United Republic of Tanzania Ministry of Energy and Minerals



# POWER SYSTEM MASTER PLAN 2016 UPDATE



December 2016

# LIST OF ABBREVIATIONS

Advanced Sub-C	Advanced subcritical
AfDB	African Development Bank
bbl	blue barrel (US unit)
CCGTs	Combined-cycle gas turbines
ССТ	Circuit
СО	Carbon monoxide
CO <sub>2</sub>	Carbon dioxide
CRIDF	Climate Resilient Infrastructure Development Facility
DC	Direct Current
DME	Dimethyl Ether
DSM	Dar es Salaam
EE&C	Energy efficiency and conservation
EGC	Energy generation capability
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESIA	Environmental and Social Impact Assessment
EWURA	Energy and Water Utilities Regulatory Authority
F/S	Feasibility Study
FDI	Foreign Direct Investment
FOR	Forced outage rate
FYDP	Five Year Development Plan
GDP	Gross Domestic Product
GHG	Greenhouse gases
GWh	Gigawatt-hours = 1,000,000,000 watt-hours
GT	Gas Turbine
GTL	Gas to Liquids
HFO	Heavy Fuel Oil
IAEA	International Atomic Energy Agency
IEA	International Energy Agency
IPP	Independent Power Producer
IPTL	Independent Power Tanzania Limited
kWh	Kilowatt-hours = 1,000 watt-hours

Japan International Cooperation Agency
kilo Ampere
kilo Joule
Kilo Volt
Kilowatt-hours = 1,000 watt-hours
Local Government Authorities
Liquefied Natural Gas
Loss Of Load Probability
Long Term Perspective Plan
Ministry of Energy and Minerals
Million British thermal Unit
Ministry of Finance
Million United States Dollar
Mega Volt Ampere
Mega Volt Ampere Reactive
Megawatt = 1,000,000 watts
Megawatt-hours = 1,000,000 watt-hours
Not Applicable
National Bureau of Statistics
National Development Corporation
National Environmental Advisory Committee
National Environment Management Council
Natural Gas Utilization Master Plan
Nitrogen oxides
Organization for Economic Co-operation and Development
Operation and Maintenance
Power Station
Particulate Matter
Power System Master Plan
Rural Energy Agency
Rufiji Basin Development Authority
Super-Critical
Selective Catalytic Reduction

SEA	Strategic Environmental Assessments
SNC	SNC-Lavalin International Inc.
SNCR	Selective noncatalytic reduction
SO <sub>2</sub>	Sulfur dioxide
SPP	Small Power Project
SVC	Static Var Compensator
TANAPA	Tanzania National Parks Authority
TANESCO	Tanzania Electric Supply Company Limited
TANWAT	Tanzania Wattle Company
TBS	Tanzania Bureau of Standards
Tcf	Trillion cubic feet
T/D	Transmission and Distribution
TPDC	Tanzania Petroleum Development Corporation
Tr	Transformer
TZS	Tanzanian Shillings
USA	United States of America
USC	Ultra-Super-Critical
USD	United States Dollar
US\$	United States Dollar
WASP	Wien Automatic System Planning Package
WB	World Bank
WMAs	Wildlife Management Areas
WTI	West Texas Intermediate

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#### CHAPTER ONE

#### 1 INTRODUCTION

#### 1.1 Purpose and Scope

The 2016 Power System Master Plan (PSMP) reflects and accommodates recent development in the economy, including development in the gas sub sector as well as government policy guidelines. The policy guidelines include, among others the desire by the government to accelerate economic growth through the Vision 2025, MKUKUTA and the Five Year Development Plan–II (2016/17-2020/21, FYDP-II). The government also aims to expedite economic growth by means of the revival and renovation of industries.

"Among the outcomes associated with the attainment of these objectives, FYDP 2016/17-2020/21 will raise annual real GDP growth to 10 percent by 2021 (from 7.0 percent in 2015), per capita income to US\$ 1,500 (from US\$ 1,043in 2014) and reduction of the poverty rate to 16.7 percent from 28.2 percent recorded in 2011/12. The Plan also envisages raising FDI flows from US\$ 2.14 billion in 2014 to over US\$ 9.0 billion by 2021; increase electricity generation from 1,501MW in 2015 to 4,915MW by 2020 and improving electricity connections to 60 percent of the population, up from 36 percent in 2015. On average, manufacturing sector will grow by over 10 percent per annum with its share in total exports increasing from 24 percent in 2014/15 to 30 percent in 2020." The government vision is to become a middle income country by 2025 with electricity consumption of 490kWh/capita.

