5.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(13)	Panzuo	MW	2.64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(14)	Bupu	MW	2.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(15)	Mwalusembe	MW	5.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(16)	Vianzi	MW	3.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-	-
	(17)	Njia nne	MW	2.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
	(18)	Kiparang'anda	MW	3.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-
5		Rufiji District Council	MW	16.14																																
6		Mafia District Council	MW	18.42																																
7		kibaha Town District C	MW	53.75																																
	(1)	Pangani	MW	2.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(2)	Maili Moja	MW	9.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(3)	Tumbi	MW	4.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 4.87	-	-	-	-
	(4)	Picha ya Ndege	MW	7.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(5)	Mkuza	MW	6.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(6)	Kibaha	MW	4.95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(7)	Msangani	MW	2.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-
	(8)	Kongowe	MW	7.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(9)	Misugusugu	MW	2.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(10)	Visiga	MW	3.72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
	(11)	Mbwawa	MW	1.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1 -	-	-	-	-
Zanzibar		Zanzibar total	MW	228.05																																

S-3. Transformer Data (for Network Substations)

Name of S/S	ID No.	Capacity Bank	Capacity Unit	No. of Phase	No.	Cool-ing	Vector Group	Conn-ection	Tap Winding	Tap (kV)	Tap %	Tap Taps	%Z @Rated	%Z @10 MVA	Year	Remarks
Arusha	T1	5	5	3	1			Y Y D	P S	66 33			No data			
Babati	T1	30	30	3	1	ONAN	YNyn0d11	Y Y D	P S	220 66		25	9.88	3.29		
	T2	30	30	3	1	ONAN	YNyn0d11	Y Y D	P S	220 66		25	9.86	3.29		
	T3	8.4	8.4	3	1	ONAN	YNyn0d11	Y Y D	P S T	66 33 11		25	PS 8.51	PS 10.13		
	T4	8.4	8.4	3	1	ONAN	YNyn0d11	Y Y D	P S T	66 33 11		25	PS 8.55	PS 10.18		
Bulyanhulu	T1	15	15	3	1				P S	220 33						
	T2	15	15	3	1				P S	220 33			No data			
	T3	15	15	3	1				P S	220 6.6						
Bunda	T1	15 15 5	15 15 5	3	1	ONAN	YNyn0d11	Y Y D	P S T	132 66 33		13	PS 9.97 ST 5.31 TP 1.61	PS 6.65 ST 3.54 TP 3.22		
Buzwagi	T1	30	30	3	1			Y Y D	P S	220 33			No data			
Chalinze	T1	5	5	3	1	ONAN	YNyn0(d)	Y Y D	P S T	132 33		17	8.80	17.60		
	T2	10	10	3	1	ONAN	YNyn0(d)	Y Y D	P S T	132 33			10.00	10.00		All transformers are out of circuits.
	T3	45	45	3	1	ONAN	YNyn0(d)	Y Y D	P S T	132 6.6			No data			
Dodoma	T2	30	30	3	1	ONAN	YNyn0(d)	Y Y D	P S	220 33	+/-10	17	13.16	4.39		
	T3	30	30	3	1	ONAN	YNyn0(d)	Y Y D	P S	220 33	+/-10	17	13.21	4.40		
Factory Zone III (Kipawa)	T2	90	90	3	1		YNyn0(d)	Y Y D	P S	132 33	+/-10	17	11.70	1.30		Original 45 MVA transformer was replaced with 90 MVA one.
	T3	90	90	3	1		YNyn0(d)	Y Y D	P S	132 33	+/-10	17	11.70	1.30		Ditto
Hale Hydro	T1	15	15	3	1	ONAN	YNd1	Y D	P S	132 33		7	9.70	6.47		
	T2	15	15	3	1	ONAN	YNd1	Y D	P S	132 33		7	9.70	6.47		
	T1	12.5	12.5	3	1	ONAN	Dyn	D Y	P S	33 11		5	9.80	7.84		For 10.5 MW Generator (G1)
	T2	12.5	12.5	3	1	ONAN	Dyn	D Y	P S	33 11		5	9.80	7.84		Ditto (G2)
Ilala	T1	90	90	3	1	ONAN	YNd1	Y D	P S	132 33	+/-10	17	13.57	1.51	2006	T1 is going to be replaced with 60 MVA in 2016.
	New T1	60	60	3	1	ONAN	YNyn0d1	Y Y D	P S	132 33	+/-10	17	12.40 (planned)	2.07	2016 (planned)	Japan Grant Aid Project
	T2	60	60	3	1	ONAN	YNyn0d1	Y Y D	P S	132 33	+/-10	17	12.40	2.07	2007	
	T5	60	60	3	1	ONAN	YNyn0d1	Y Y D	P S	132 33	+/-10	17	12.35	2.06		No manufacturing year on Name plate
	T7	60	60	3	1	ONAN	YNyn0d1	Y Y D	P S	132 33	+/-10	17	12.40 (planned)	2.07	2016 (planned)	Japan Grant Aid Project
Iringa	T1	22.5	22.5	3	1	ONAF	YNyn0(d)	Y Y D	P S	220 33	+/-10	17	14.10	6.27		
	T2	22.5	22.5	3	1	ONAF	YNyn0(d)	Y Y D	P S	220 33	+/-10	17	14.10	6.27		
Kange	T1	20	20	3	1	ONAF	YNyn0d5	Y Y D	P S	132 33	+/-10	17	12.24	6.12		

Summary of Transformers

Name of S/S	ID No.	220/132/33	220/132	220/66	220/33/33	220/33	220/11	220/6.6	132/66/33	132/66	132/33/11	132/33	132/11	132/6.6	132/3.3	66/33/11	66/33	66/11	33/33	33/11	11/11
Arusha	T1																5				
Babati	T1			30																	
	T2			30																	
	T3															8.4					
	T4															8.4					
Bulyanhulu	T1					15															
	T2					15															
	T3							15													
Bunda	T1								15												
Buzwagi	T1					30															
Chalinze	T1											5									
	T2											10									
	T3													45							
Dodoma	T2					30															
	T3					30															
Factory Zone III (Kipawa)	T2											90									
	T3											90									
Hale Hydro	T1											15									
	T2											15									
	T1																			12.5	
	T2																			12.5	
Ilala	T1											90									
	New T1											60									
	T2											60									
	T5											60									
	T7											60									
Iringa	T1					22.5															
	T2					22.5															
Kange	T1											20									

Name of S/S	ID No.	Capacity Bank	Capacity Unit	No. of Phase	No.	Cooling	Vector Group	Connection	Tap Winding	Tap (kV)	Tap %	Taps	%Z @Rated	%Z @10 MVA	Year	Remarks
Karatu	T1	8.4	8.4	3	1	ONAN	YNyn0d5	Y Y D	P S	66 33		25	PS 8.46 ST 18.62 TP 8.51	PS 10.07 ST 22.17 TP 10.13		
Kasiga	T1	20	20	3	1	ONAN	YNyn0d5	Y Y D	P S	132 33	+/-10	17	12.24	6.12		
KIA	T1	20	20	3	1					132 33		No data				Kilimanjaro International Airport Newly commissioned.
	T2	20	20	3	1					132 33						
Kibara	T1	5	5	3	1					66 33		No data				
Kibeta/Bukoba	T1	10	10	3	1	ONAN	YNyn0d11	Y Y D	P S	132 33	+/-10	17	9.66	9.66		
	T2	10	10	3	1	ONAN	YNyn0d11	Y Y D	P S	132 33	+/-10	17	9.66	9.66		
Kidatu Hydro	T1	60	60	3	1	OFAN	Dyn11	D Y	P S	220 11		3	8.84	1.47		For 51 MW Generator (G1)
	T2	60	60	3	1	OFAN	Dyn11	D Y	P S	220 11		3	8.84	1.47		Ditto (G2)
	T3	60	60	3	1	OFAN	Dyn11	D Y	P S	220 11		3	8.84	1.47		Ditto (G3)
	T4	60	60	3	1	OFAN	Dyn11	D Y	P S	220 11		3	8.84	1.47		Ditto (G4)
	T5	22.5	22.5	3	1	ONAN	YNyn0(d)	Y Y D	P S	220 33	+/-10	17	9.30	4.13		
	T6	22.5	22.5	3	1	ONAN	YNyn0(d)	Y Y D	P S	220 33	+/-10	17	9.30	4.13		
Kihansi Hydro	T1	71	71	3	1			Y D	P S	220 11						For 60 MW Generator (G1)
	T2	71	71	3	1			Y D	P S	220 11			No data			Ditto (G2)
	T3	71	71	3	1			Y D	P S	220 11						Ditto (G3)
	T6	10	10	3	1			Y Y D	P S	220 33						
Kiyungi	T1	15	15	3	1	ONAN	YNyn0d1	Y Y D	P S	132 66		17	11.06	7.37		
	T2	5	5	3	1	ONAN	YNyn0d1	Y Y D	P S	66 33		5	7.08	14.16		
	T3	5	5	3	1	ONAN	YNyn0d1	Y Y D	P S	66 33		5	7.11	14.22		
	T4	20	20	3	1	ONAN	YNyn0d1	Y Y D	P S	132 33		21	14.20	7.10		
	T5	10	10	3	1	ONAN	Dyn	D Y	P S	66 33		5	9.45	9.45		
	T6	20	20	3	1	ONAN	YNyn0(d)	Y Y D	P S	132 66	+/-10	17	11.00	5.50	2013	Japan Grant Aid Project
Kondoa	T1	8.4	8.4	3	1		YNyn0d11	Y Y D	P S T	66 33 11		25	PS 8.51 ST 18.68 TP 8.53	PS 10.13 ST 22.24 TP 10.15		
	T2	8.4	8.4	3	1		YNyn0d11	Y Y D	P S T	66 33 11		25	PS 8.47 ST 18.59 TP 8.47	PS 10.08 ST 22.13 TP 10.08		
Kyaka	T1	10	10	3	1	ONAN	YNyn0d11	Y Y D	P S	132 33	+/-10	17	9.66	9.66		
	T2	10	10	3	1	ONAN	YNyn0d11	Y Y D	P S	132 33	+/-10	17	9.66	9.66		
Lusu	T1	15	15	3	1	ONAN	YNyn0d1	Y Y D	P S	132 33	+/-10	17	11.04	7.36		
Makambako	T1	45	45	3	1		YNa0d	Y Y D		220 132 33		No data				

Summary of Transformers

Name of S/S	ID No.	220/132/33	220/132	220/66	220/33/33	220/33	220/11	220/6.6	132/66/33	132/66	132/33/11	132/33	132/11	132/6.6	132/3.3	66/33/11	66/33	66/11	33/33	33/11	11/11
Karatu	T1															8.4					
Kasiga	T1											20									
KIA	T1											20									
	T2											20									
Kibara	T1																5				
Kibeta/Bukoba	T1											10									
	T2											10									
Kidatu Hydro	T1						60														
	T2						60														
	T3						60														
	T4						60														
	T5					22.5															
	T6					22.5															
Kihansi Hydro	T1						71														
	T2						71														
	T3						71														
	T6					10															
Kiyungi	T1									15											
	T2																5				
	T3																5				
	T4											20									
	T5																10				
	T6									20											
Kondoa	T1															8.4					
	T2															8.4					
Kyaka	T1											10									
	T2											10									
Lusu	T1											15									
Makambako	T1	45																			

Name of S/S	ID No.	Capacity		No. of Phase	No.	Cool-ing	Vector Group	Conn-ection	Tap				%Z		Year	Remarks	Summary of Transformers																			
		Bank	Unit						Winding	(kV)	%	Taps	@Rated	@10 MVA			220/132/33	220/132	220/66	220/33/33	220/33	220/11	220/6.6	132/66/33	132/66	132/33/11	132/33	132/11	132/6.6	132/3.3	66/33/11	66/33	66/11	33/33	33/11	11/11
Makumbusho	T1	45	45	3	1	ONAN	YNyn0d1	Y Y D	P S	132 33	+/-10	17	11.60	2.58	2009												45									
	T2	45	45	3	1	ONAN	YNyn0d1	Y Y D	P S	132 33	+/-10	17	11.60	2.58	2009												45									
Makuyuni	T1	10	10	3	1	ONAN	YNyn0(d)	Y Y D	P S	66 33	+/-10	17	7.00	7.00	2013	Japan Grant Aid Project																10				
Mbeya	T1	30	30	3	1	ONAN	YNyn0d11	Y Y D	P S	220 33	+/-10	17	12.77	4.26							30															
	T2	30	30	3	1	ONAN	YNyn0d11	Y Y D	P S	220 33	+/-10	17	12.52	4.17							30															
Mbulu	T1	8.4	8.4	3	1	ONAF	YNyn0d11	Y Y D	P S T	66 33 11		25	PS 8.48 ST 18.62 TP 8.49	PS 10.10 ST 22.17 TP 10.11																	8.4					
Mlandizi	T1	10	10	3	1	ONAN	YNyn0(d)	Y Y D	P S	132 33	+/-10	17	9.70	9.70													10									
	T2	10	10	3	1	ONAN	YNyn0(d)	Y Y D	P S	132 33	+/-10	17	9.70	9.70													10									
Morogoro	T1	90	90	3	1	ONAF	YNa0d11	Y Y D	P S T	220 132 33		13	PS 8.22 ST 15.70 TP 11.52	PS 0.91 ST 1.74 TP 1.28			90																			
	T2	20	20	3	1	ONAN	YNa0d11	Y Y D	P S	33 33		13	0.206			Regulating transformer																		20		
	T3	20	20	3	1	ONAN	YNa0d11	Y Y D	P S	33 33		13	0.220			Ditto																		20		
Mtera Hydro	T1	45	15	1	3	ONAN	YNd11	Y D	P S	220 11	+/-10	17	11.30	2.51		For 40 MW Generator (G1)						45														
	T2	45	15	1	3	ONAN	YNd11	Y D	P S	220 11	+/-10	17	11.30	2.51		Ditto (G2)						45														
	ST1	2	2	3	1	ONAN	Dyn11	D Y	P S	11 11			7.10	35.50																						2
	ST2	2	2	3	1	ONAN	Dyn11	D Y	P S	11 11			7.10	35.50																						2
Mufindi	T1	35	35	3	1	ONAN	YNyn0d11	Y Y D	P S T	220 33 11	+/-10	17	PS 9.24 ST 8.11 TP 15.90	PS 2.64 ST 2.32 TP 4.54						35																
	T2	35	35	3	1	ONAN	YNyn0d11	Y Y D	P S T	220 33 11	+/-10	17	PS 9.24 ST 8.11 TP 15.90	PS 2.64 ST 2.32 TP 4.54						35																
Musoma	T1	15	15	3	1	ONAN ONAF	YNd11	Y D	P S	132 33	+/-10	17	10.37	6.91													15									
	T2	15	15	3	1	ONAN ONAF	YNd11	Y D	P S	132 33	+/-10	17	10.37	6.91													15									
Mwanza	T1	60	60	3	1	ONAF	YNa0d1	Y Y D	P S T	220 132 33	+/-10	17	PS 9.54 ST 20.10 TP 37.00	PS 1.59 ST 10.05 TP 9.25		%Z of ST at 20 MVA base %Z of TP at 40 MVA base	60																			
	T2	60	60	3	1	ONAF	YNa0d1	Y Y D	P S T	220 132 33	+/-10	17	PS 9.60 ST 20.10 TP 37.11	PS 1.60 ST 10.05 TP 9.28		Ditto Ditto	60																			
	T3	60	60	3	1	ONAF	YNa0d1	Y Y D	P S T	220 132 33	+/-10	17	PS 9.60 ST 20.10 TP 37.11	PS 1.60 ST 10.05 TP 9.28		Ditto Ditto	60																			
Njiro	T1	30	30	3	1	ONAN	YNyn0(d)	Y Y D	P S	132 33	+/-10	17	12.00	4.00													30									
	T2	30	30	3	1	ONAN	YNyn0(d)	Y Y D	P S	132 33	+/-10	17	12.00	4.00													30									
	T3	60	60	3	1	ONAN	YNa0	Y Y	P S	220 132	+/-10	17	12.80	2.13				60																		
	T4	60	60	3	1	ONAN	YNa0	Y Y	P S	220 132	+/-10	17	12.80	2.13				60																		
Nyakato	T1	60	60	3	1				P S	132 11			No data			For Generator												60								
	T2	60	60	3	1				P S	132 11						Ditto												60								
Nyamongo	T1	45	45	3	1					132 33			No data														45									

Name of S/S	ID No.	Capacity Bank	Capacity Unit	No. of Phase	No.	Cooling	Vector Group	Connection	Tap Winding	Tap (kV)	Tap %	Taps	%Z @Rated	%Z @10 MVA	Year	Remarks
N.Y.M. Hydro	T1	5	5	3	1	ONAN	YNd1	Y D	P S	66 11		9	6.92	13.84		For 4 MW Generator (G1)
	T2	5	5	3	1	ONAN	YNd1	Y D	P S	66 11		9	6.92	13.84		Ditto (G2)
	T3	5	5	3	1	ONAN	YNyn0(d)	Y Y D	P S	66 33		17	7.54	15.08		
Pangani Hydro	T1	40	40	3	1	ONAN	YNd11	Y D	P S	132 11		5	8.90	2.23		For 34 MW Generator (G1)
	T2	40	40	3	1	ONAN	YNd11	Y D	P S	132 11		5	8.90	2.23		Ditto (G2)
Same	T1	5	5	3	1	ONAN ONAF	YNyn0d1	Y Y D	P S	132 33	+/-10	17	7.58	15.16		
Shinyanga	T1	60	60	3	1	ONAF	YNa0d11	Y Y D	P S T	220 132 33	+/-10	17	PS 8.56 ST 20.08 TP 37.19	PS 1.43 ST 10.04 TP 9.30		%Z of ST at 20 MVA base %Z of ST at 40 MVA base
	T2	60	60	3	1	ONAF	YNa0d11	Y Y D	P S T	220 132 33	+/-10	17	PS 8.56 ST 20.08 TP 37.19	PS 1.43 ST 10.04 TP 9.30		Ditto Ditto
	T3	60	60	3	1	ONAF	YNa0d11	Y Y D	P S T	220 132 33	+/-10	17	PS 8.56 ST 20.08 TP 37.19	PS 1.43 ST 10.04 TP 9.30		Ditto Ditto
Singida	T1	20	20	3	1	ONAN ONAF	YNyn0d5	D Y	P S	220 33	+/-10	17	12.93	6.47		
	T2	20	20	3	1	ONAN ONAF	YNyn0d5	D Y	P S	220 33	+/-10	17	12.93	6.47		
Songas	T9	60	60	3	1								No data			
	T10	60	60	3	1											
Tabora	T1	15	15	3	1	ONAN ONAF	YNd1	Y D	P S	132 33	+/-10	17	10.22	6.81		
	T2	15	15	3	1	ONAN ONAF	YNd1	Y D	P S	132 33	+/-10	17	10.22	6.81		
Tanga	T1	10	10	3	1	ONAN	Dyn1	D Y	P S	132 33		13	9.27	9.27		
	T2	10	10	3	1	ONAN	Dyn1	D Y	P S	132 33		13	9.27	9.27		
	T5	20	20	3	1	ONAN	Dyn1	D Y	P S	132 33		13	9.40	4.70		
Tegeta (Kunduchi)	T1	50	50	3	1	ONAN	YNyn0(d)	Y Y D	P S	132 33	+10/-15	21	12.10	2.42	1993	ONAF 65 MVA: Future
	T2	50	50	3	1	ONAN	YNyn0(d)	Y Y D	P S	132 33	+10/-15	21	12.00	2.40	1993	ONAF 65 MVA: Future
Tegeta Gas Plant	T1	65	65	3	1			Y Y D	P S	132 11			No data			For 5 x 8.75 MW Generators (G1 to G5)
	T2	65	65	3	1			Y Y D	P S	132 11						
Ubungo	T4	120 (90) 35	120 (90) 35	3	1	ONAF (ONAN)	YNyn0d11	Y Y D	P S T	132 33 11	+/-10	17	PS 13.55 ST 7.13 TP 22.69	PS 1.13 ST 0.59 TP 1.89	2012	%Z at 120 MVA base ( ) shows at ONAN cooling.
	T5	120 (90) 35	120 (90) 35	3	1	ONAF (ONAN)	YNyn0d11	Y Y D	P S T	132 33 11	+/-10	17	PS 13.67 ST 7.13 TP 22.72	PS 1.14 ST 0.59 TP 1.89	2012	Ditto Ditto
	T6	150 (120/90) 50	150 (120/90) 50	3	1	ONAF (ONAN)	YNa0d11	Y Y D	P S T	220 132 33	+6/-10	17	PS 9.30 ST 6.00 TP 9.40	PS 0.62 ST 0.40 TP 0.63	1974	%Z at 150 MVA base ( ) shows at ONAN cooling.
	T7	150 (120/90) 50	150 (120/90) 50	3	1	ONAF (ONAN)	YNa0d11	Y Y D	P S T	220 132 33	+6/-10	17	PS 9.20 ST 6.00 TP 9.40	PS 0.61 ST 0.40 TP 0.63	1974	Ditto Ditto
Ubungo Gas Plant	T1	65	65	3	1					132 33			No data			For 6 x 8.75 MW Generators (G1 to G6)
	T2	65	65	3	1					132 33						Ditto (G7 to G12)

Name of S/S	ID No.	220/132/33	220/132	220/66	220/33/33	220/33	220/11	220/6.6	132/66/33	132/66	132/33/11	132/33	132/11	132/6.6	132/3.3	66/33/11	66/33	66/11	33/33	33/11	11/11
N.Y.M. Hydro	T1																	5			
	T2																	5			
	T3																5				
Pangani Hydro	T1												40								
	T2												40								
Same	T1											5									
Shinyanga	T1	60																			
	T2	60																			
	T3	60																			
Singida	T1					20															
	T2					20															
Songas	T9												60	Songasの管理のため、除く							
	T10												60								
Tabora	T1											15									
	T2											15									
Tanga	T1											10									
	T2											10									
	T5											20									
Tegeta (Kunduchi)	T1											50									
	T2											50									
Tegeta Gas Plant	T1												65								
	T2												65								
Ubungo	T4										120										
	T5										120										
	T6	150																			
	T7	150																			
Ubungo Gas Plant	T1												65								
	T2												65								

Name of S/S	ID No.	Capacity Bank	Capacity Unit	No. of Phase	No.	Cool-ing	Vector Group	Conn-ection	Tap Winding	Tap (kV)	Tap %	Tap Taps	%Z @Rated	%Z @10 MVA	Year	Remarks
New Ubungo Gas Plant	T1	56 (33)	56 (33)	3	1	ONAF (ONAN)	YNd1	Y D	P S	132 11		17	12.91 7.50	2.31 2.27		%Z at 56 MVA base %Z at 33 MVA base
	T2	56 (33)	56 (33)	3	1	ONAF (ONAN)	YNd1	Y D	P S	132 11		17	12.98 7.65	2.32 2.32		Ditto
	T3	56 (33)	56 (33)	3	1	ONAF (ONAN)	YNd1	Y D	P S	132 11		17	12.81 7.55	2.29 2.29		Ditto
Wazo	T1	25	25	3	1		YNd5	Y Y D	P S	132 3.3	+/-10	17	14.20	5.68		Tanzania Portland Cement Co. Ltd. (TPCC)
	T2	25	25	3	1		YNd5	Y Y D	P S	132 3.3	+/-10	17	14.20	5.68	2013	
Zanjibar I	T1	30	30	3	1					132 33						ZECO
	T2	30	30	3	1					132 33			No data			
	T5	25	25	3	1					132 11						
Zanjibar II	T1	60 (38)	60 (38)	3	1	ONAF (ONAN)	YNyn0d5	Y Y D	P S	132 33	+/-10	17	12.00	2.00		ZECO
	T2	60 (38)	60 (38)	3	1	ONAF (ONAN)	YNyn0d5	Y Y D	P S	132 33	+/-10	17	12.00	2.00		
Zuzu Thermal	T1	5	5	3	1					33 11			No data			For 1 x 1.75 MW and 2 x 2.85 MW Generators

Total MVA 4,195.4 MVA
No. of Unit 121 Numbers

Summary of Transformers

Name of S/S	ID No.	220/132/33	220/132	220/66	220/33/33	220/33	220/11	220/6.6	132/66/33	132/66	132/33/11	132/33	132/11	132/6.6	132/3.3	66/33/11	66/33	66/11	33/33	33/11	11/11
New Ubungo Gas Plant	T1												56								
	T2												56								
	T3												56								
Wazo	T1														25						
	T2														25						
Zanjibar I	T1											30									
	T2											30									
	T5												25								
Zanjibar II	T1											60									
	T2											60									
Zuzu Thermal	T1																			5	
		795 10	120 2	60 2	70 2	320 14	543 9	15 1	15 1	35 2	240 2	1,130 38	628 13	45 2	0 0	50.4 6	45 7	10 2	40 2	30 3	4 2
		220/132/33	220/132	220/66	220/33/33	220/33	220/11	220/6.6	132/66/33	132/66	132/33/11	132/33	132/11	132/6.6	132/3.3	66/33/11	66/33	66/11	33/33	33/11	11/11

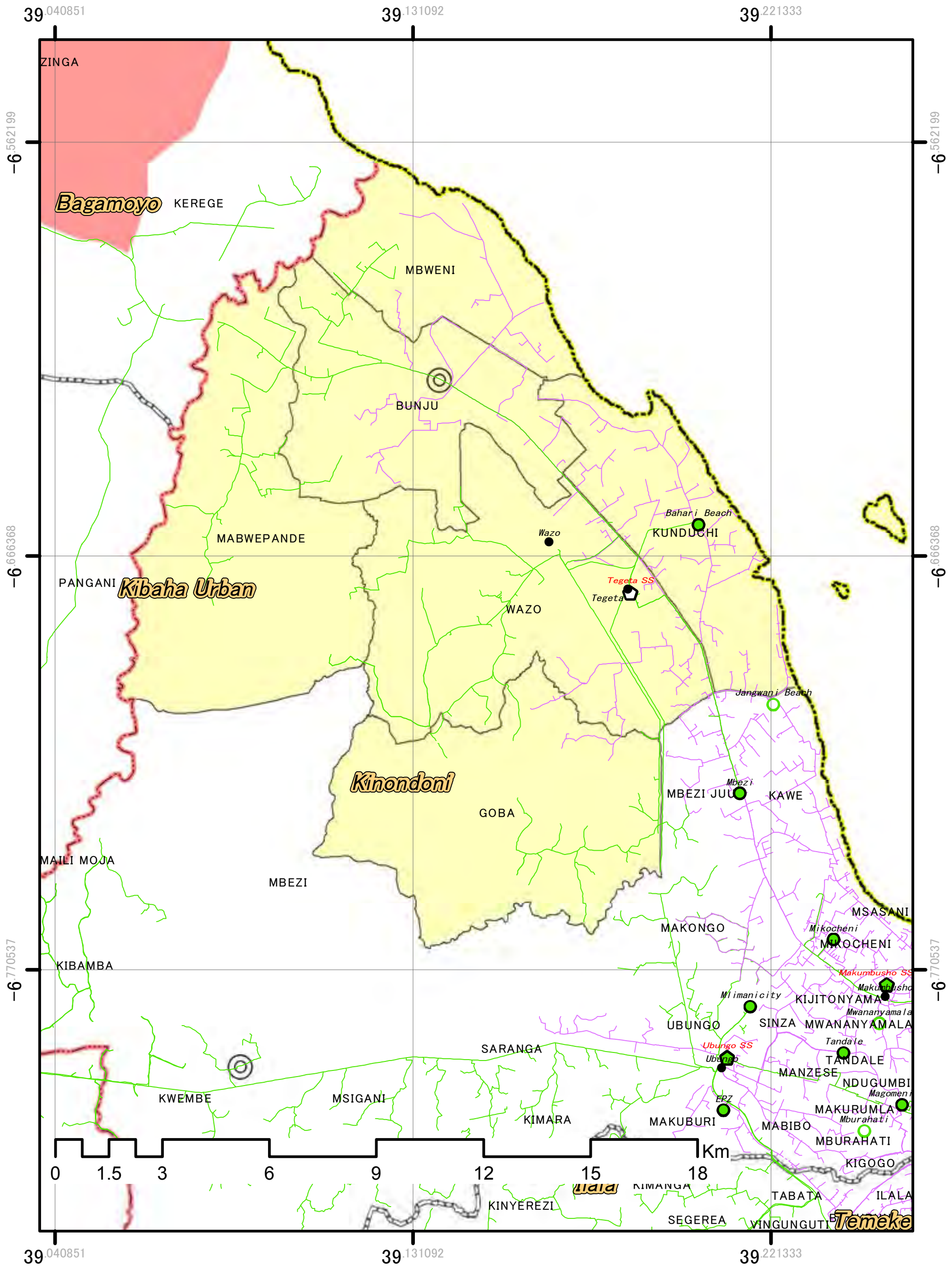
Summary of Transformers

Not counted in total due to TPCC property.

Not counted in total due to ZECO property.

S-4 Distribution areas of each section in the year

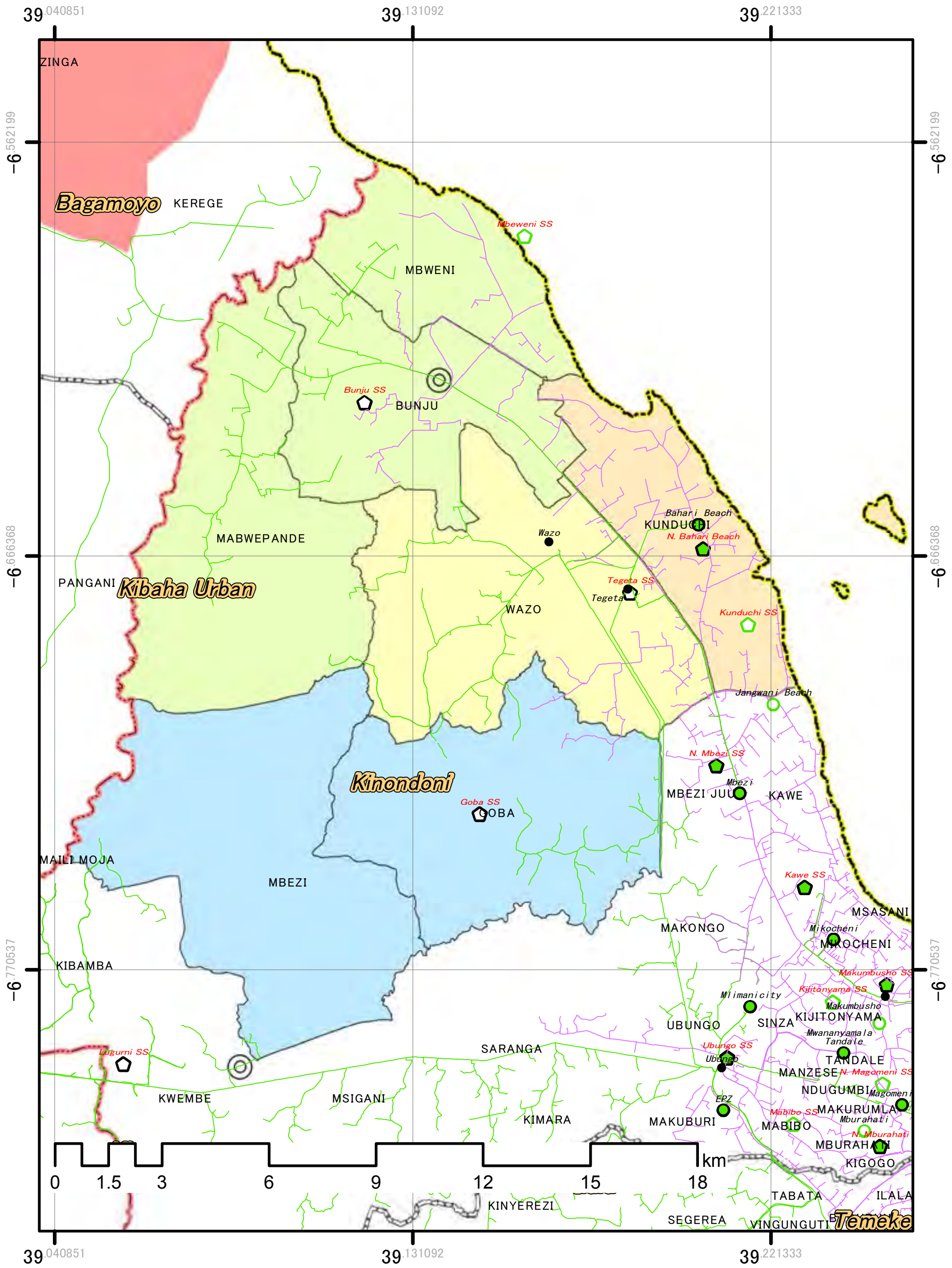
2020



Legend

Tegeta SS

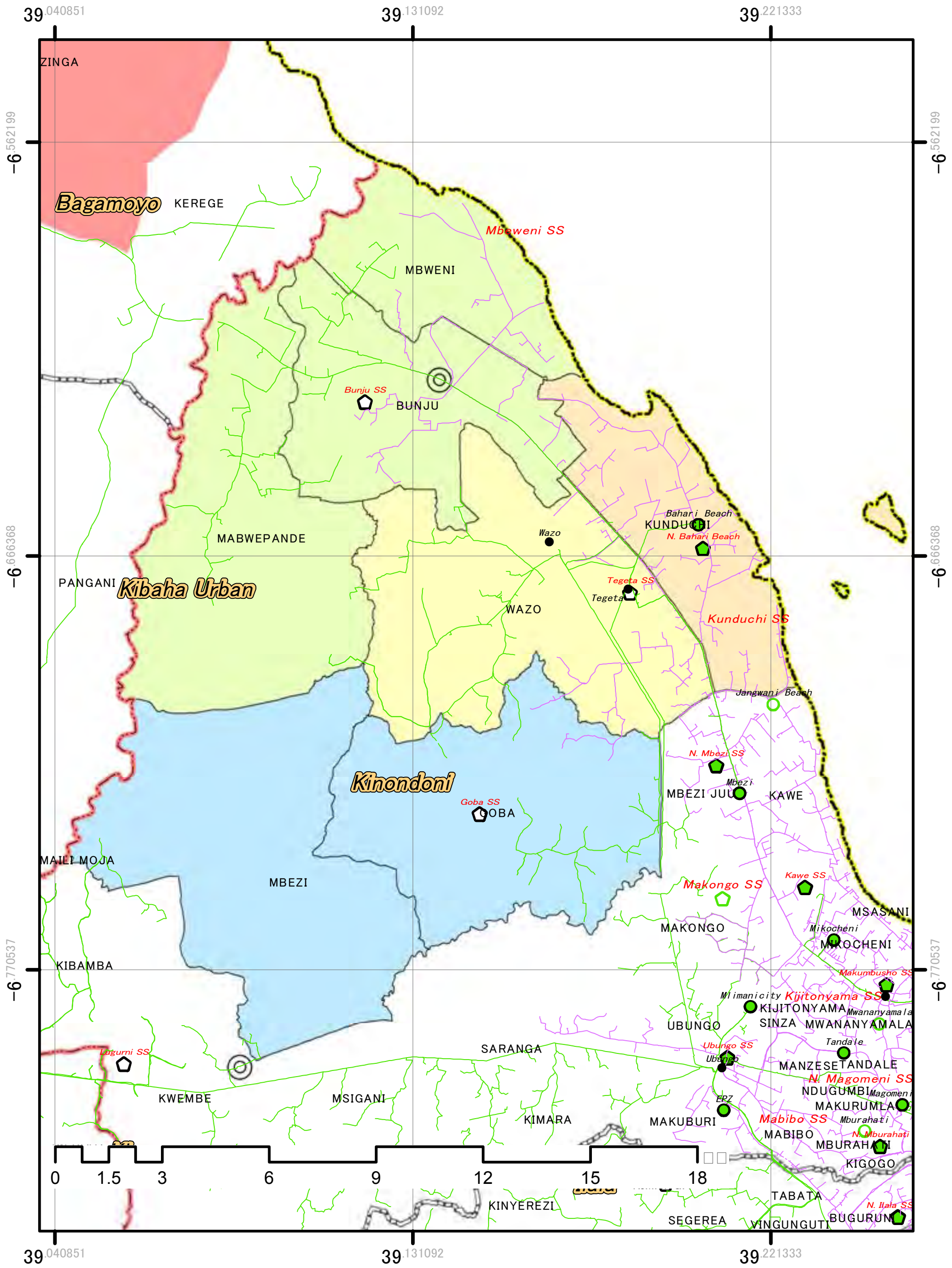
2025



Legend

Tegeta SS
Goba SS
Bunju SS
N. Bahari Beachi SS

2030



Legend

Tegeta SS
Goba SS
Bunju SS
N. Bahari Beachi SS

Common Legend

[EXISTING]
Substation 132/33/11kV
Substation 33/11kV
Feeder 33kV
Feeder 11kV

[PLAN/STUDY/IN PROCESS]
Substation 132/33/11kV
Substation 33/11kV

[MASTER PLAN]
Power Station
Substation 132/33kV
Substation 132kV
Substation 33kV

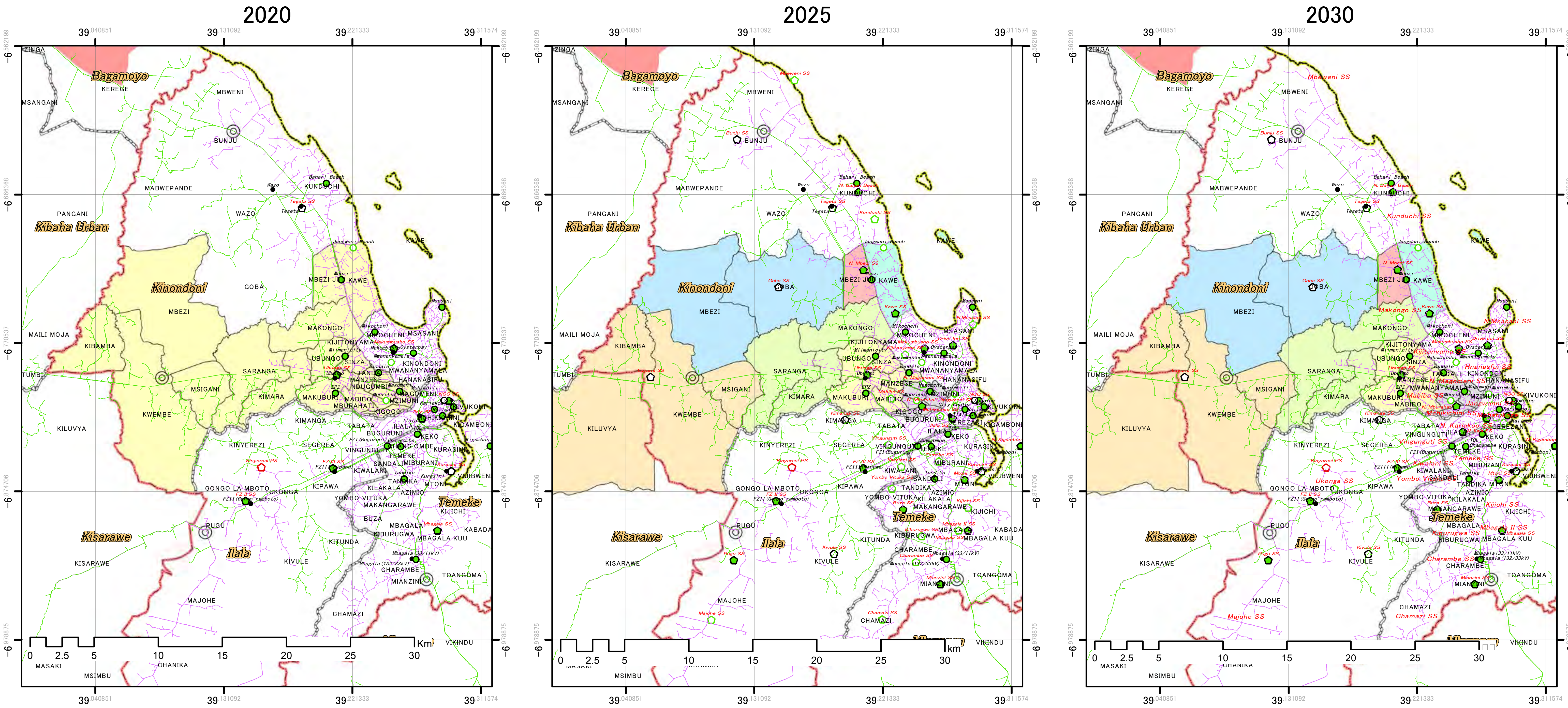
SEZ
New Satellite Center

Borderline
Regional boundary
District boundary

N
W
E
S

1:200,000

Tegeta SS



Legend

Ubungo SS	

Legend

Ubungo SS	Goba SS	N. Mbezi SS
Ubungo / Goba	Lugumi SS	N. Mbezi / Kawe
		N. Mburahati SS

Legend

Ubungo SS	Goba SS	N. Mbezi SS
Ubungo / Goba	Lugumi SS	N. Mbezi / Kawe
		N. Mburahati SS

Common Legend

[EXISTING]
- *Substation 132/33/11kV*
- *Substation 33/11kV*
- Feeder 33kV
- Feeder 11kV

[PLAN/STUDY/IN PROCESS]
- *Substation 132/33/11kV*
- *Substation 33/11kV*

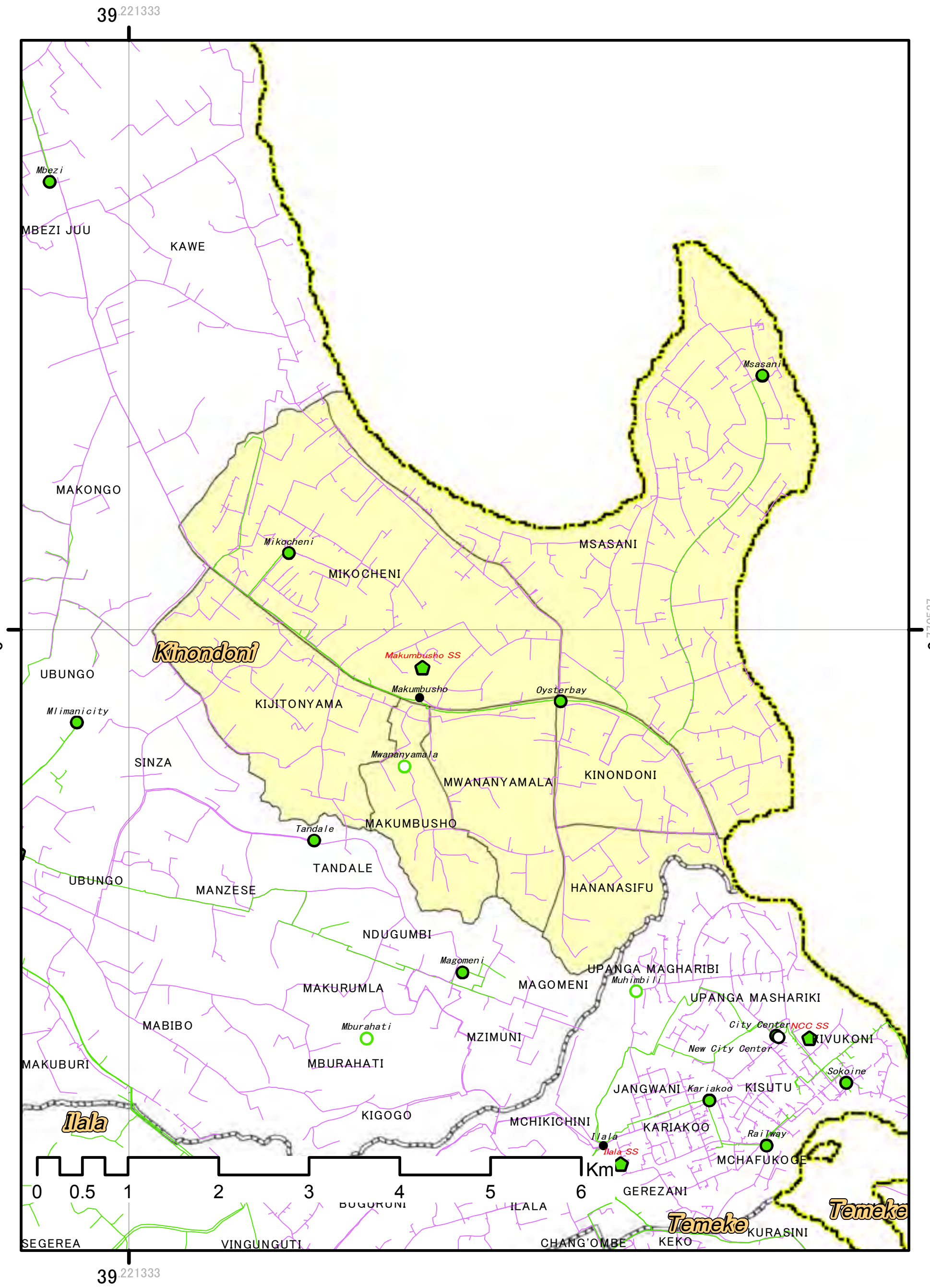
[MASTER PLAN]
- *Power Station*
- *Substation 132/33kV*
- *Substation 132kV*
- *Substation 33kV*
- SEZ
- New Satellite Center
- Borderline
- Regional boundary
- *District boundary*