The fundamental objective is also to attain stable power supply in order to achieve Economic Growth, Energy Security and Environmental Protection. The government of Tanzania set the maximum target to reduce poverty by achieving high economic growth, which could be achieved through a stable and efficient power system.

The overall objective of the Plan is to re-assess short-term (2016 - 2020), mid-term (2021 - 2025) and long term (2026 - 2040), generation and transmission plans requirements and the need for connecting presently off-grid regions, options for power exchanges with neighboring countries, and increased supply of reliable power. While the short-term plan requires immediate decision and actions, the mid - long term plans require coordinated planning and project development studies to ensure that future electricity supply utilizes the least cost projects in consistent with sound planning criteria in order to address national interests. This report has been prepared drawing inference on specific data items or detailed procedures in the previous PSMP 2008 and the subsequent 2009 and 2012 Update studies.

In 2008, a Power System Master Plan (PSMP) was developed by the consultant SNC - Lavalin of Canada for the Government of Tanzania, through TANESCO, to provide a fundamentally new plan to guide the development of the power system in Tanzania for the next 25 years. The study provided a detailed assessment of load demand projections, available options for meeting the demand and requirements for a new higher voltage backbone transmission system for the country.

The Plan was updated in 2009 by MEM and TANESCO with the technical support from the SNC - Lavalin consultant which reviewed the progress and challenges encountered during the first year of implementation. The 2012 Update was conducted by technical staffs from MEM, TANESCO, President's Office - Planning Commission, Ministry of Finance, TPDC, EWURA, REA and NBS. The Plan has also incorporated comments from various stakeholders. This PSMP 2016 Update was also conducted by the same technical team with technical assistance from Japan International Cooperation Agency (JICA). The PSMP 2016 Update covers the following main components:

- a) Revised load forecast based on the current situation and updated expectations;
- b) Reassessment of the short-term, mid-term and long-term generation plan;
- c) Update of the transmission plan to reflect the update in plans for connecting presently isolated regions and increased generation capacities;
- d) Environmental and social considerations for proposed projects; and
- e) Economic and financial analysis

#### 1.2 Scope of the work

The following five primary components underlie the PSMP 2016 Update study:

- a) Confirmation of planning criterion;
- b) Load forecast update including the collection of past and future power demand in all regions;
- c) Generation plan update, including updating and confirming data on all generation sources, existing and future options;
- d) Transmission plan update, including ongoing additions and reinforcement to the existing system, taking into account the interconnection of presently isolated areas to the national grid, and options for import from neighboring countries;
- e) Mitigation measures on environmental and social impact from planned power development projects;
- f) Investment plans and financial analysis on planned power projects; and
- g) Preparing a new PSMP 2016 Update report.

#### 1.3 Information collected for the PSMP 2016 Update

#### Load forecast data

- a) Historical peak demand at branch, sub-station, grid and national levels;
- b) Historical energy sales by category of load and by region and substation; and
- c) Historical transmission and distribution losses, energy production, energy purchases and energy exports;

- d) The information on the accelerated electrification scheme and its implementation status;
- e) Current and recent electricity forecasts
- f) Historical performance of the national economy up to year 2015; and
- g) Information on expectations for the growth of the national economy and the individual sectors.

#### Hydrological data

- a) Existing hydrological data from 1940 to date reference hydrology from TANESCO's stations;
- b) Data on reservoirs and hydro plants from TANESCO;
- c) All meteorological/synoptic records to date from The Tanzania Meteorological Agency;
- d) All stream flow and reservoir water level records to date from Ministry of Water; and
- e) Estimates/studies of water abstraction amounts including information from the Ministry of Water.

#### System planning

- a) Existing system operating and maintenance data;
- b) Fuel types, prices, volume and characteristics;
- c) Generation and transmission expansion planning criteria used in previous studies;
- Inventory and characteristics of existing and committed units including hydro units, simple cycle gas turbine units, combined cycle units and others (solar, wind, etc.); Inventory and characteristics of transmission facilities including transmission lines and substations;
- e) Transmission system current configuration and short- term plans; and
- f) Previous study reports on identified new generation options and transmission.