N
W
E
S

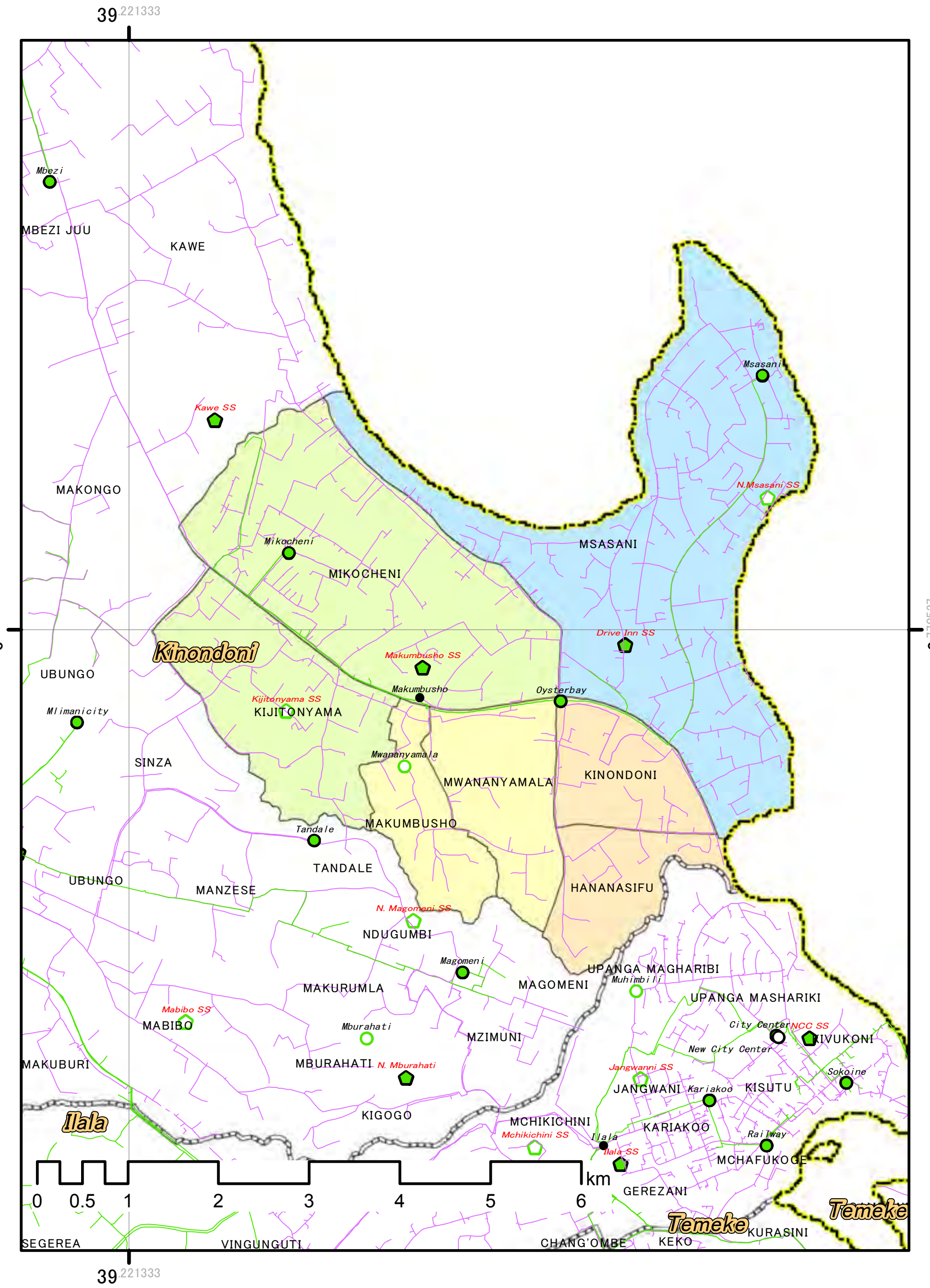
1:300,000

Ubungo SS

2020



2025



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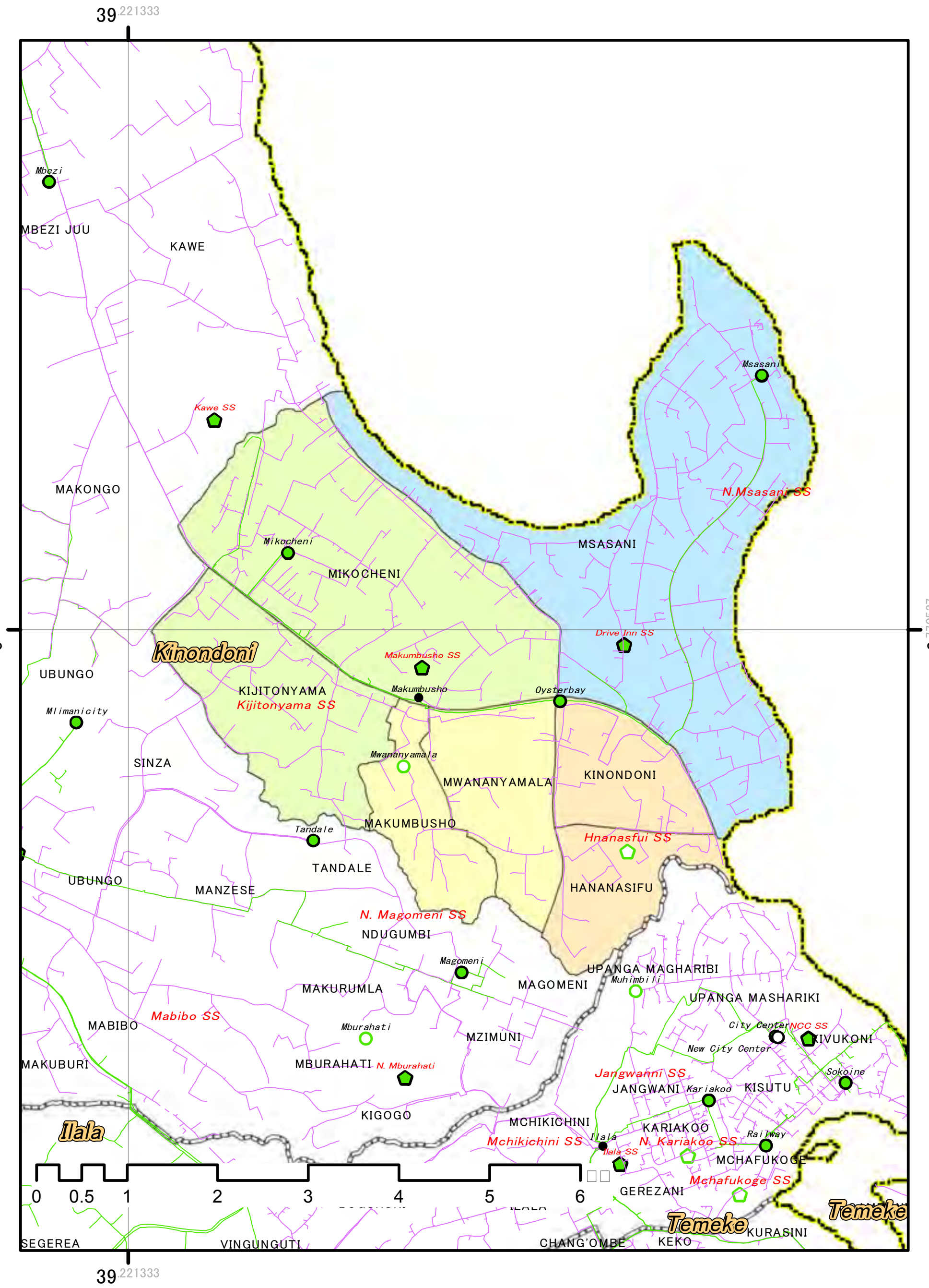


Legend

- Makumbusho SS

Legend

- Makumbusho SS
- Makumbusho/Drive Inn
- Makumbusho / Kawe
- Drive Inn SS

Legend

- Makumbusho SS
- Makumbusho/Drive Inn
- Makumbusho / Kawe
- Drive Inn SS

Common Legend

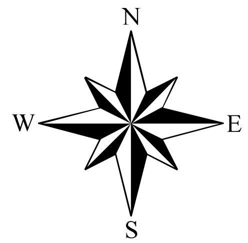
[EXISTING]
- *Substation 132/33/11kV*
- *Substation 33/11kV*
- Feeder 33kV
- Feeder 11kV

[PLAN/STUDY/IN PROCESS]
- *Substation 132/33/11kV*
- *Substation 33/11kV*

[MASTER PLAN]
- *Power Station*
- *Substation 132/33kV*
- *Substation 132kV*
- *Substation 33kV*

- SEZ
- New Satellite Center

- Borderline
- Regional boundary
- *District boundary*



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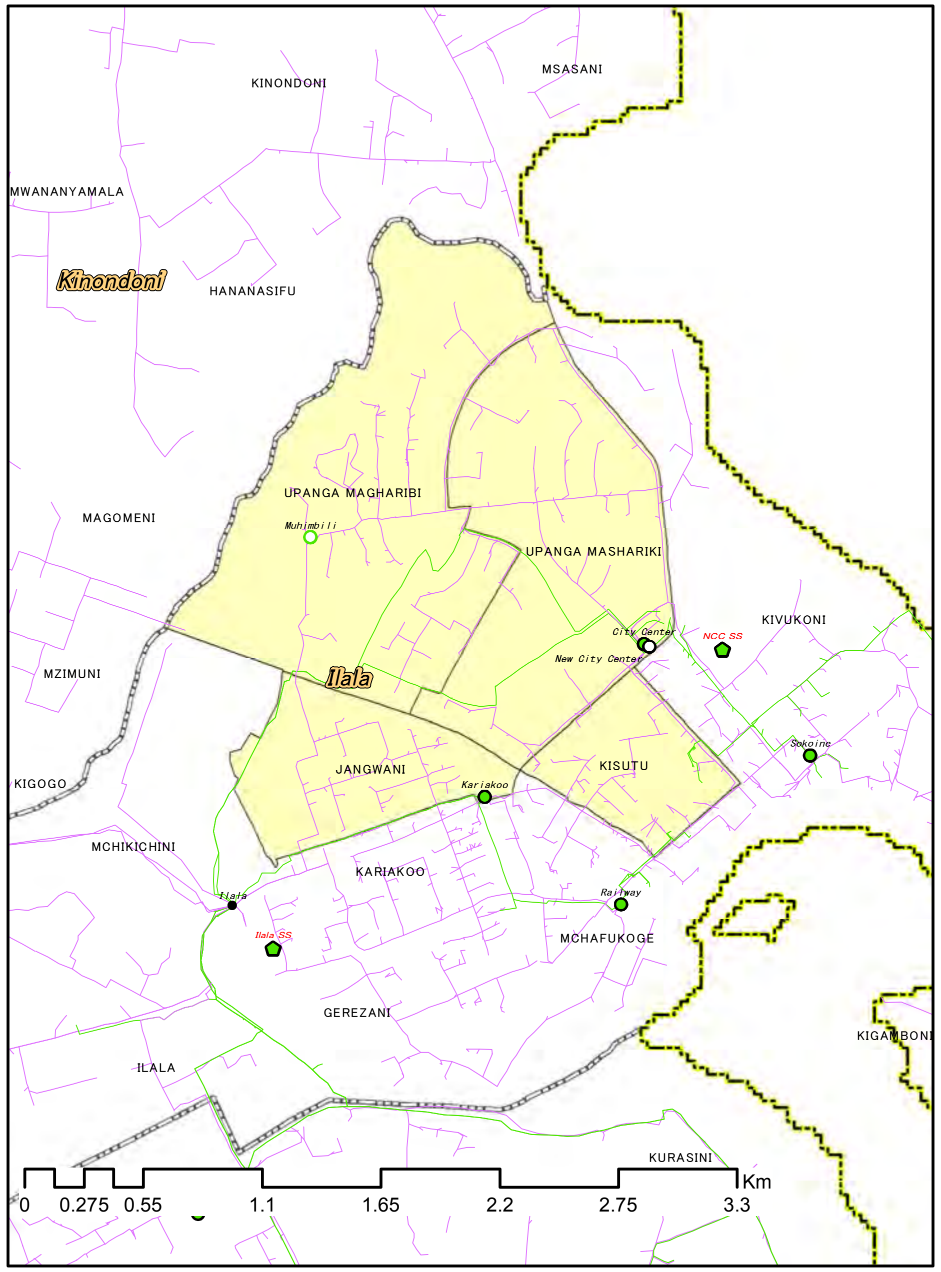
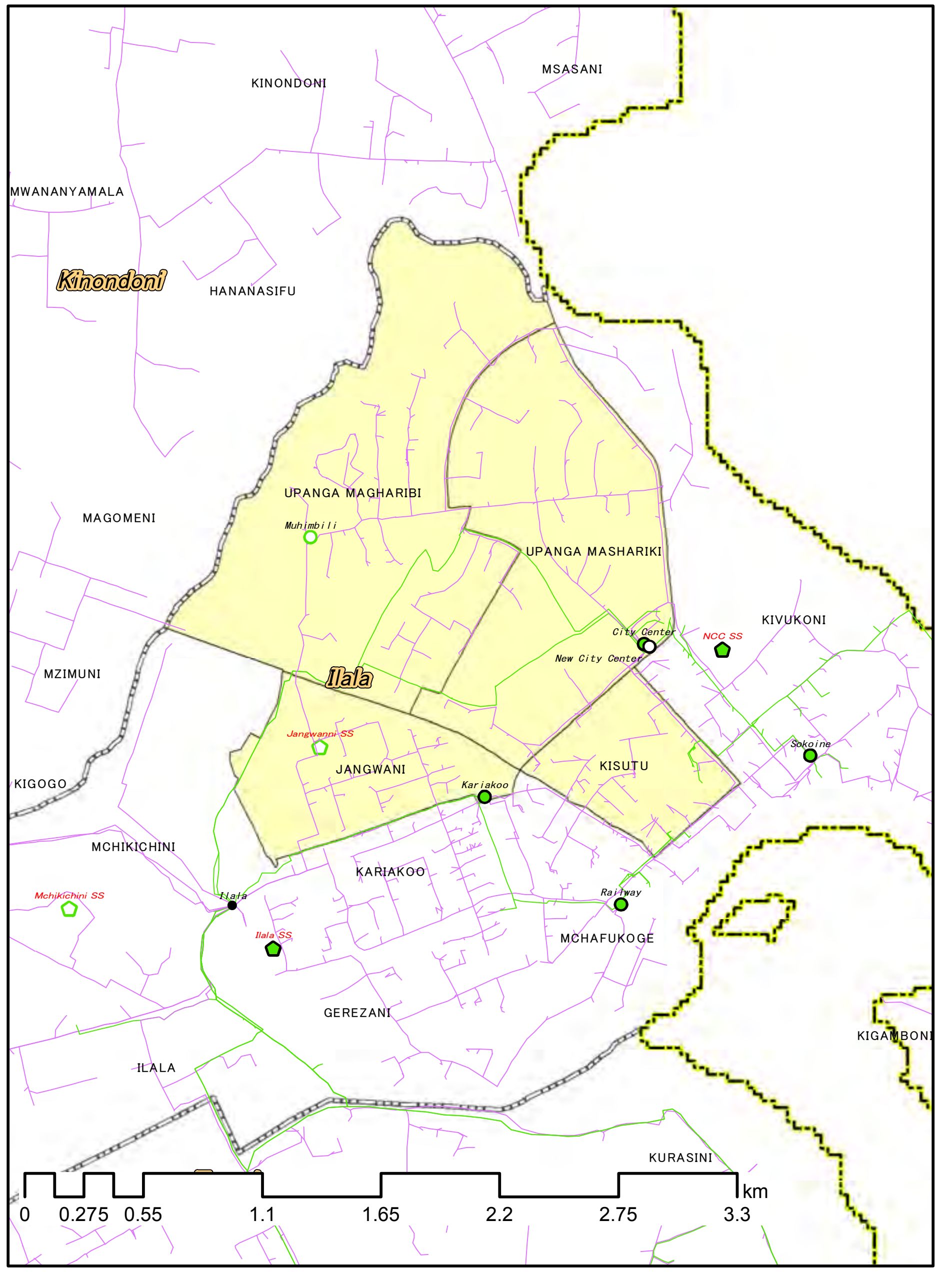
Makumbusho SS

S-4-3

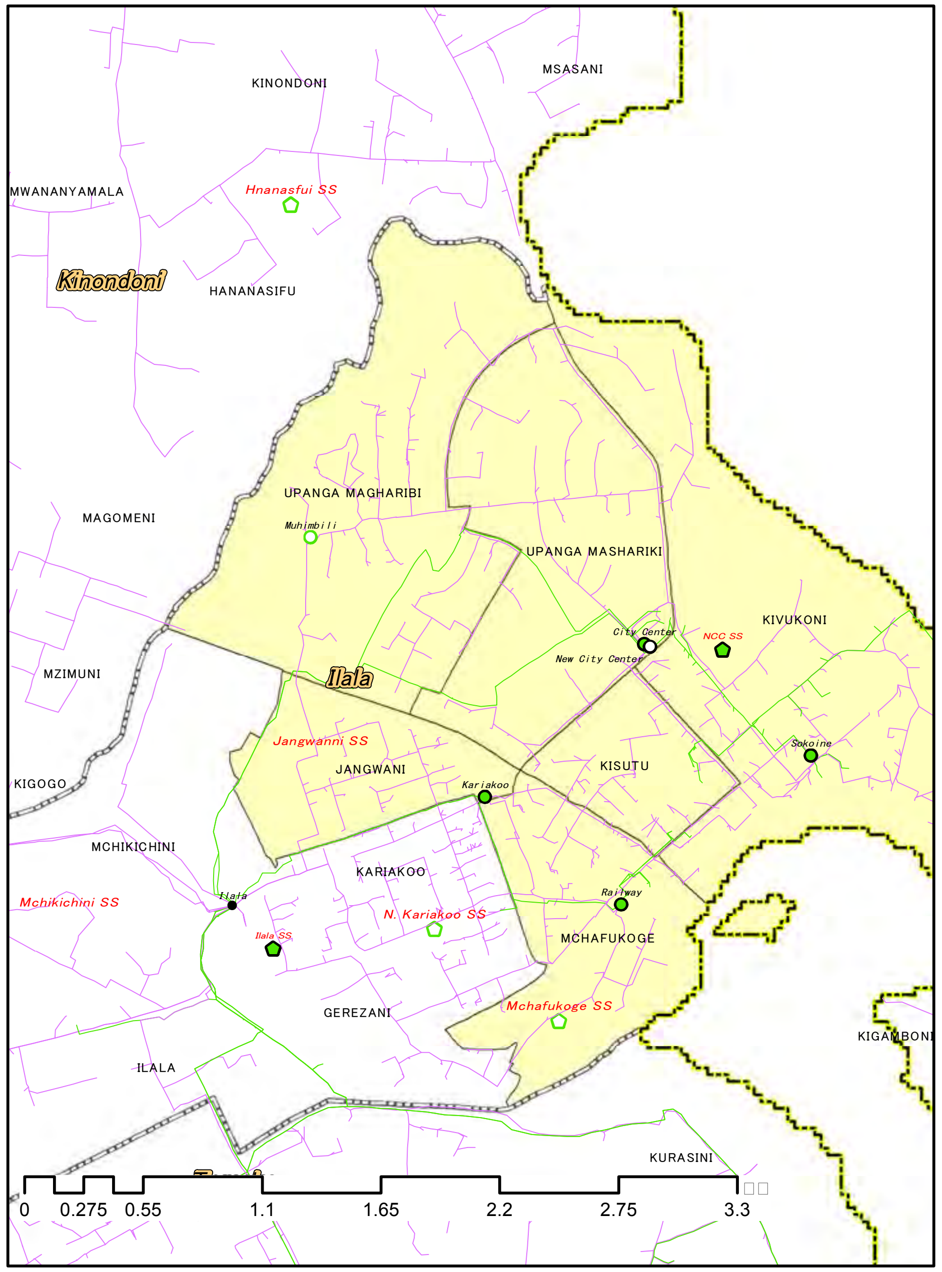
2020



2025



2030



Legend

NCC SS

Legend

NCC SS

Legend

NCC SS

Common Legend

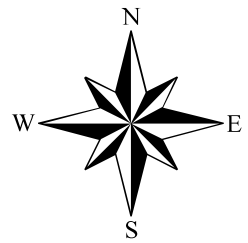
[EXISTING]
Substation 132/33/11kV
Substation 33/11kV
Feeder 33kV
Feeder 11kV

[PLAN/STUDY/IN PROCESS]
Substation 132/33/11kV
Substation 33/11kV

[MASTER PLAN]
Power Station
Substation 132/33kV
Substation 132kV
Substation 33kV

SEZ
New Satellite Center

Borderline
Regional boundary
District boundary



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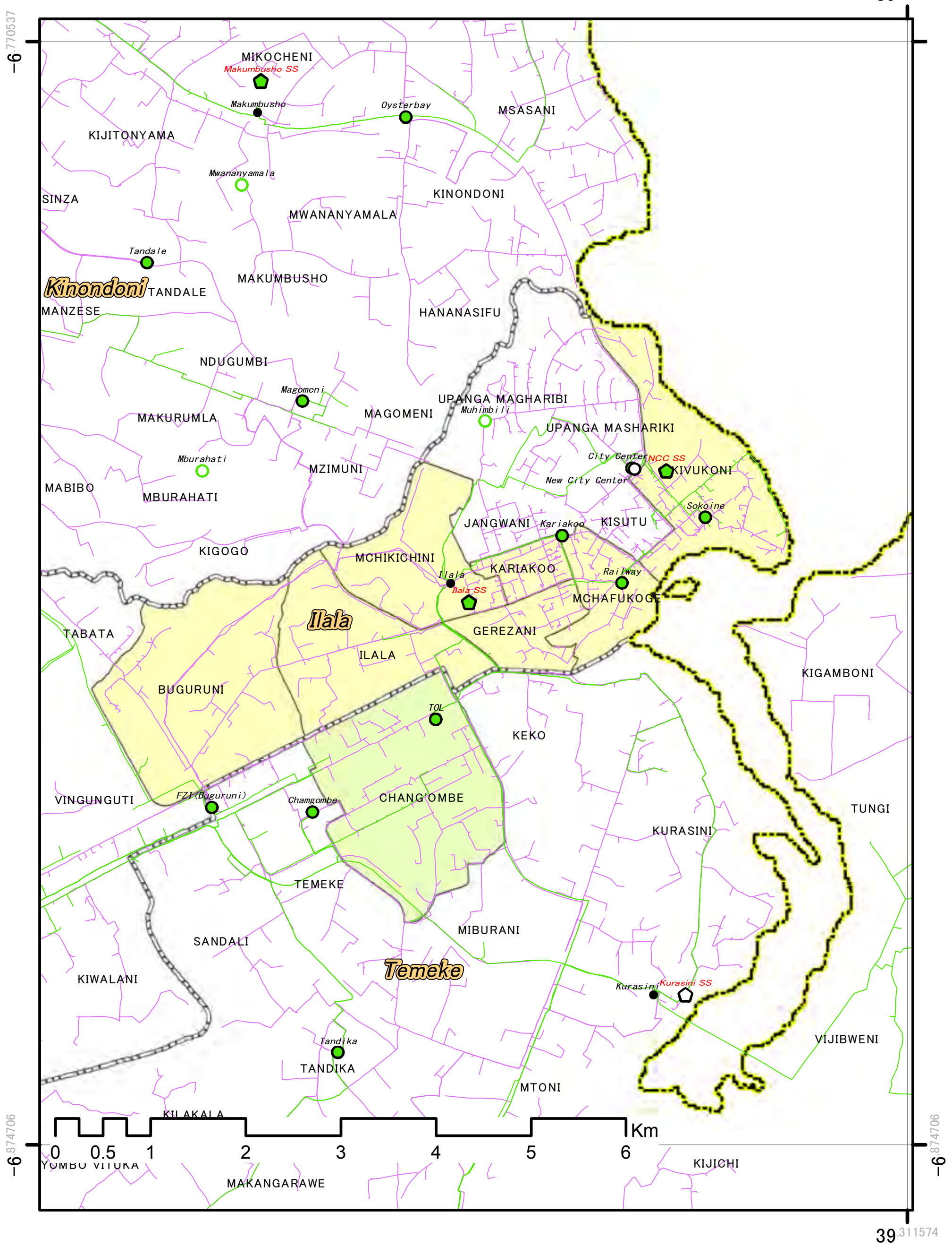
NCC SS

S-4-4

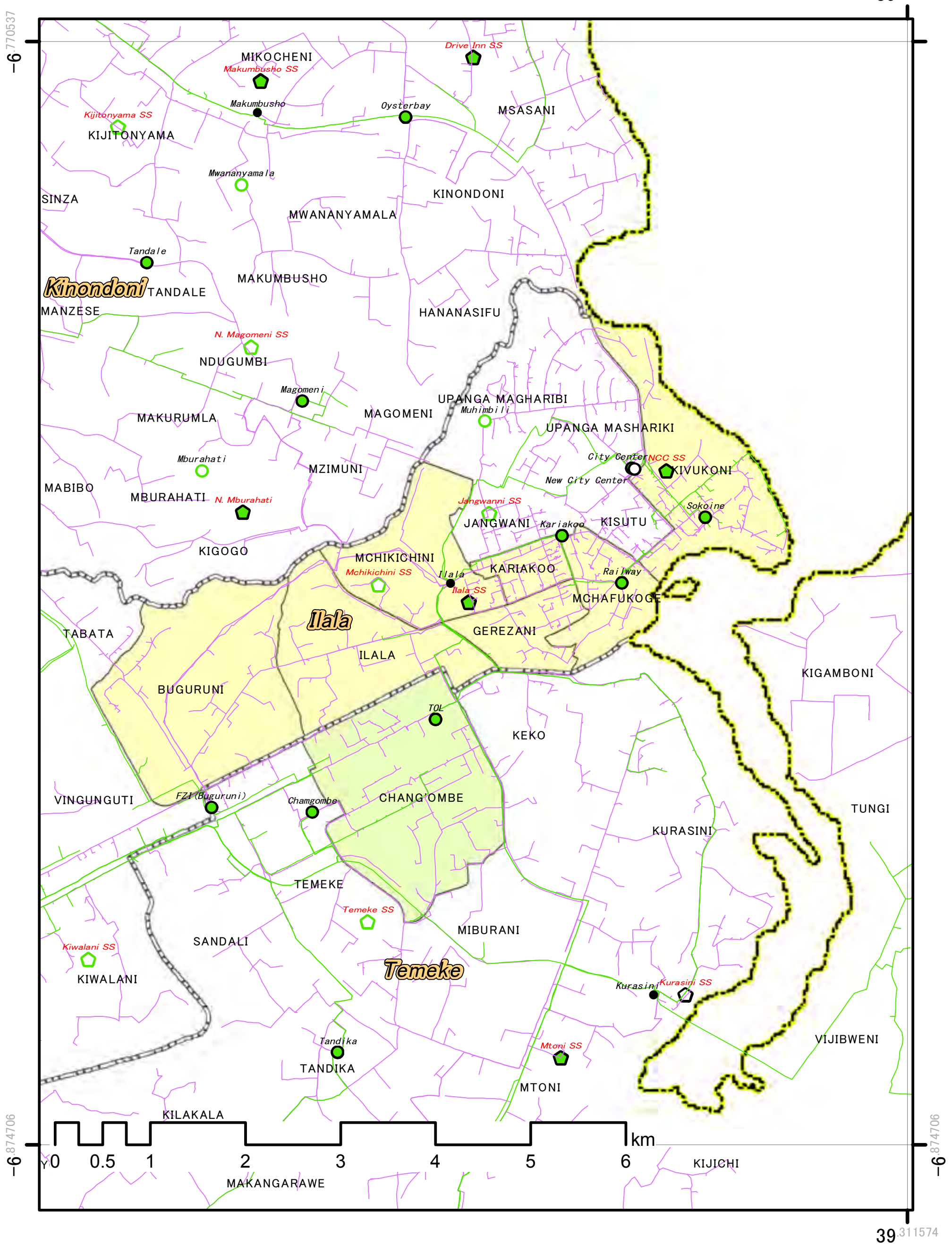
2020



Legend

Ilala SS | Ilala / FZ III SS

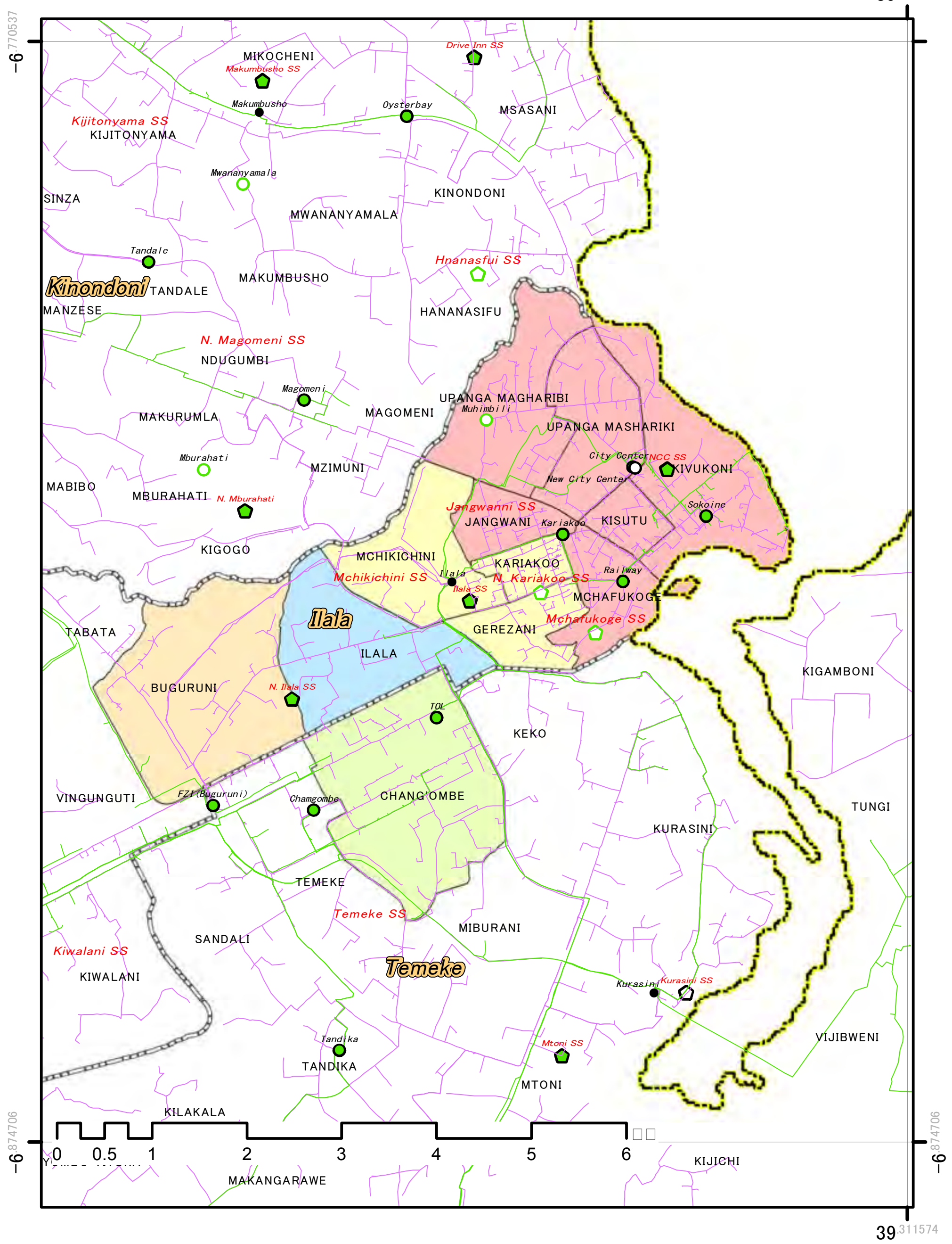
2025



Legend

Ilala SS | Ilala / Kurasini SS

2030



Legend

Ilala SS | Ilala / N.Ilala | NCC SS

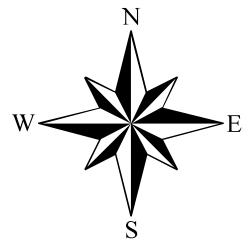
Ilala / Kurasini SS | N. Ilala SS

Common Legend

[EXISTING]
- *Substation 132/33/11kV*
- *Substation 33/11kV*
- Feeder 33kV
- Feeder 11kV

[PLAN/STUDY/IN PROCESS]
- *Substation 132/33/11kV*
- *Substation 33/11kV*

[MASTER PLAN]
- *Power Station*
- *Substation 132/33kV*
- *Substation 132kV*
- *Substation 33kV*
- SEZ
- New Satellite Center
- Borderline
- Regional boundary
- *District boundary*



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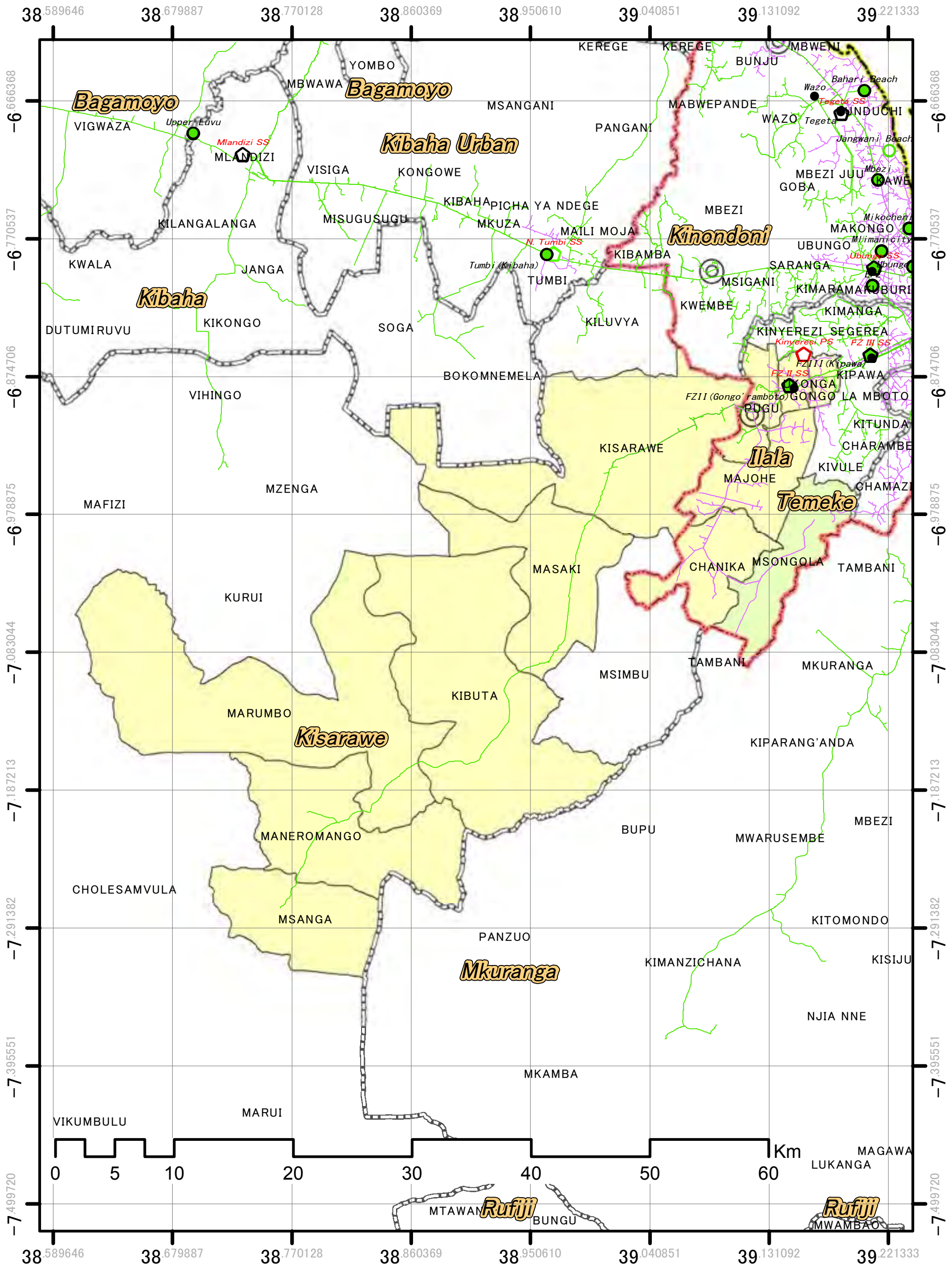
Ilala SS

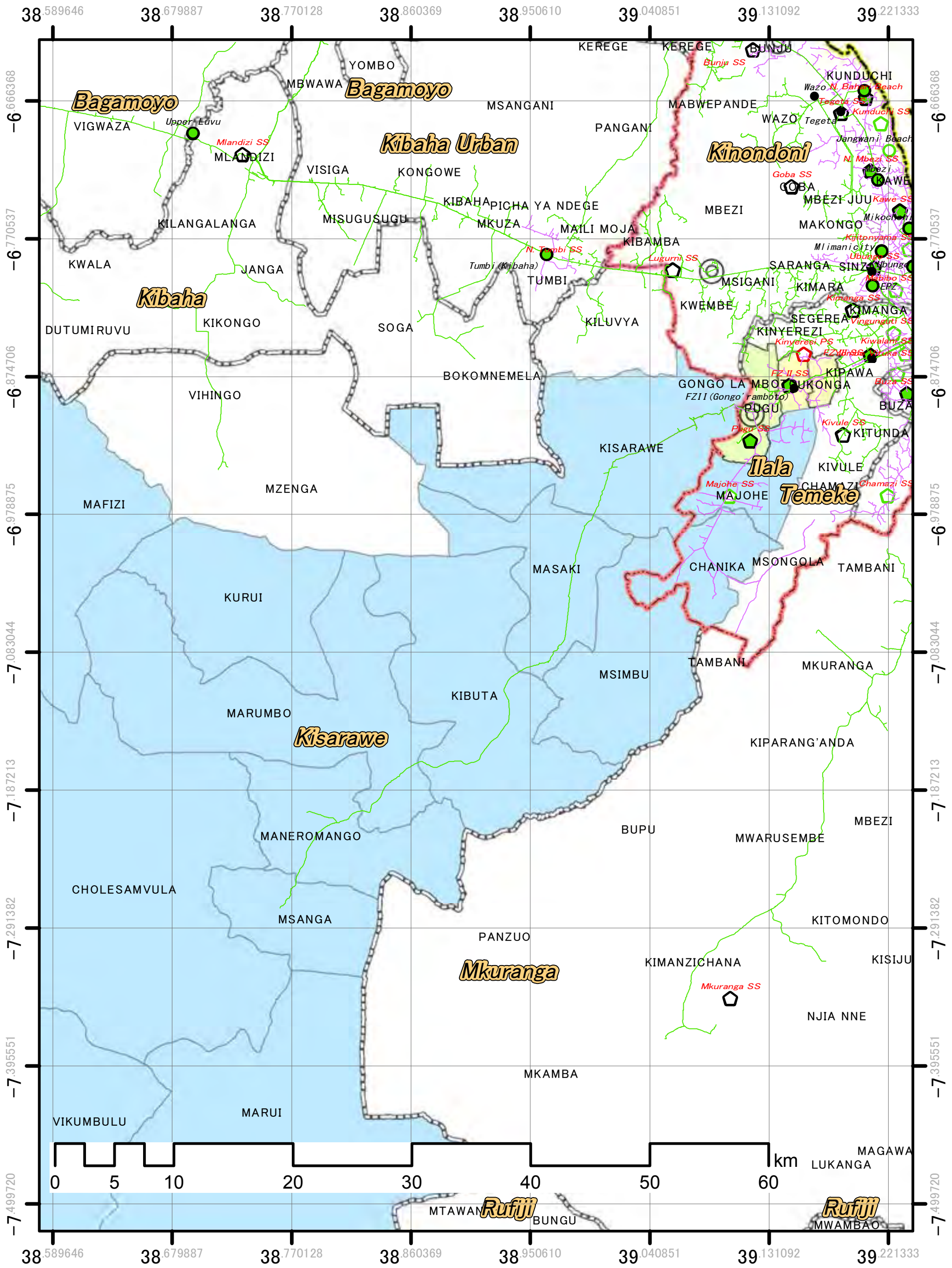
2020



Legend

FZ II SS
FZ II / Mbagala SS

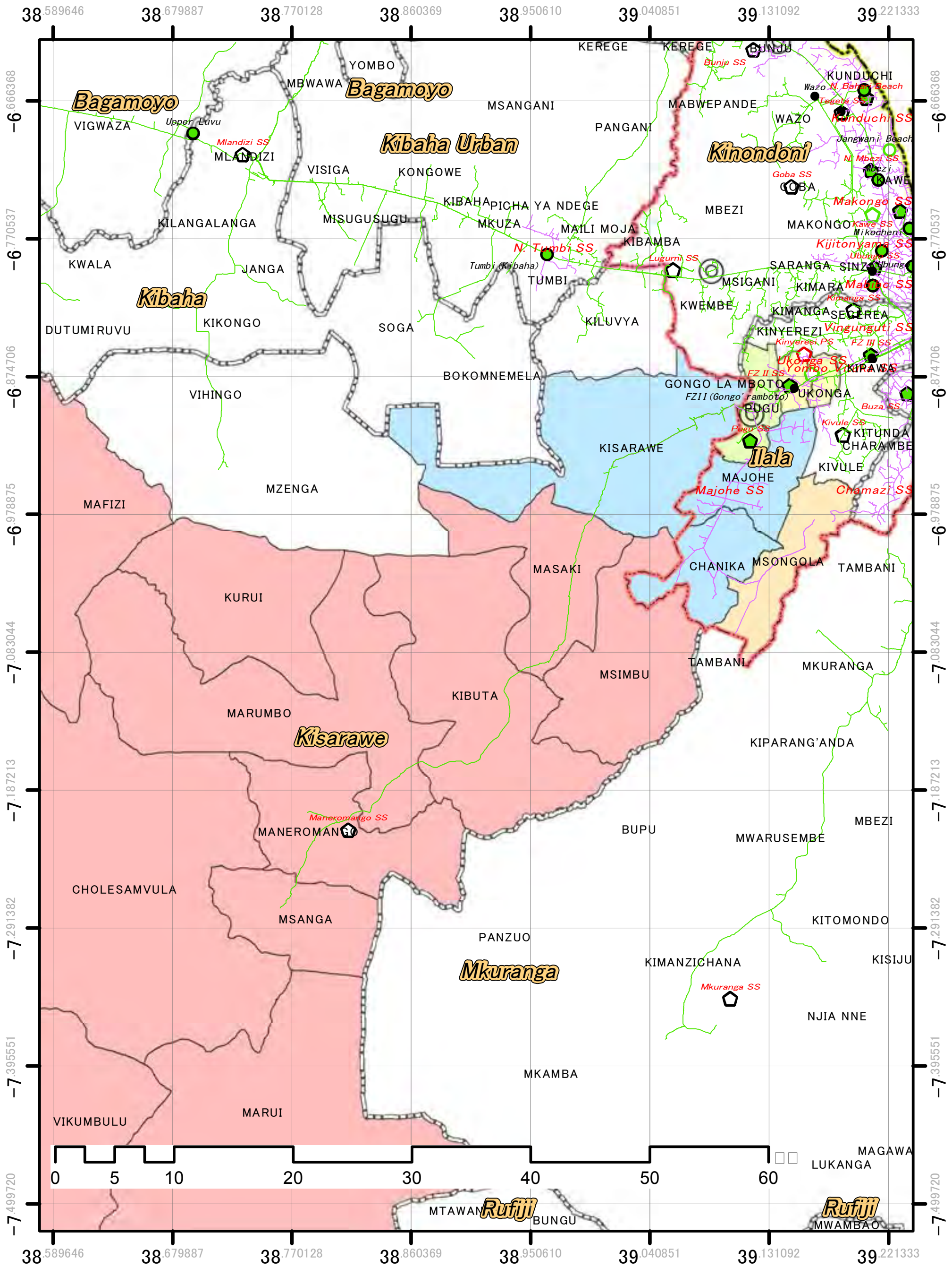
2025



Legend

FZ II SS
FZ II / Pugu SS
Pugu SS

2030



Legend

FZ II SS
Pugu SS
Maneromango SS
FZ II / Pugu SS
Pugu / Mianzini SS

Common Legend

[EXISTING]
- *Substation 132/33/11kV*
- *Substation 33/11kV*
- Feeder 33kV
- Feeder 11kV

[PLAN/STUDY/IN PROCESS]
- *Substation 132/33/11kV*
- *Substation 33/11kV*

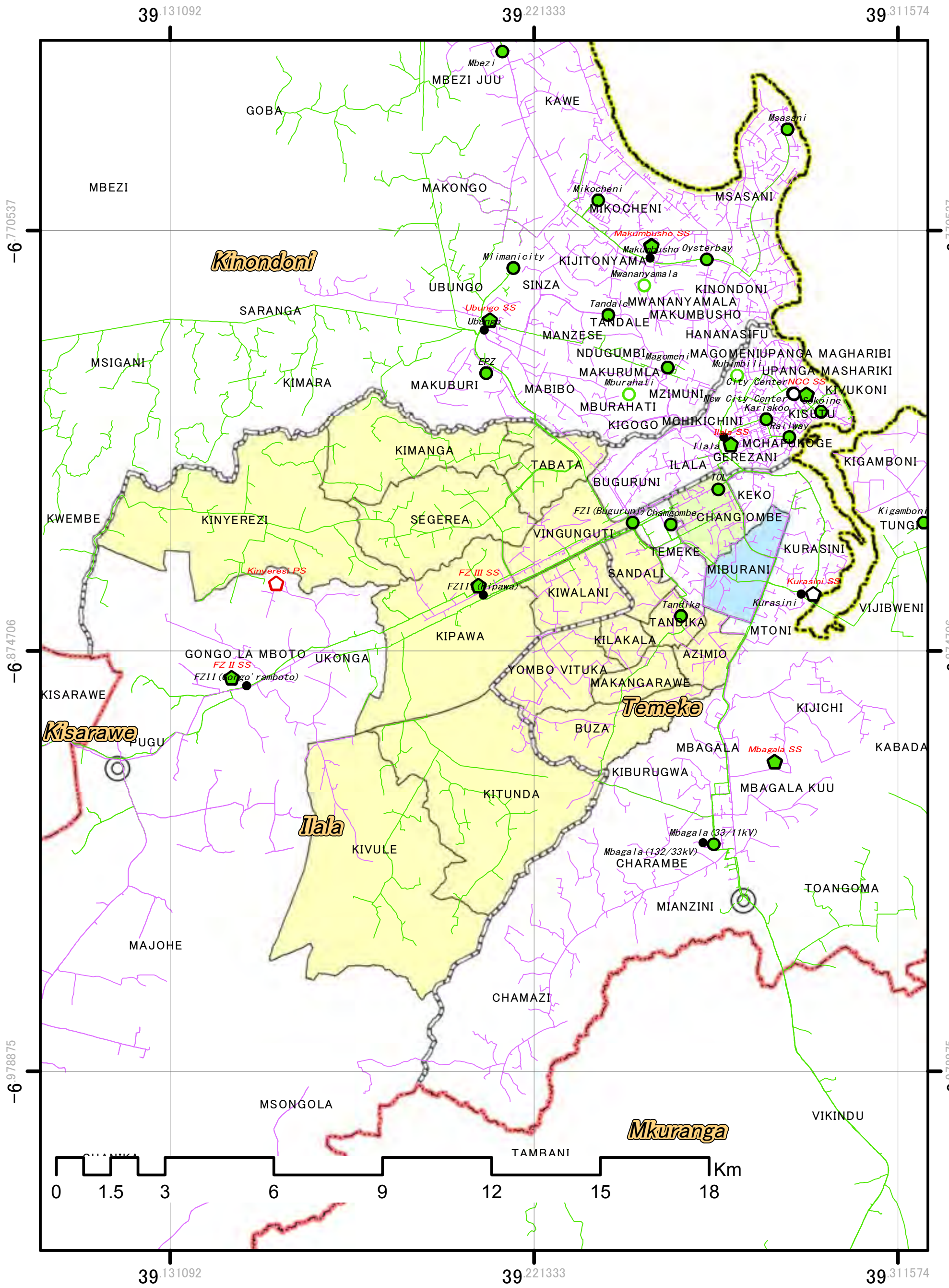
[MASTER PLAN]
- *Power Station*
- *Substation 132/33kV*
- *Substation 132kV*
- *Substation 33kV*
- SEZ
- New Satellite Center
- Borderline
- Regional boundary
- *District boundary*

N
W
E
S

1:600,000

FZII SS

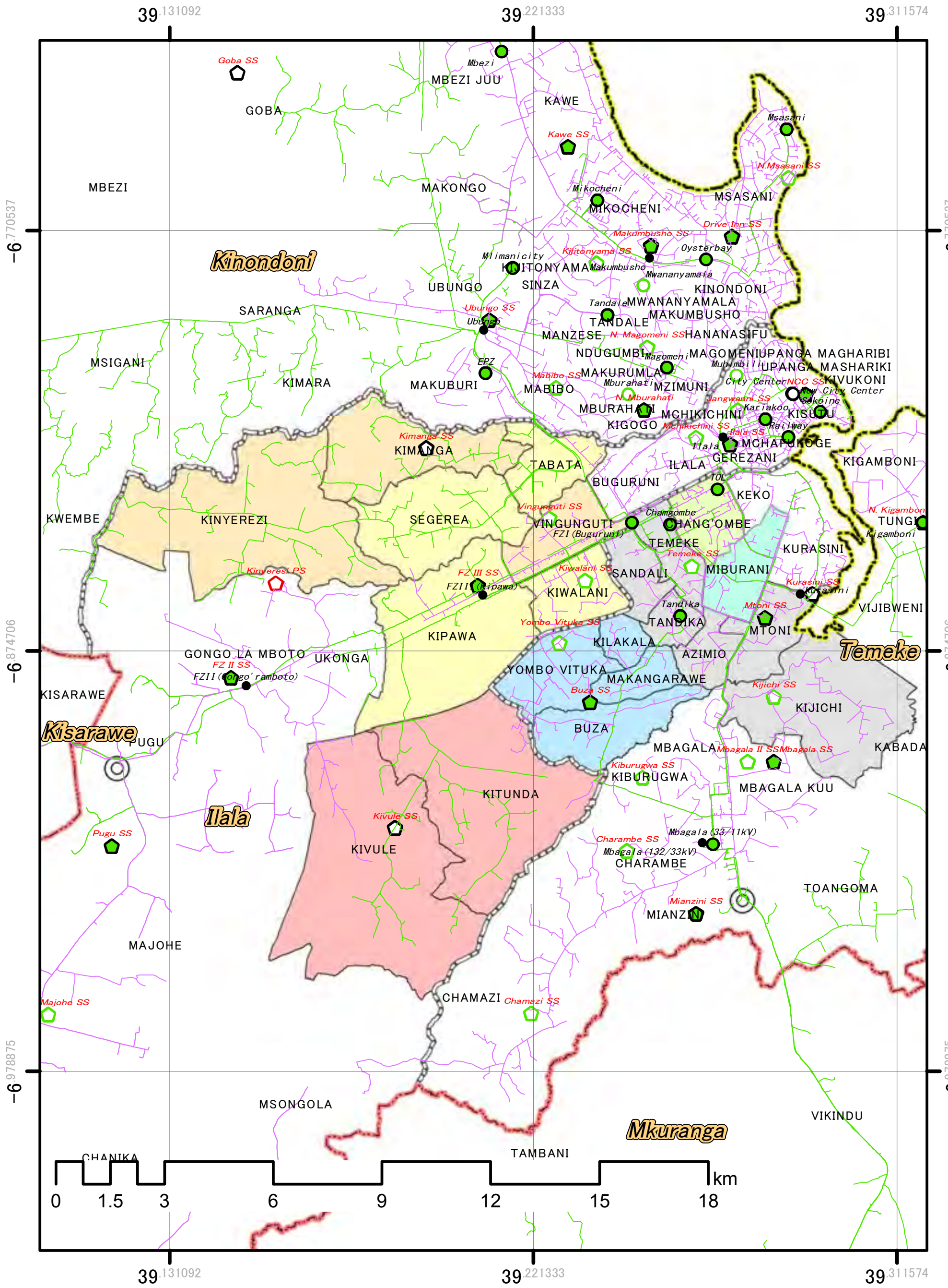
2020



Legend

- FZ Ⅲ SS
- Ilala / FZ Ⅲ SS
- FZ Ⅲ / Kurasini SS

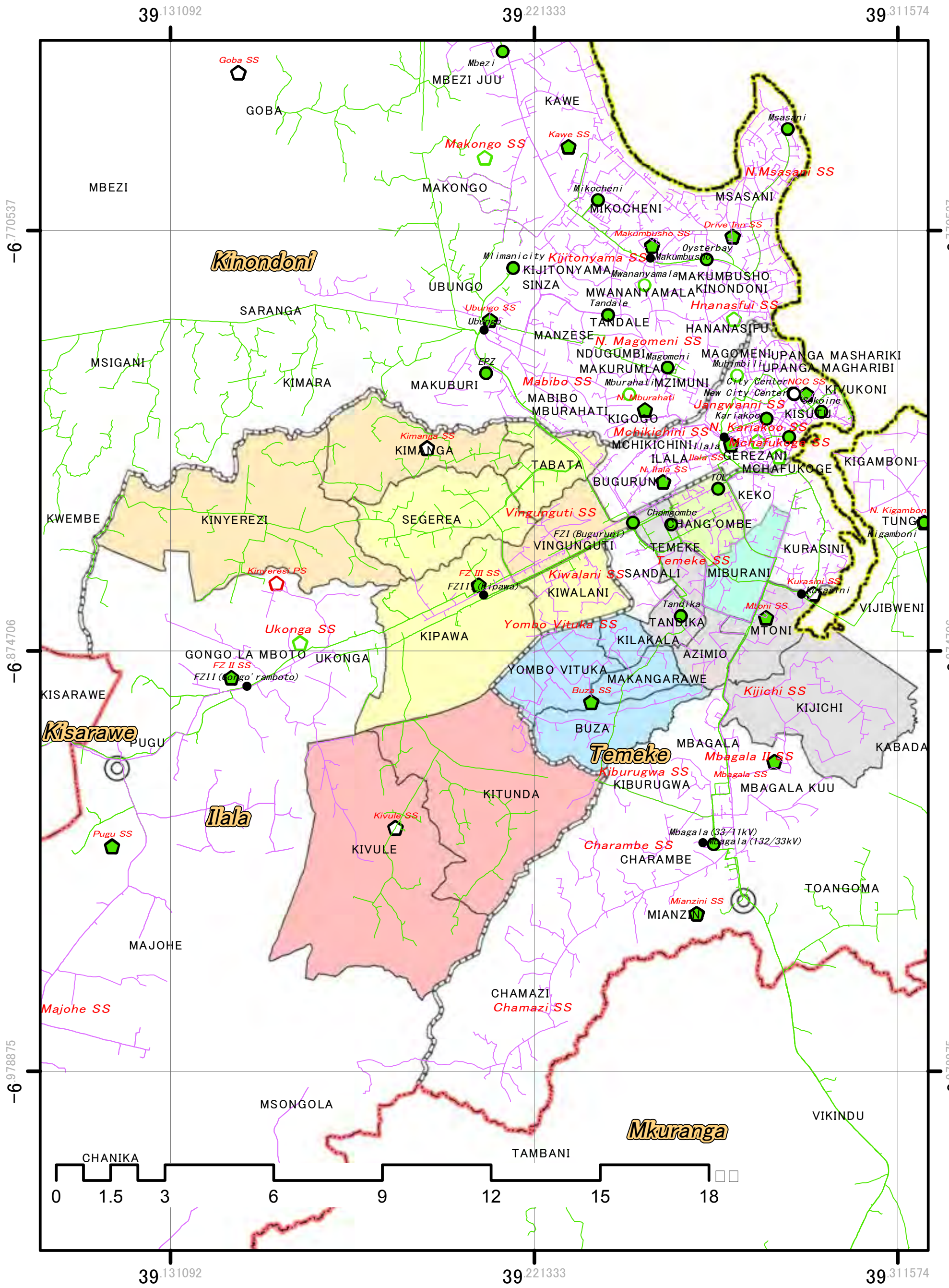
2025



Legend

- FZ Ⅲ SS
- Buza SS
- Kivule SS
- Ilala / Kurasini SS
- Kimanga SS
- Kurasini / Mtoni SS
- Mtoni SS

2030



Legend

- FZ Ⅲ SS
- Buza SS
- Kivule SS
- Ilala / Kurasini SS
- Kimanga SS
- Kurasini / Mtoni SS
- Mtoni SS

Common Legend

[EXISTING]
- Substation 132/33/11kV
- Substation 33/11kV
- Feeder 33kV
- Feeder 11kV

[PLAN/STUDY/IN PROCESS]
- Substation 132/33/11kV
- Substation 33/11kV

[MASTER PLAN]
- Power Station
- Substation 132/33kV
- Substation 132kV
- Substation 33kV

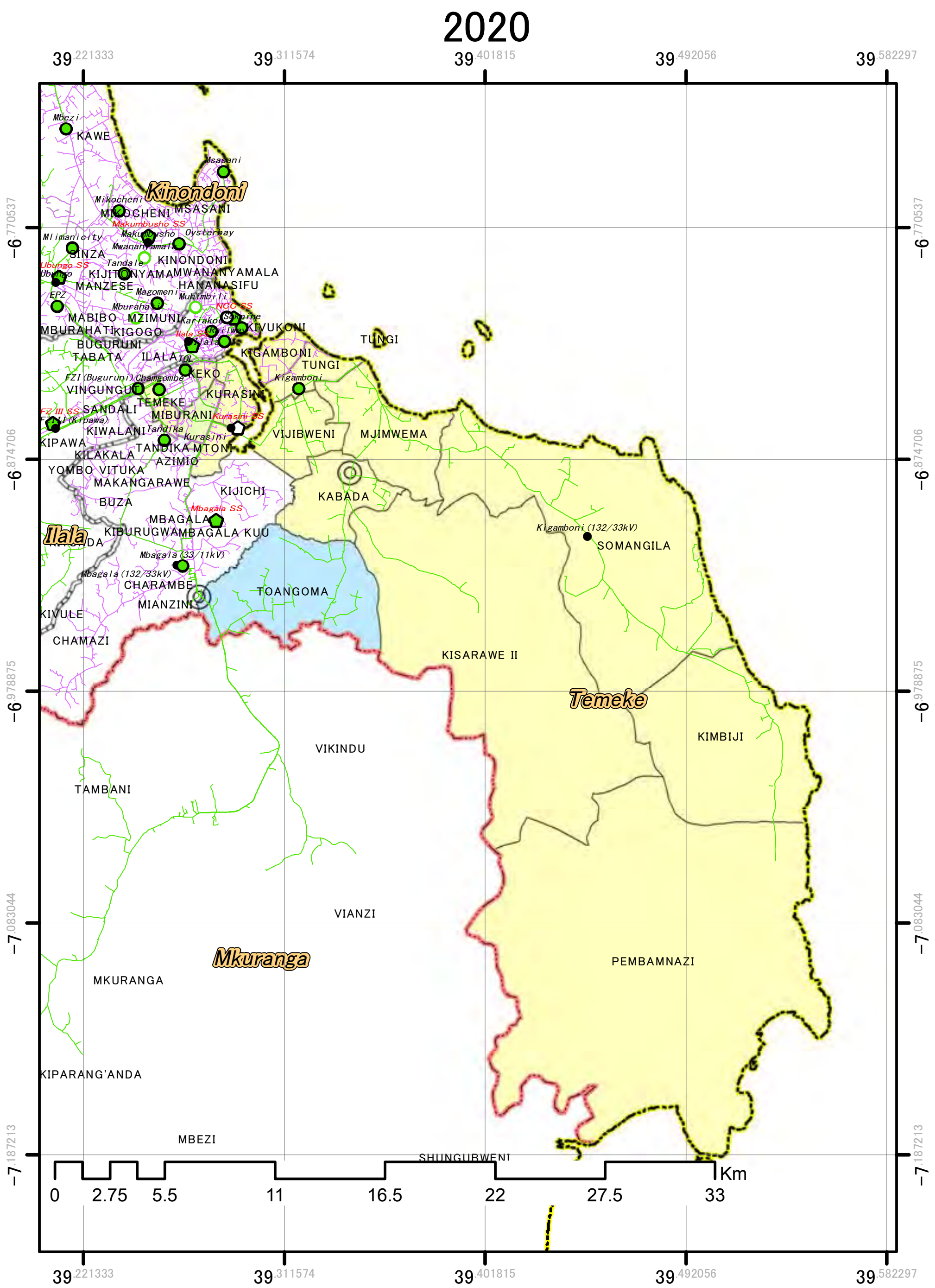
- SEZ
- New Satellite Center

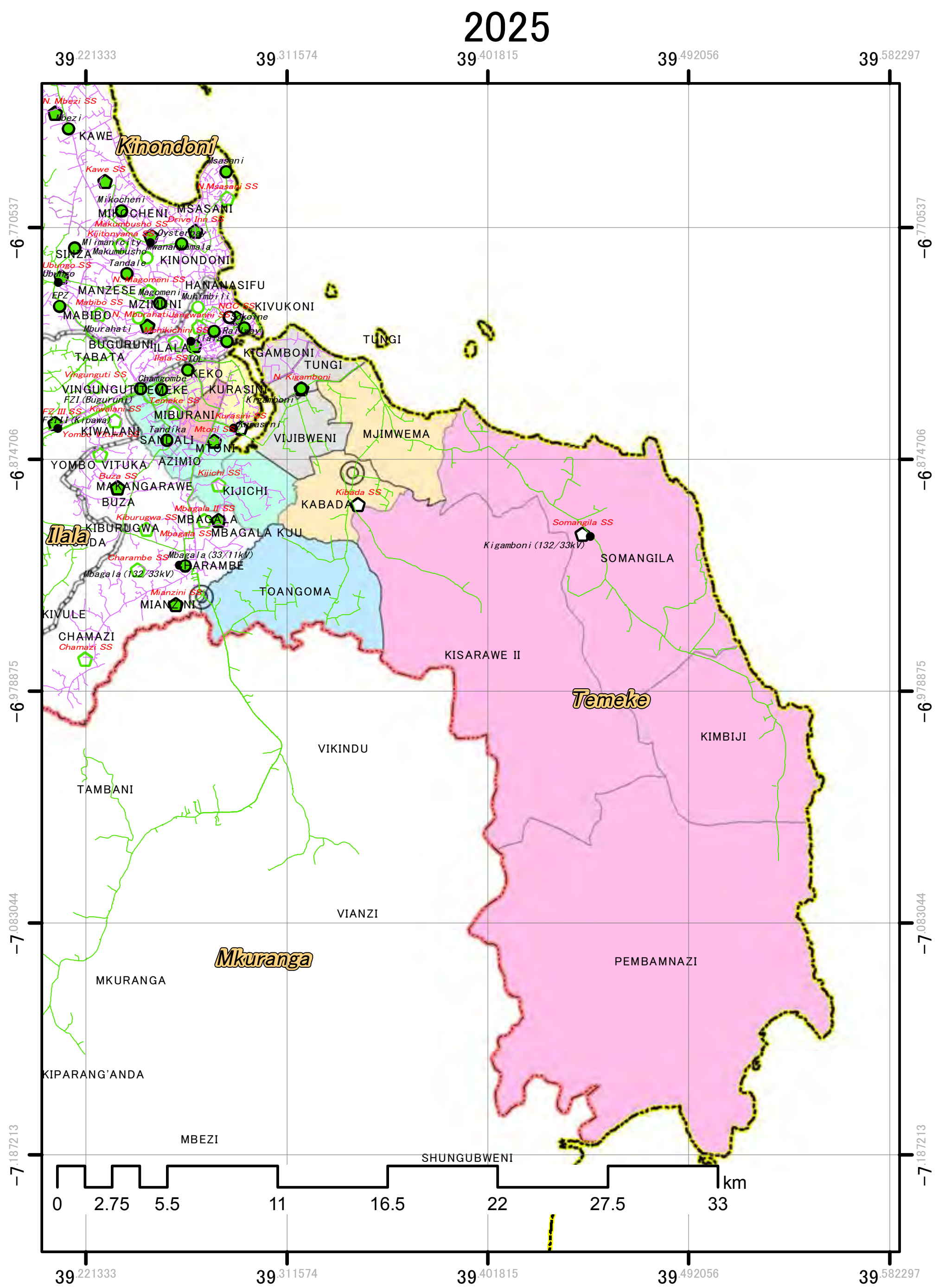
- Borderline
- Regional boundary
- District boundary

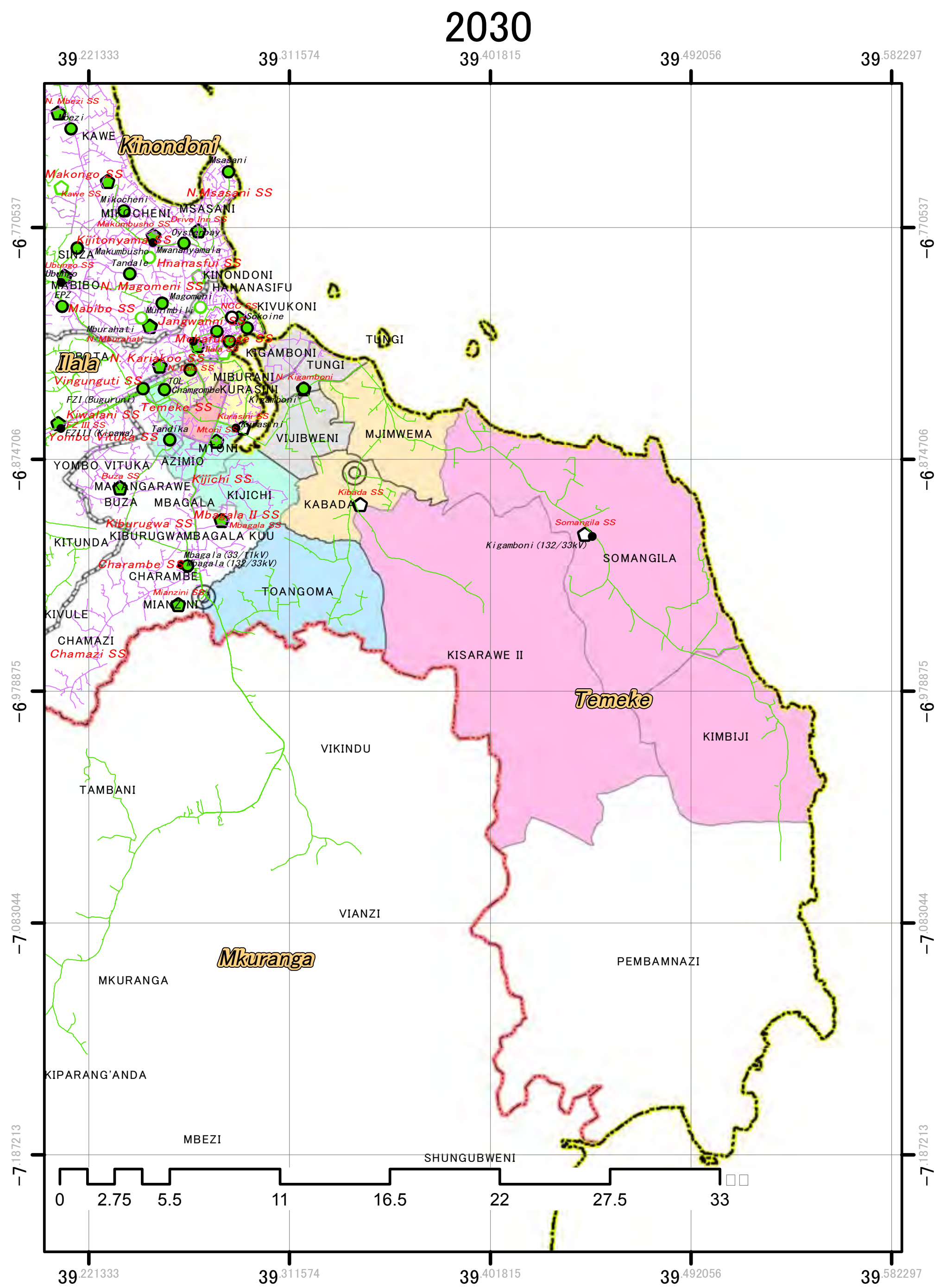
N W E S

1:200,000

FZ III SS







Legend (2020)

Kurasini SS | FZ III / Kurasini SS | Kurasini / Mbagala

Legend (2025)

Kurasini SS | Kibada SS | N. Kigamboni SS
Ilala / Kurasini SS | Kurasini / Mtoni SS | Somangila SS
Kibada / Mbagala SS | Mtoni SS

Legend (2030)

Kurasini SS | Kibada SS | N. Kigamboni SS
Ilala / Kurasini SS | Kurasini / Mtoni SS | Somangila SS
Kibada / Mbagala SS | Mtoni SS

Common Legend

[EXISTING]
- *Substation 132/33/11kV*
- *Substation 33/11kV*
- Feeder 33kV
- Feeder 11kV

[PLAN/STUDY/IN PROCESS]
- *Substation 132/33/11kV*
- *Substation 33/11kV*

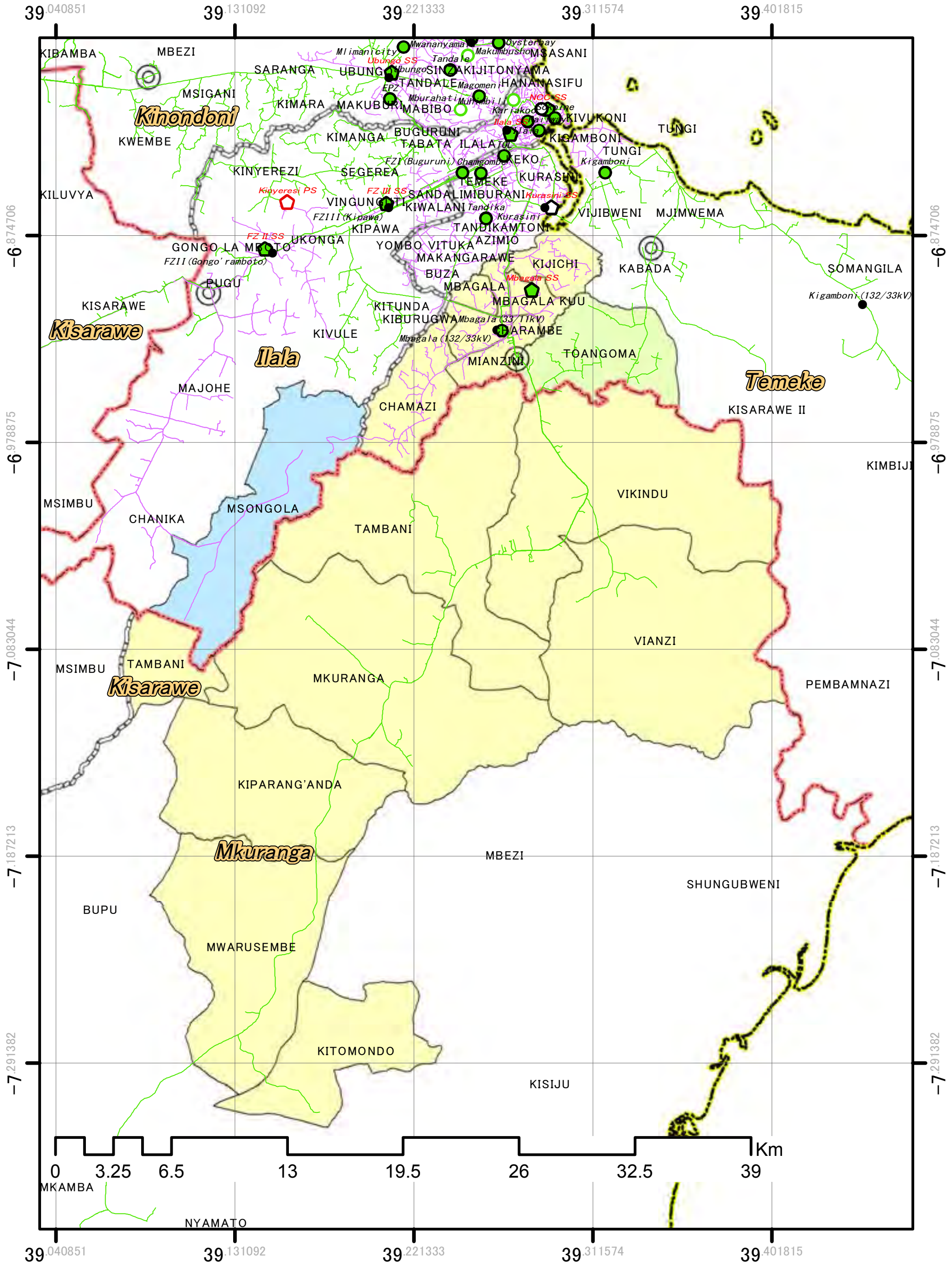
[MASTER PLAN]
- *Power Station*
- *Substation 132/33kV*
- *Substation 132kV*
- *Substation 33kV*
- SEZ
- New Satellite Center
- Borderline
- Regional boundary
- *District boundary*

N S W E

1:350,000

Kurasini SS

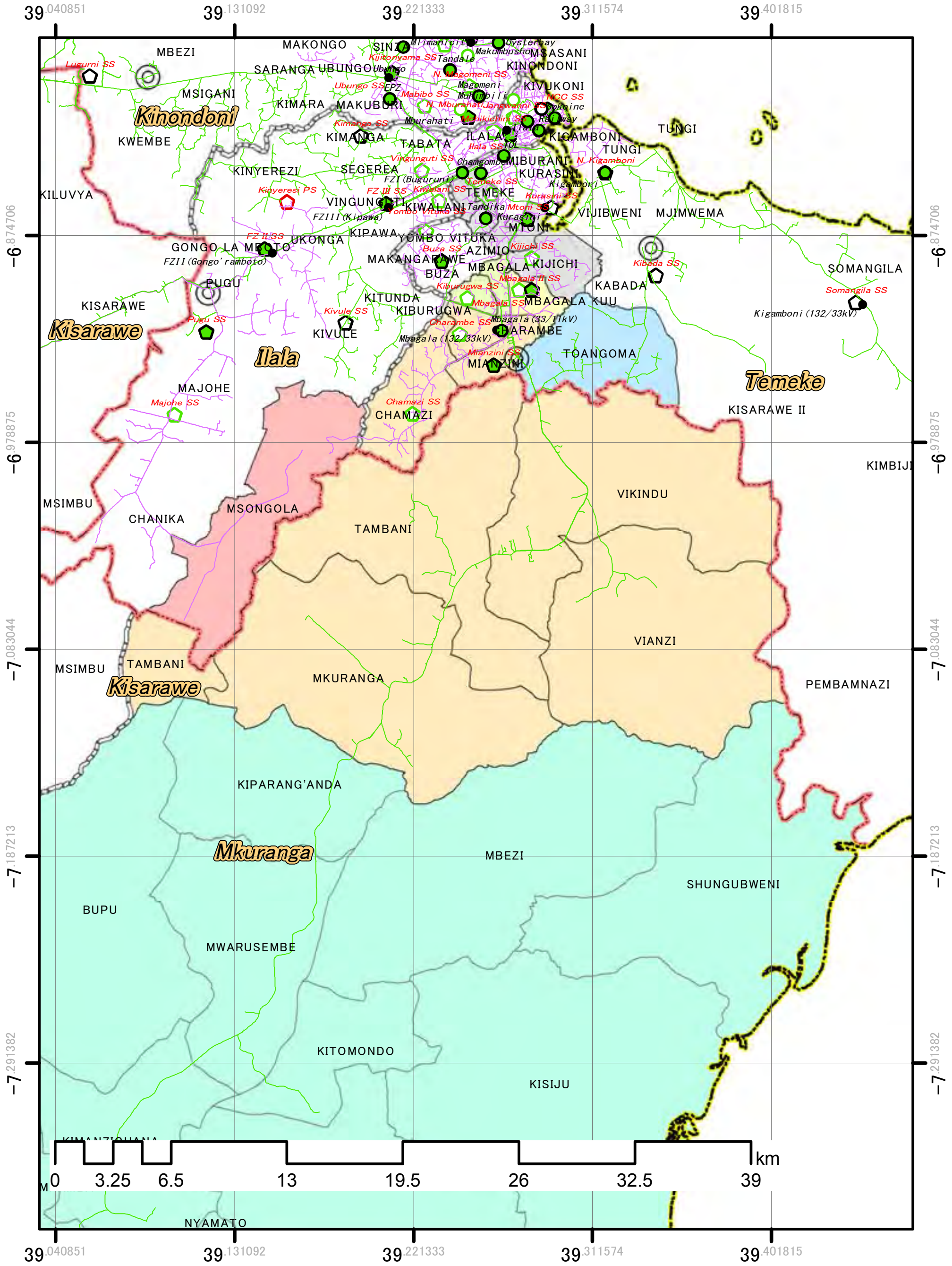
2020



Legend

- Mbagala SS
- Kurasini / Mbagala
- FZ II / Mbagala SS

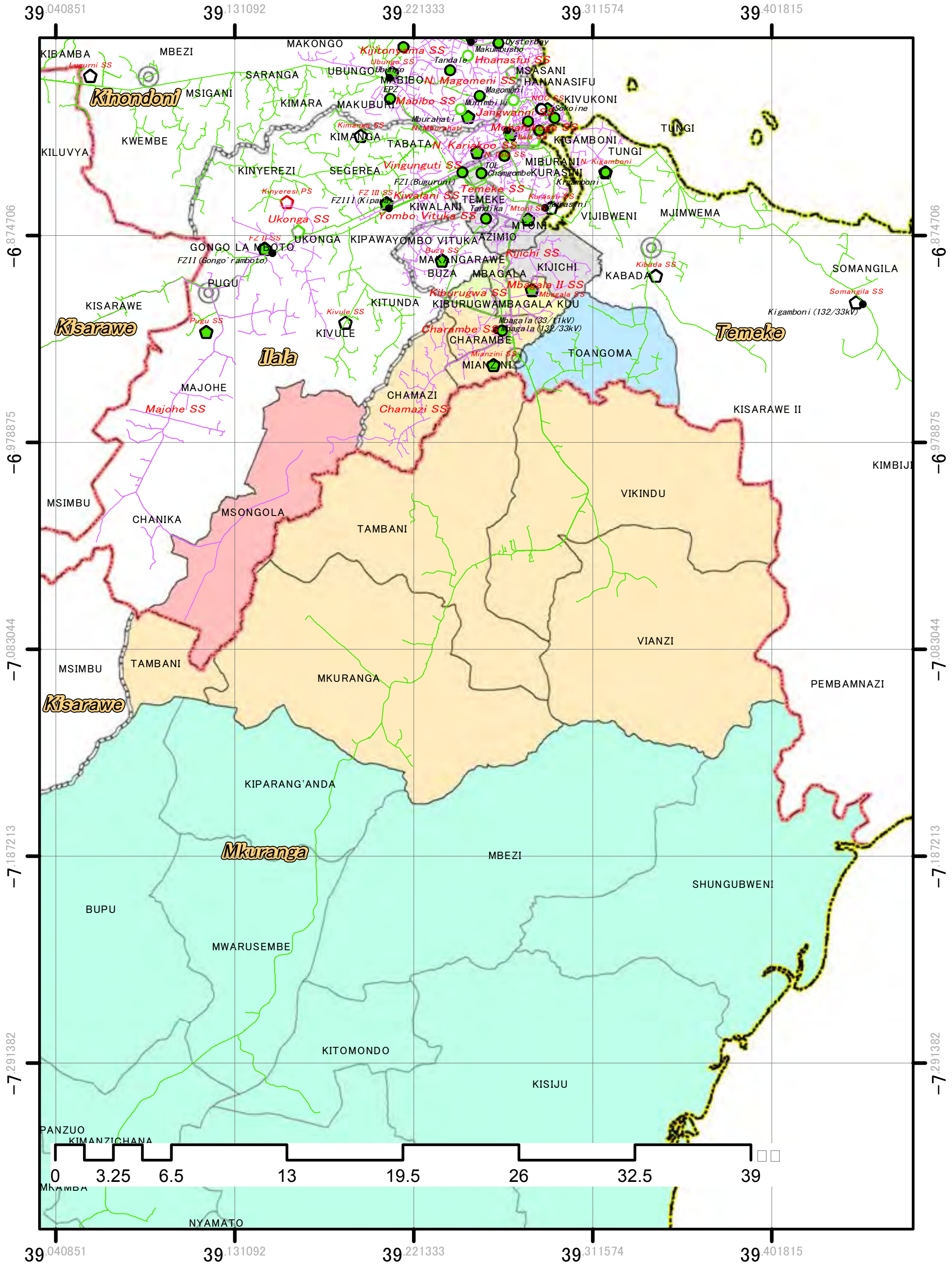
2025



Legend

- Mbagala SS
- Kibada / Mbagala SS
- Pugu / Mianzini SS
- Buza / Mbagala SS
- Mianzini SS
- Mkuranga SS
- Mtoni SS

2030



Legend

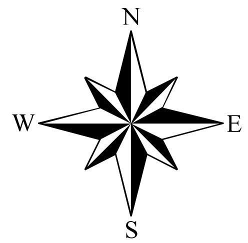
- Mbagala SS
- Kibada / Mbagala SS
- Pugu / Mianzini SS
- Buza / Mbagala SS
- Mianzini SS
- Mkuranga SS
- Mtoni SS

Common Legend

[EXISTING]
- *Substation 132/33/11kV*
- *Substation 33/11kV*
- Feeder 33kV
- Feeder 11kV

[PLAN/STUDY/IN PROCESS]
- *Substation 132/33/11kV*
- *Substation 33/11kV*

[MASTER PLAN]
- *Power Station*
- *Substation 132/33kV*
- *Substation 132kV*
- *Substation 33kV*
- SEZ
- New Satellite Center
- Borderline
- Regional boundary
- *District boundary*



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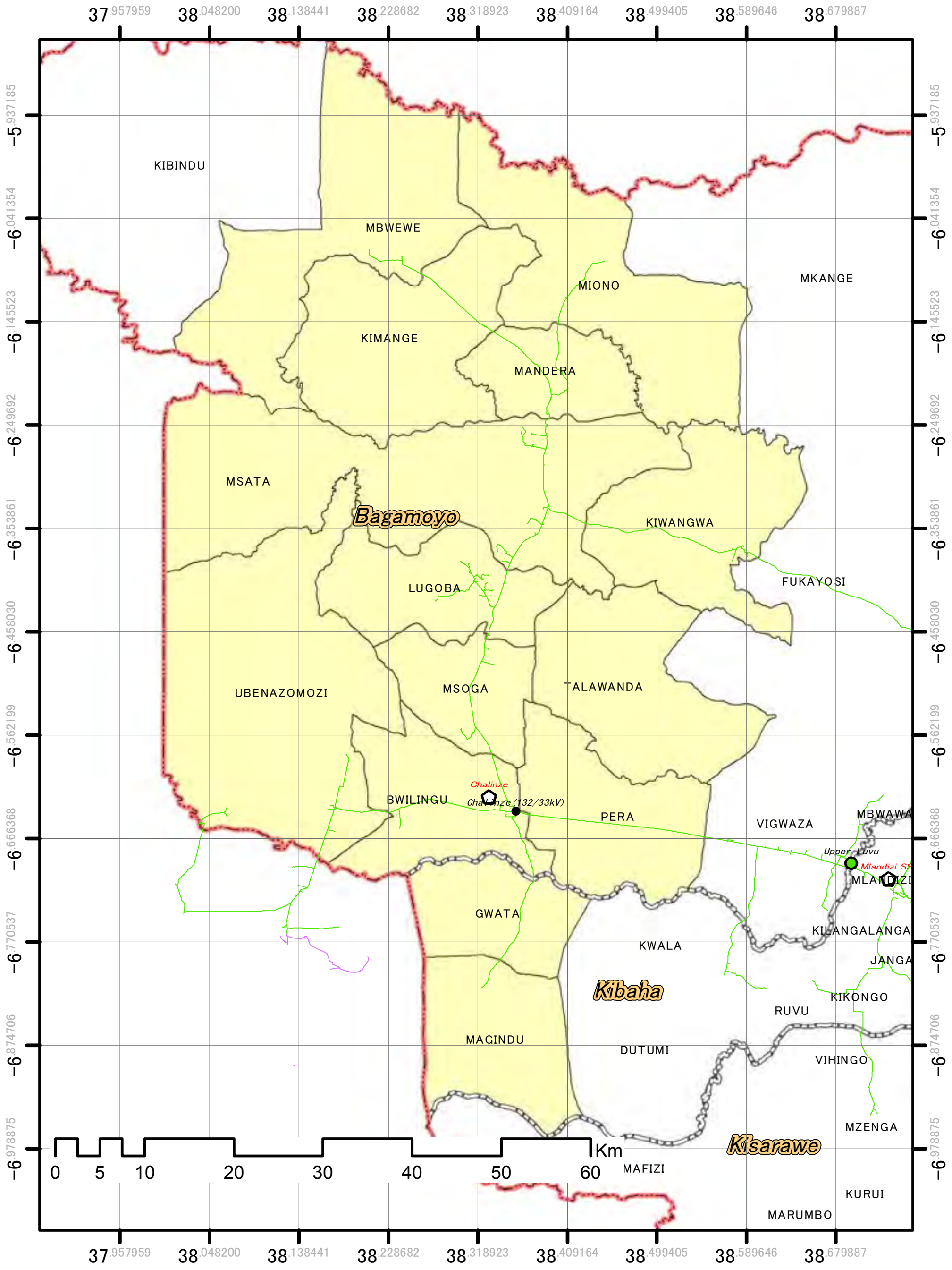
Mbagala SS

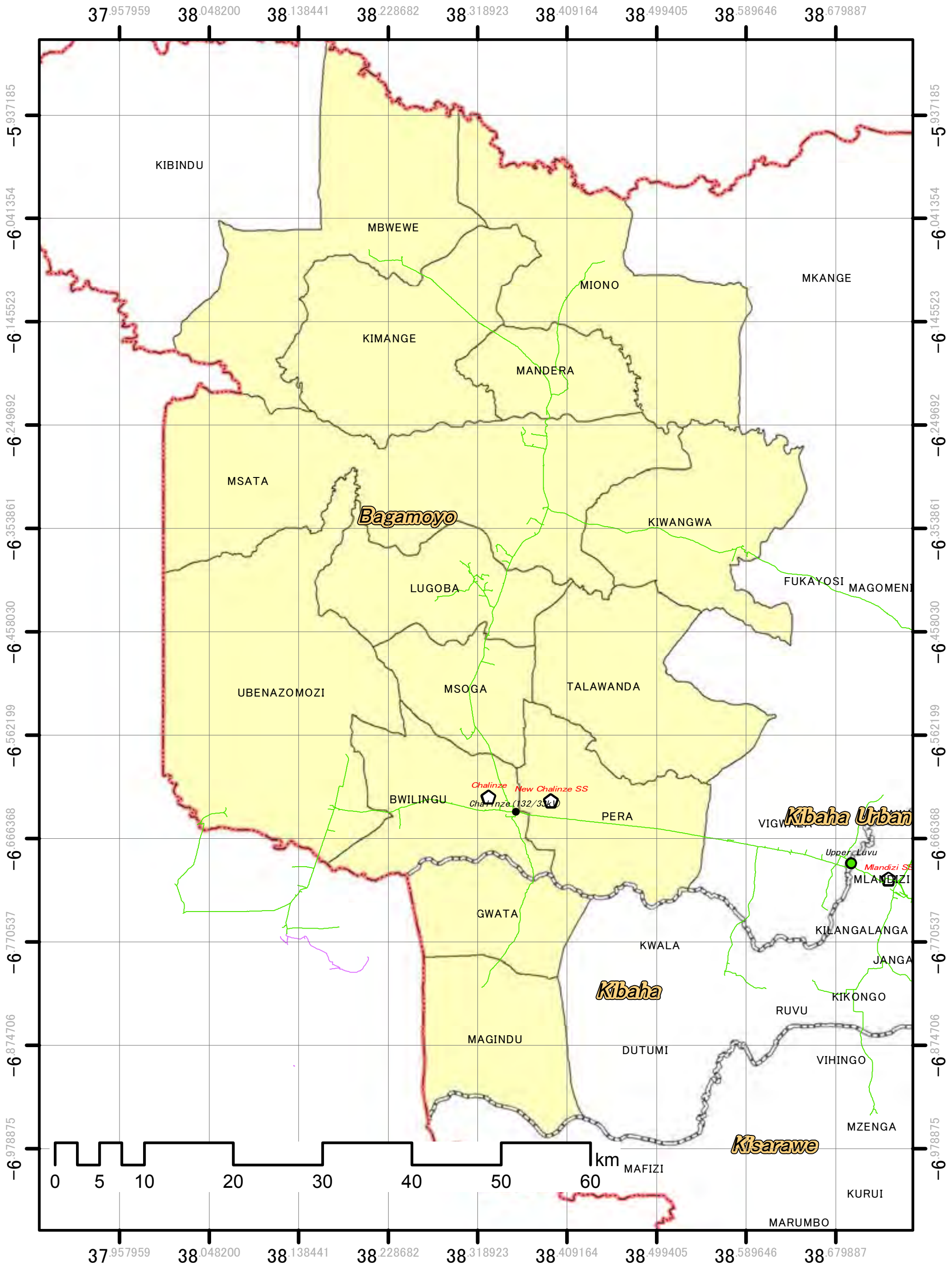
2020



Legend

Chalinze SS

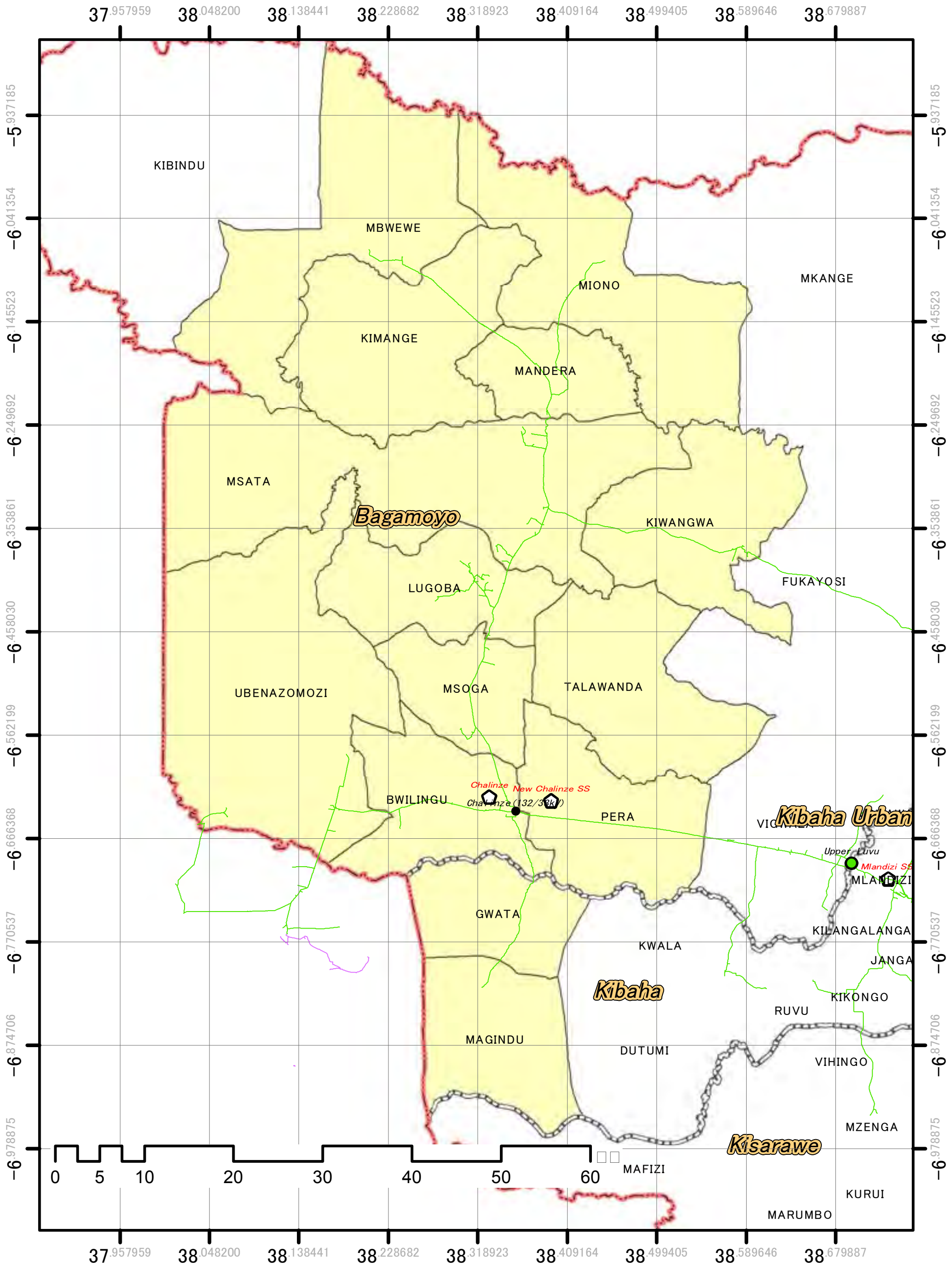
2025



Legend

Chalinze SS

2030



Legend

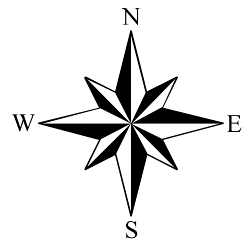
Chalinze SS

Common Legend

[EXISTING]
- *Substation 132/33/11kV*
- *Substation 33/11kV*
- Feeder 33kV
- Feeder 11kV

[PLAN/STUDY/IN PROCESS]
- *Substation 132/33/11kV*
- *Substation 33/11kV*

[MASTER PLAN]
- *Power Station*
- *Substation 132/33kV*
- *Substation 132kV*
- *Substation 33kV*
- SEZ
- New Satellite Center
- Borderline
- Regional boundary
- *District boundary*



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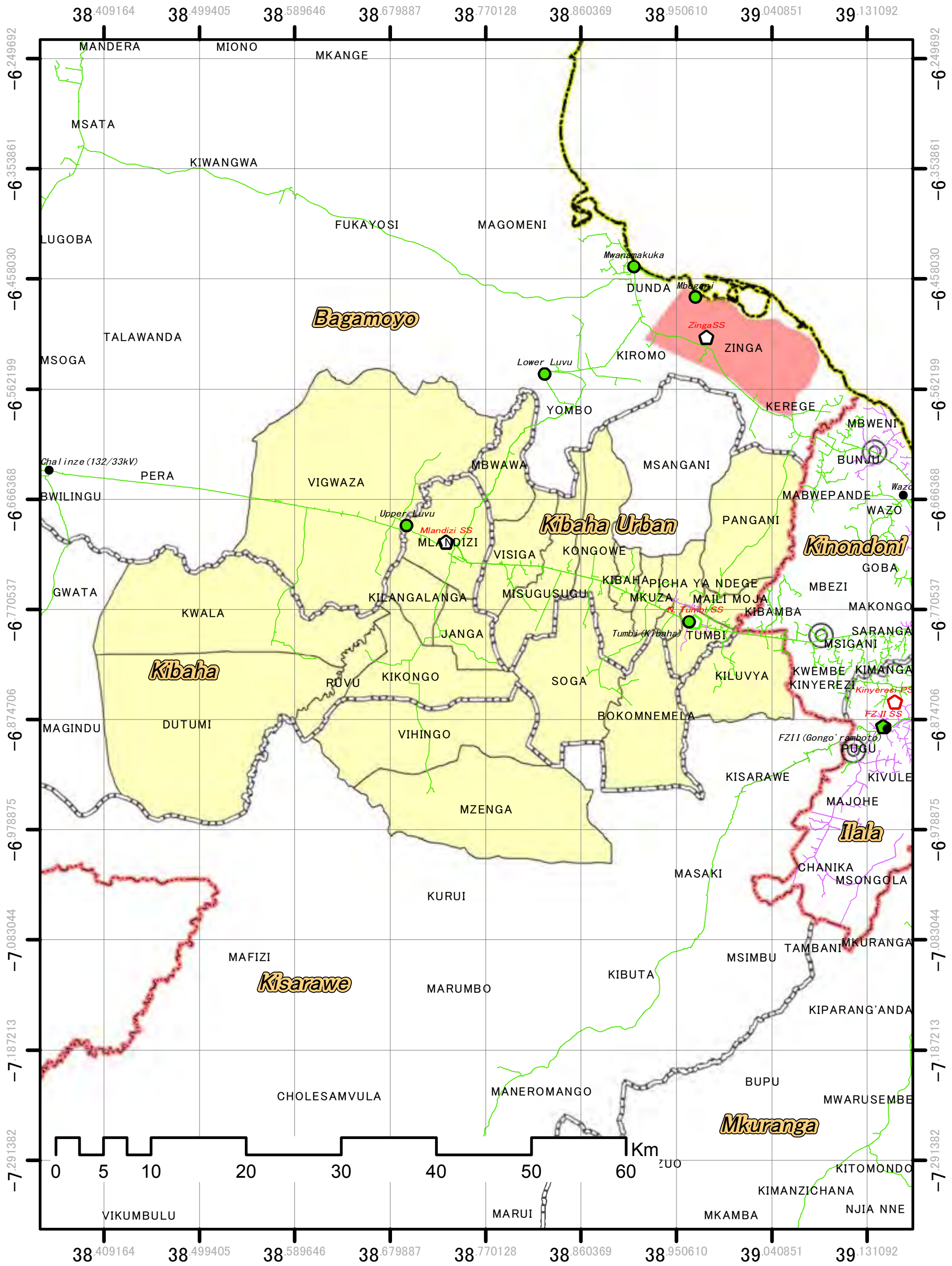
Chalinzse SS

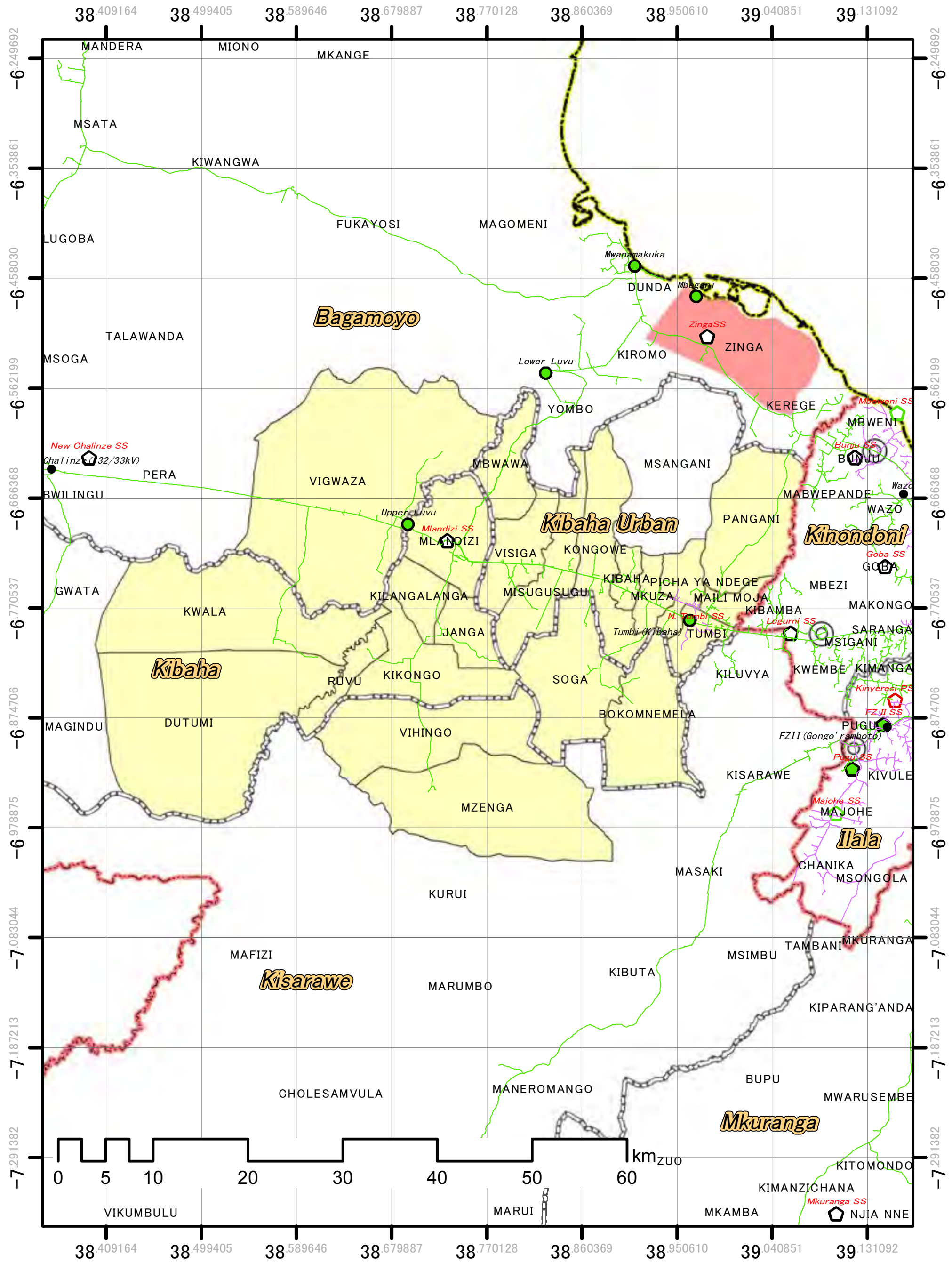
2020



Legend

Mlandizi SS

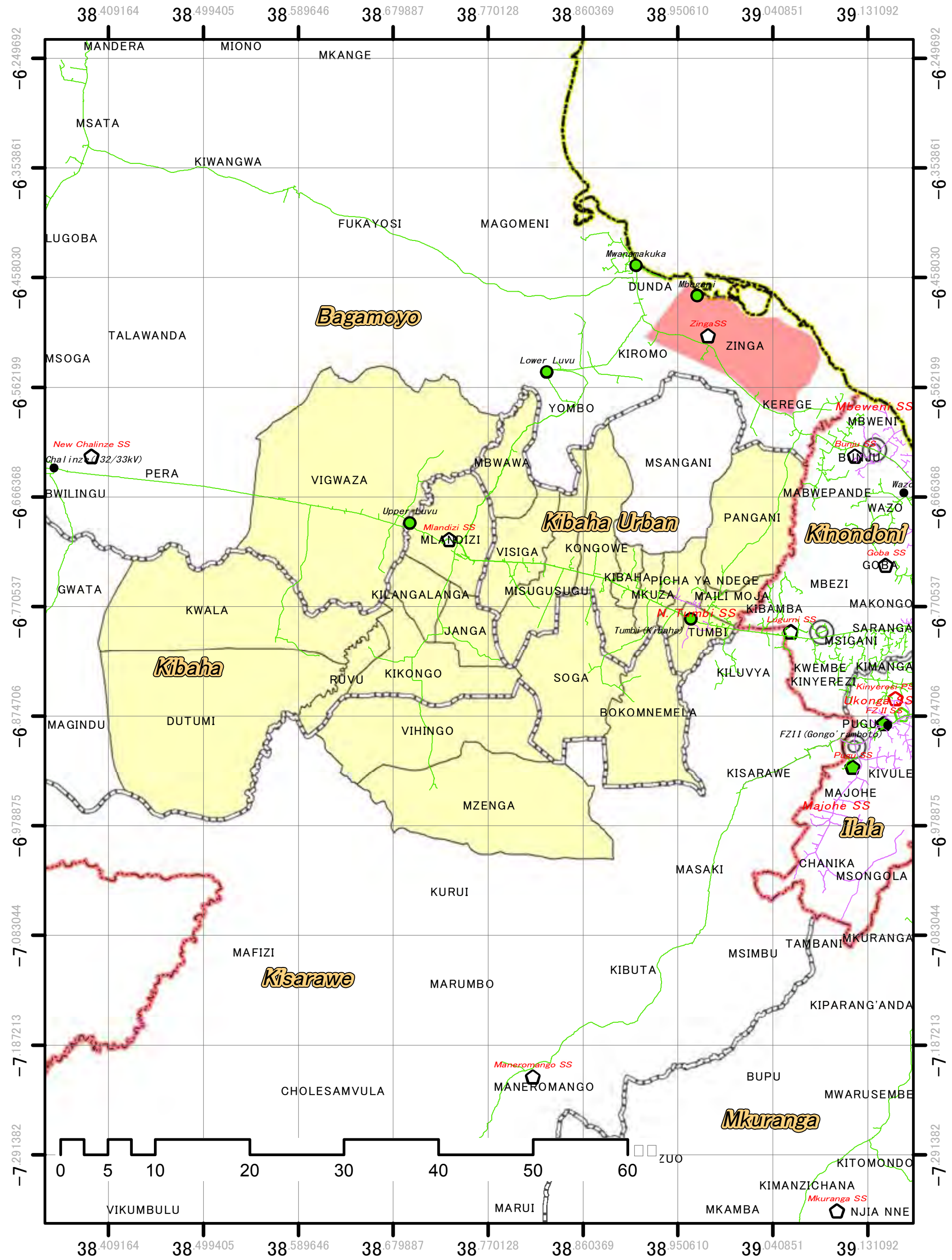
2025



Legend

Mlandizi SS

2030



Legend

Mlandizi SS

Common Legend

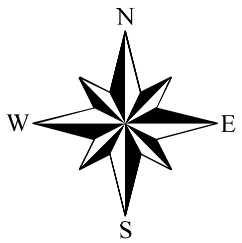
[EXISTING]
- Substation 132/33/11kV
- Substation 33/11kV
- Feeder 33kV
- Feeder 11kV

[PLAN/STUDY/IN PROCESS]
- Substation 132/33/11kV
- Substation 33/11kV

[MASTER PLAN]
- Power Station
- Substation 132/33kV
- Substation 132kV
- Substation 33kV

- SEZ
- New Satellite Center

- Borderline
- Regional boundary
- District boundary



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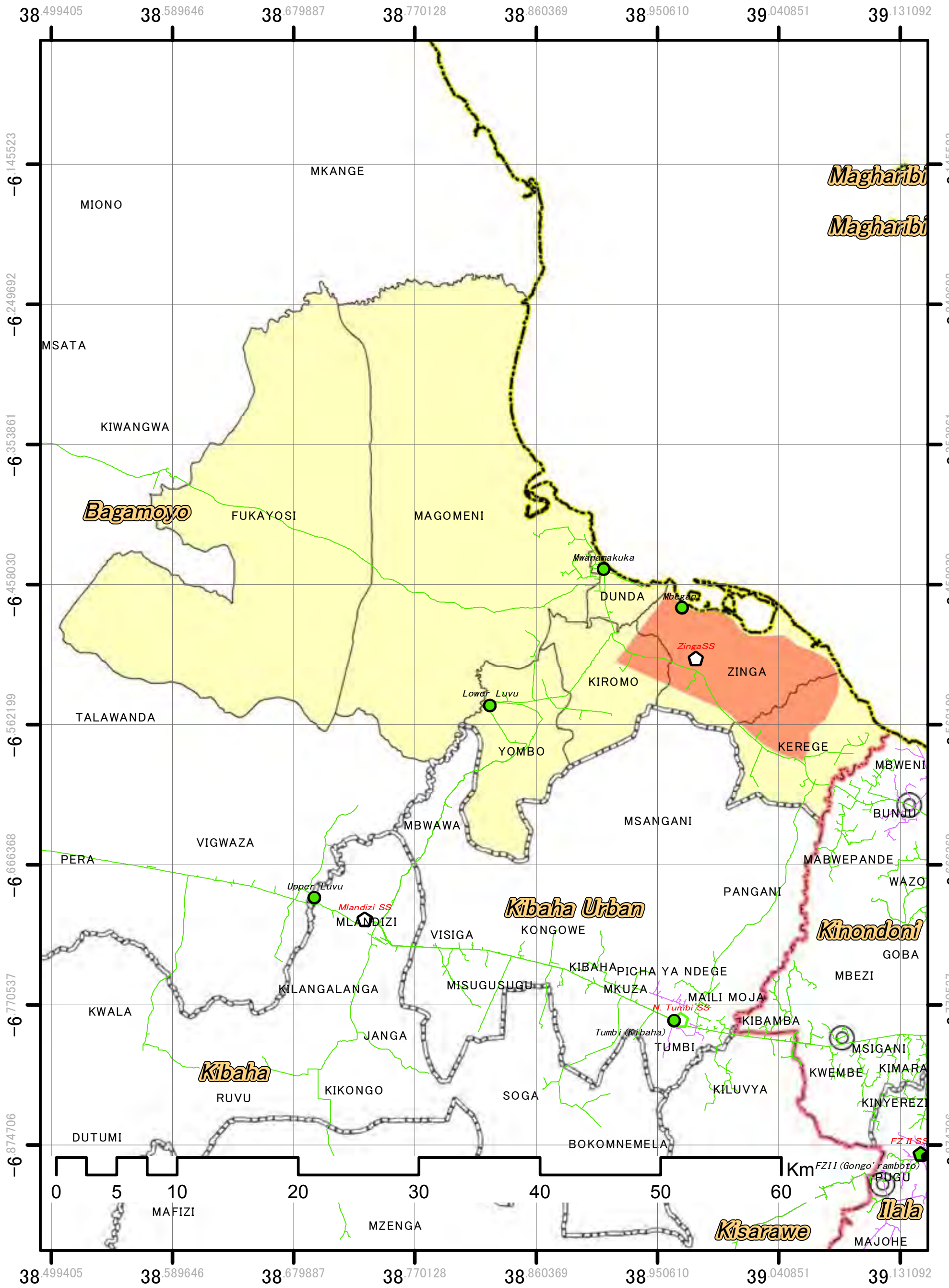
S-4-11

Mlandizi SS

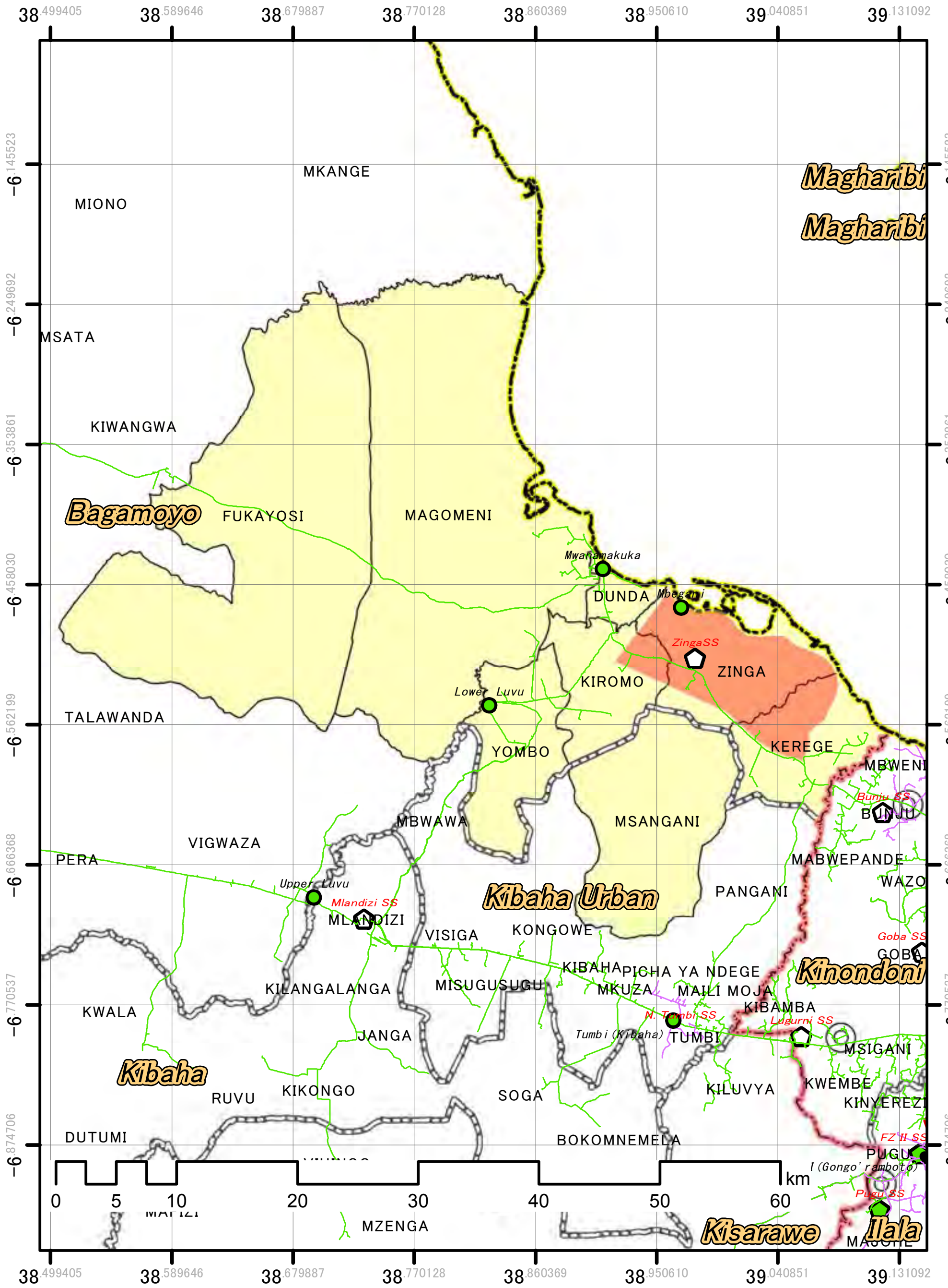
2020



Legend

Zinga SS

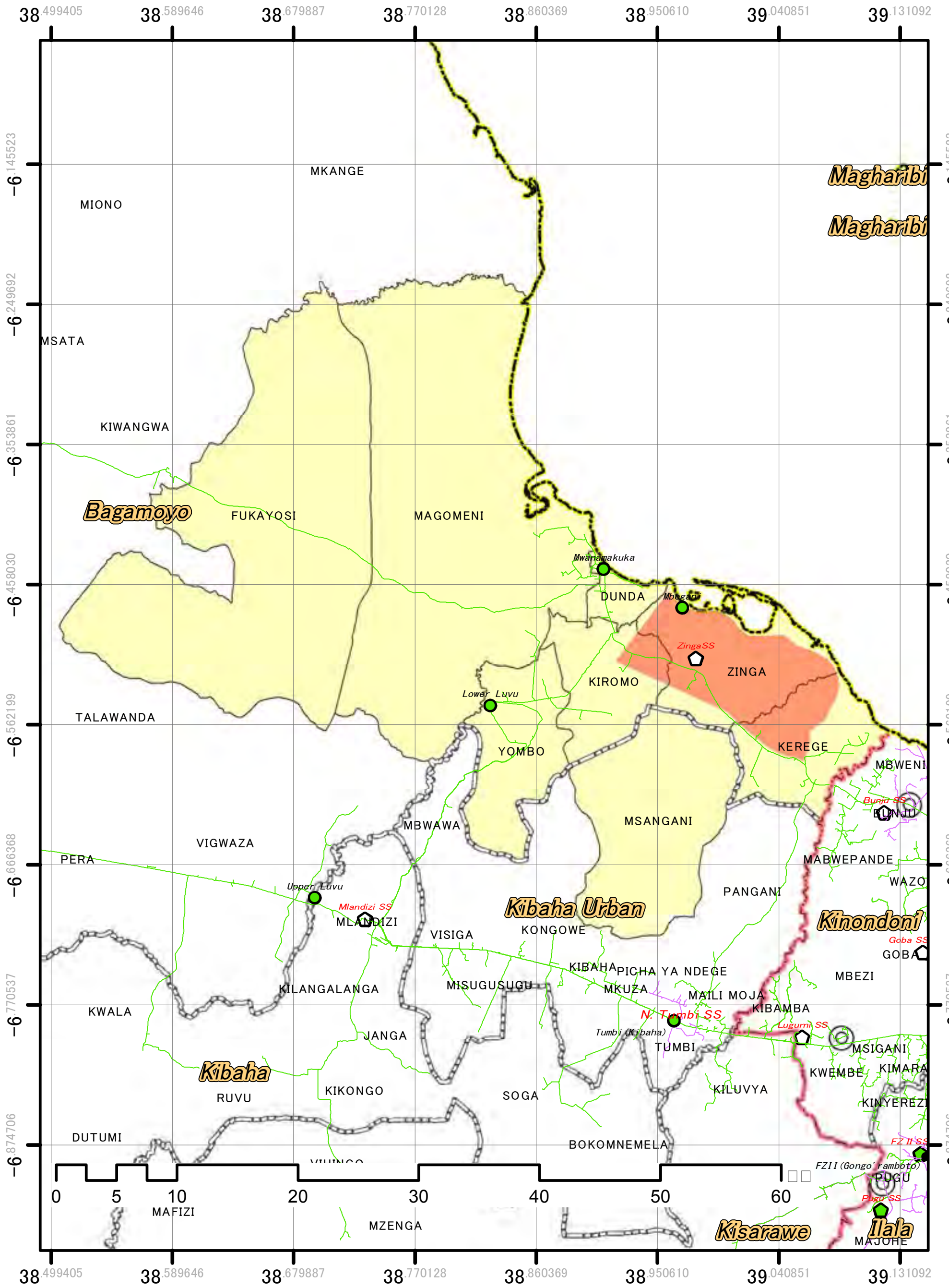
2025



Legend

Zinga SS

2030



Legend

Zinga SS

Common Legend

[EXISTING]
- Substation 132/33/11kV
- Substation 33/11kV
- Feeder 33kV
- Feeder 11kV

[PLAN/STUDY/IN PROCESS]
- Substation 132/33/11kV
- Substation 33/11kV

[MASTER PLAN]
- Power Station
- Substation 132/33kV
- Substation 132kV
- Substation 33kV

- SEZ
- New Satellite Center

- Borderline
- Regional boundary
- District boundary

N W E S

1:600,000

Zinga SS

S-5. Present situation of database construction and workshop opening

1 Overview of the Workshop

1.1 Objective of the Workshop

In 3rd year of the Project, as a part of database construction for future master plan, the study team has conducted workshop for the development of power distribution network GIS database development. The purpose of the workshop is to introduce tools which may benefit for the GIS database development and share issues among participant regarding development of database for future master plan.

1.2 Schedule

Following table shows implementation schedule of the workshop.

Table 1-1 Schedule

Date	Activities	Venue
17th January 2017	Needs survey	TANESCO HQ
18th January 2017 AM	Site survey and interview	Kinondoni North Regional Office
18th January 2017 PM	Site survey and interview	Kinondoni South Regional Office
19th , 20th January 2017	Data analysis	
23rd January 2017	Site survey and interview	Kinondoni North Regional Office
26th , 27th January 2017	Workshop Preparation	
30th January 2017	Workshop (Internal-session)	Kinondoni North Regional Office
31st January 2017	Workshop (Introduction)	Kinondoni North Regional Office
1st February 2017	Workshop (Hands-on Session)	Kinondoni North Regional Office
2nd February 2017	Workshop (Evaluation)	Kinondoni North Regional Office

1.3 Contact Persons

Following table shows participant of the workshop and site survey.

Table 1-2 Participant of Site Survey and Workshop

SN	Name	Organization / Position
1	Eng. Theodory Bayona	Ag. Senior Manager Distribution
2	Mr. Salum P.J. Kagambo	Principal Engineer Distribution Management System
3	Eng. Chambua Frank	Principal Engineer in Kinodoni South Regional Office
4	Eng. Yahaya A. Mbezi	Staff in Kinondoni North Regional Office
5	Mr. Amasha A. Fundi	Staff in Kinondoni North Regional Office

SN	Name	Organization / Position
6	Mr. Gido B. Laswai	Staff in Kinondoni North Regional Office
7	Mr. Charles J. Mayala	Staff in Kinondoni North Regional Office
8	Ms. Adeline Karumuiva	Staff in Kinondoni North Regional Office
9	Mr. Abuu Iddy	Staff in Kinondoni North Regional Office
10	Eng. Catherine Shayo	Staff in Kinondoni South Regional Office
11	Mr. Fadlnli S. Chilambe	Staff in Kinondoni South Regional Office

2 Current Situation

2.1 Summary

Dar es Salaam and Coast Region has following five (5) regional offices to manage power distribution network. Ilala, Temeke, Costal Region, Kinondoni North of four (4) regional offices are recently completed development of GIS database in the same data structure. Development of GIS database in each regional office is independently executed. Therefore, Kinondoni South regional office also developed its GIS database upon prototype development in 2012.

- Ilala (released 2016)
- Temeke (released 2016)
- Kinondoni North (released 2016)
- Coast Region (released 2016)
- Kinondoni South (2012 prototype release and development is on-going)

The objective of GIS database development is almost same in each project. It is considered to improve customer satisfaction. Followings are major use cases to improve customer satisfaction.

- Evaluating the impact of the malfunctioning facility in power distribution network, prioritizing countermeasures and limit affection for customer.
- Using database as base data for planning distribution network expansion.
- Optimizing network facility distribution by estimating energy consumption based on the customer information.

Major coverage of the database is as follows;

- Distribution line network Low-voltage line, Medium-voltage line
- Substation and other facilities (Transformers, poles and so forth)
- Customer
- Road, building, and channel as a base map

During database development stage, commercial software is utilized to speed up development.

Currently, software for data maintenance and distribution was based on OSS (Open Source Software) technology. Therefore, it contributes to reducing TCO (Total Cost of Operation). However, speed for database development has slow down and increased risk of getting a delay on maintenance.

For future, development of the GIS database may help more advanced use of the GIS database such as equipment ledger associated with drawings, synchronized with real-time data provided by SCADA（Supervisory Control and Data Acquisition） system to visualize current condition of the network, or at least facility development planning in a future project.

Following issues are major concerns for the sustainability of the existing GIS database.

- Independent (not synchronized) development effort and management jurisdiction for GIS database
- Un-unified form of database (undocumented)

2.2 Current Situation

2.2.1 Kinondoni North Regional Office

Dar es Salaam and Coast Region has following five (5) regional offices to manage power distribution network. Ilala, Temeke, Costal Region, Kinondoni North of four (4) regional offices are recently completed development of GIS database with the same data structure.

The objective of GIS database development is set to improve customer satisfaction. Followings are major use case to improve customer satisfaction. However, development of GIS database in each regional office is independently executed.

- Evaluating the impact of the malfunctioning facility in the distribution network, prioritizing countermeasures and limit affection for the customer.
- Using database for planning distribution network expansion.
- Optimizing network facility distribution by estimating energy consumption by the customer information

Major coverage of the database is as follows;

- Distribution line network such as low-voltage line, medium-voltage line
- Substation and other facilities (Transformers, poles and so forth)
- Customer
- Road, building, and channel as a base map

(1) Human Resources

In each regional office has at least one (1) Planning Engineer who is responsible for GIS database development. Under regional office, there are several district offices, and each office has around two (2) or three (3) technicians. With those human resources, GIS database development has maintained.

(2) Equipment and System Structure

In each regional office, following equipment has in place.

- Two (2) Trimble (GPS) hand-held device for field survey and data entry support
- only one (1) only Base station to acquire a signal for geometrical correction
- Several tablets and its inputting application developed for customer information collection
- One (1) Workstation for geometrical correction and data conversion
- Two (2) Workstation for data entry and editing

The following figure shows the configuration of GIS system for power distribution network.

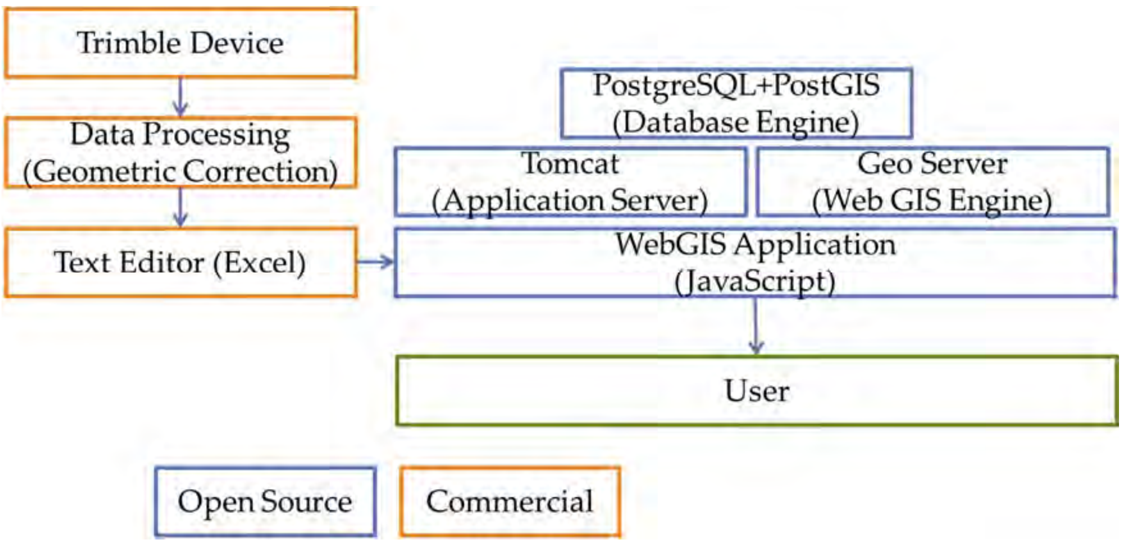


Figure 2-1 GIS System Configuration in Kinondoni North

(3) Data Structure and Data Processing Workflow

Same data structure and data processing workflow has introduced in Ilala, Temeke, Costal Region, Kinondoni North of four (4) regional offices for the power distribution network GIS database. The following figure shows data processing workflow for GIS database development. However, the data structure of power distribution network is not well documented. Therefore, dissemination of the GIS database development has been stalled.

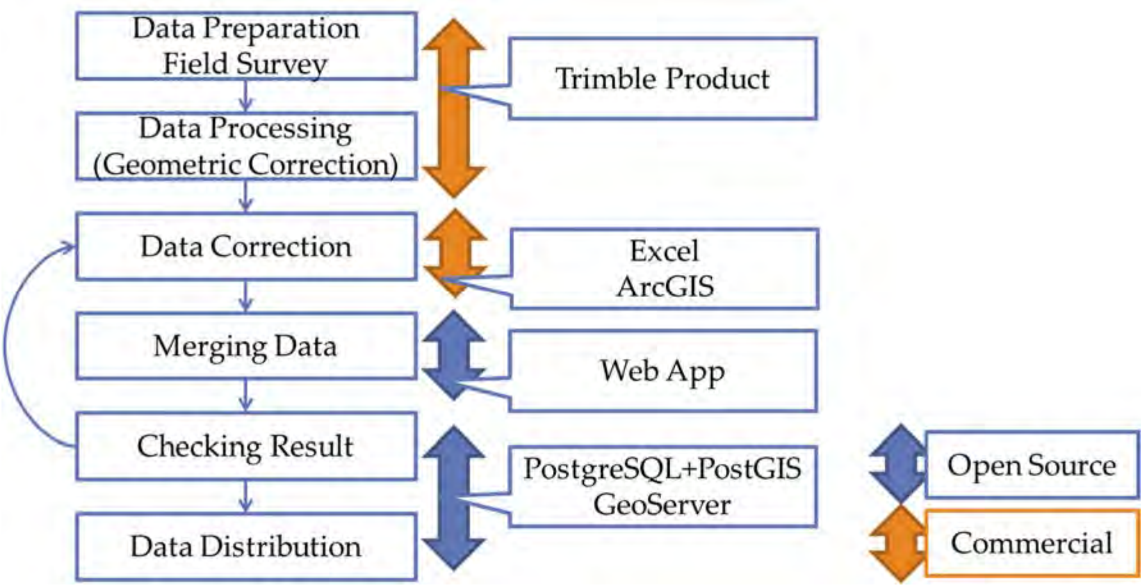


Figure 2-2 Workflow of the GIS Database Maintenance

2.2.2 Kinondoni South Regional Office

In 2012, Kinondoni South regional office started GIS database for power distribution network development. With the support of Dar es Salaam University, the prototype has released. However, the coverage area of the database was limited. After prototype has released, effort to extend coverage has slow down due to limited human resources and software resources.

The objective of GIS database development is same as other regional offices. It set to improve customer satisfaction. Due to independent management structure, Kinondoni South regional office did not participate in a profit of other regional offices' GIS database development. As a result, data structure has remained the previous condition, and no much benefit has obtained from OSS (Open Source Software) utilization.

Major coverage of the database is as follows;

- Distribution line network Low-voltage line (50-60%), Medium-voltage line (95%)
- Substation and other facilities (Transformers, poles and so forth)

- Customer (under development)
- Road, building, and channel as a base map (old data)

(1) Human Resources

In Kinondoni South, one (1) Planning Engineer who is responsible for GIS database development is stationed. Under him, the office has around two (2) or three (3) technicians. With those human resources, GIS database development has maintained.

(2) Equipment and System Structure

In Kinondoni South regional office, following equipment has in place.

- One (1) Garmin (GPS) hand-held device for field survey
- One (1) Workstation for GIS database development with ArcGIS 10 license

(3) Data Structure and Data Processing Workflow

Almost database development has been halted due to limited resources. Even advanced data structures were not shared since it has no documentation for the data structures.

2.3 Cause of Delay in GIS database development

Major cause of the delay is considered as followings.

- Due to dependency on commercial software, it limits the number of licenses, and it leads to limit participants (weakening development body)
- Weak documentation protocol remains no documents for database development (hard to share earned knowledge)

During database development stage, contractor utilizes commercial software to speed up development. However, after the release of the GIS database, commercial software licensed to the regional offices is limited and due to limited licenses, participants to GIS database development also limited. Therefore, it is weakening the internal development body of the GIS database development.

Weak documentation protocol also made difficult to share acquired knowledge of GIS database development. Since no documentation has submitted from the contractor, the result of database development only stays in the offices that benefited from previous GIS database development.

Currently, usage of OSS (Open Source Software) shows good participation of the staff for data maintenance and operation. Therefore, TCO (Total Cost of Operation) reduction contributes to the participation of the staff for GIS database development and maintenance. However, dissemination of advantage of database development has slow down and increased risk of getting a delay on maintenance.

Following issues are major concerns for the sustainability of the existing GIS database.

- Higher TCO (Total Cost of Operation) made difficult to attract participation of staff for GIS database development
- No advantage sharing among regional offices due to poor documentation among GIS database development

3 Measures

To fill the gaps of GIS database (Kinondoni South) and increase the productivity of GIS Database development without TCO increase, the much further introduction of the OSS and its open contents product are proposed. Followings are a major product to be introduced in the proposal.

- Base map data from OpenStreetMap
    - The map seamlessly covering the whole region shall help to fill the gaps of GIS database and unifying data structure
- QGIS for alternative product to commercial GIS desktop application
    - Even commercial GIS desktop application has advanced functionality, productivity of GIS desktop based on OSS technology has been much improved

3.1 Workshop and Test Environment Development

With Kinondoni North Regional Office's GIS database management team and Kinondoni South regional office's GIS database management team, through the introduction of OSS and products, prototyping of database development environment has been proposed as a workshop. The objective of the prototyping is considered as followings;

- Evaluate impact of adapting OSS GIS desktop application and usage of freely available map product
- Get familiarize and improve current database development workflow
- Study migration plan for data in Kinondoni South Regional Office to adapt data structure

3.2 Implementation Schedule

Venue: Kinondoni North Regional Office

Sun	Mon	Tue	Wed	Thu	Fri	Sat
22	23	24	25	26	27 1. Preparation	28
29	30	31 2. Trial	1 3. Evaluation	2	3	4

Preparation

- Workflow engineering for existing data acquisition procedure
- Preparation of test environment

Trial

- Introduction of QGIS (basic training of usage)
- Trial test for reengineered workflow

Evaluation

- Discussion of result of tests among usage and capacity of OSS

3.3 Conclusion

Through the workshop, test environment has been established and carry out testing. However, DB "tanesco" (restoring actual GIS database in a working environment) has been failed. The flowing figure shows overview of environment.

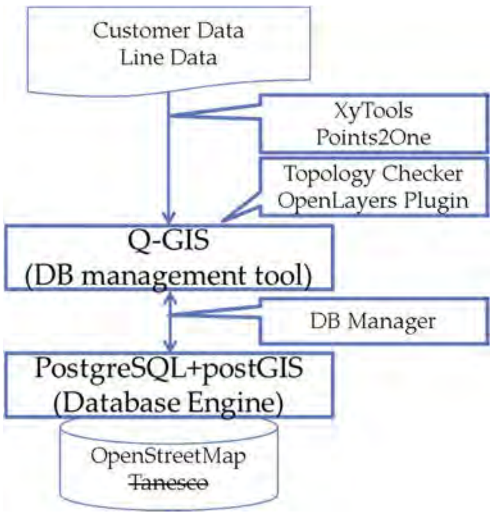


Figure 3-1 Developed Testing Environment

The network connection between the client machine and the server machine is established. An exchange of information between client machine and server machine was successfully confirmed. However, it turns out the bandwidth of wireless LAN seems not enough capacity for exchanging geospatial information. In testing, an external network (out of segment) was not performed. To expand system through WAN, it requires further testing.

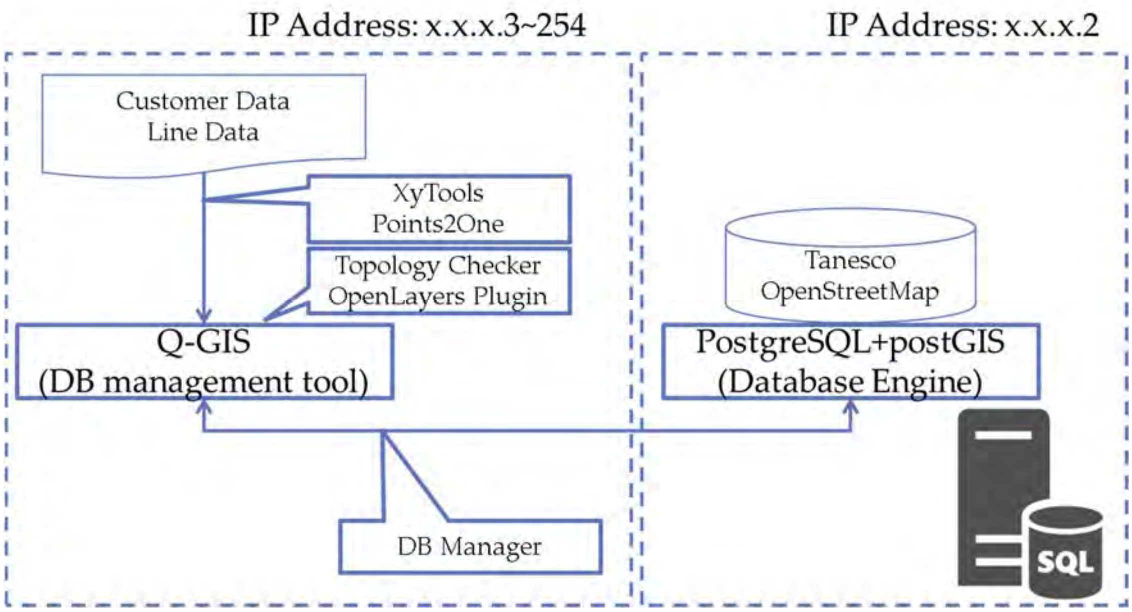


Figure 3-2 Performance Test for Network

With QGIS and other OSS (Open Source Software), the capability to maintain geospatial data is successfully confirmed. The positioning data collected by portable devices' and corrected and imported into the geospatial database.

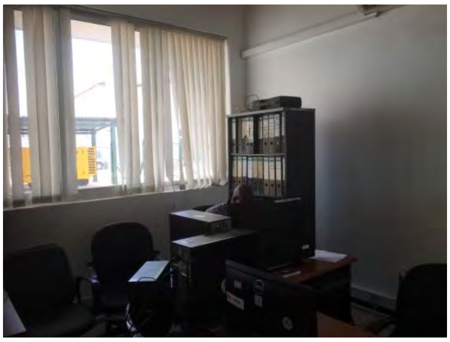
On the other hand, most of the participants were using 32 bit OS with limited memory for the working environment. To carry out database maintenance, much bigger dataset should be handled compared with testing environment. Current working environments required a further update of the memory capacity, performance of CPU, and OS.

To extend database coverage, database structure and knowledge must be shared. In current condition, documents for database structure are not provided. Most of the operation also has no documentation such as manual or working records of maintenance. It is shared among participant that the poor documentation is one of the most urgent issues to be solved.

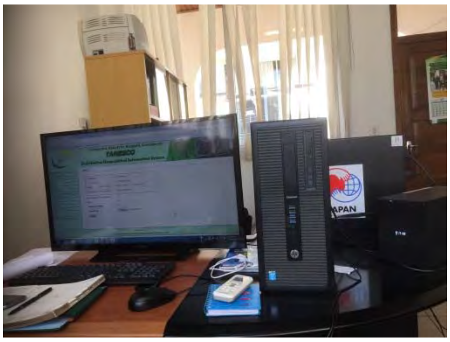
4 Photos

The photos taken during site survey and workshop.

Kinondoni North Regional Office



Working Room

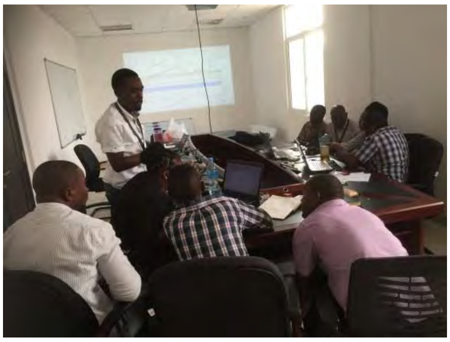


WS running GIS Database

Handheld GPS Device for Data Collection

Base Station for Data Collection

Hands-on Session



Hands-on Session

Discussion with Participants