The overall update program consisted of data update and validation, analyses and report writing. The detailed scope of work was as follows:

#### Load forecasts

- a) Initial update of load forecast based on updated consumption data;
- b) Collection of regional power demand in the past, present and future;
- c) Review of updated load forecast;
- d) Confirmation of schedule for interconnection of presently isolated regions; and
- e) Adjustments and finalization of forecast study.

#### **Generation planning**

- a) Review / update and finalize generation and planning criteria;
- b) Update hydro generation study using updated hydrological records;
- c) Review and update list of new generation candidates, and finalizes plant characteristics for use in the plan; and
- d) Prepare preferred new generation plan, based on new base case forecast, short term generation commitments, retirement dates.

#### **Transmission planning**

- a) To distribute regional load into respective substations;
- b) Update PSS/E files of system configuration and characteristics for 2015 conditions;
- c) For the new base case generation plan develop 5-year plan components, for the mid-term (2020 and 2025) and for long term (2030, 2035 and 2040); and
- d) Prepare estimates of investment costs.

#### 1.4 Factors considered in the Update plan

The update plan has taken into account a broad spectrum of new information and planning criteria. Primary factors affecting the results, as compared with the 2016 PSMP Update, include:

#### Load forecast

- a) The impact of current level of losses on the forecast;
- b) The target of reaching 75 percent electrification of households by 2035;
- c) Program for interconnection of remaining isolated systems; and
- d) Emerging of high demands of power (Mtwara corridor) and Mining activities.

#### **Generation options**

- a) Availability of resources to meet projected demand (eg. hydro, gas, coal, wind, etc.);
- b) Lead time of projects (eg. hydro projects have very long lead time);
- c) Contracts/Retirement of projects; and
- d) Capital cost of the projects.

#### Transmission Plan

- a) Concentrating on 220 and 400kV backbone voltage; and
- b) Developing transmission plans in every interval of five years, while focusing in introduction of 400kV where necessary, instead of defining requirements for the whole horizon up to year 2040.

# CHAPTER TWO

# 2 Power Demand Forecast

# 2.1 Background

This section provides estimate of the power demand in Tanzania over the study period from 2016 to 2040. The objectives of the load forecast activity were to provide set of forecasts for both short, mid and long terms for Tanzania Interconnected Power System, and the isolated systems. The forecast then forms the basis in the planning of generation and transmission facilities. This forecast study explicitly account for changed economic background, government development objectives in the power sector in addition to specific issues concerning the power demand.

# 2.2 National economy highlights

# 2.2.1 Population forecast

According to Tanzania national census of 2002 and 2012, the population trend is 2.9% per year from 1988 to 2002 and 2.7% per year from 2002 to 2012. It is considered that the future growth rate of the population is gradually going down comparing to the past trends. Therefore, the future population and the growth rate of Tanzania are approximately as follows:

					Uni	t 1000 persons
	2012~15	2015~20	2020~25	2025~30	2030~35	2035~40
Population	49,200	56,300	63,600	70,900	77,700	83,900
Growth rate (%)	2.7	2.7	2.5	2.2	1.9	1.5

#### Table 2-1: Population and growth rate forecasts of Tanzania

Source: Study team projection based on the past NBS census Note: Number of the population is at the end of the year

# 2.2.2 Foreign exchange rate

It is assumed that the current exchange rate with 2,200 TZS per US dollar (as of November 2016) and it will be devaluated a little bit in the future. According to foreign exchange theory, Tanzanian currency will be devaluated by 3% per year. It is also assumed that the foreign exchange rate after 2025 will be kept at the same level.

# 2.2.3 GDP

Tanzania has various strategic plans for future economic growth, these are: VISION 2025, FYDP (Five Year Development Plan), FYDPII and LTPP (Long Term Perspective Plan). These plans are summarized in Table 2-2.

Sources	Contents
VISION 2025	The target of GDP growth rate is 8% per year.
	The target of the GDP per capita should be \$3000 per capita by 2025.
	This implies that Tanzania will become a middle income country by 2025.
FYDP	Economic growth rate from 2000 to 2010 was 7 % per year although the target was 8%.
	But in the first FYDP, the growth rate was targeted to be more than 10% from 2011 to
	2025.
FYDPI	In the second FYDP, economic renovation by industrialization policy will increase the
	GDP share of manufacturing sector from 8% to 19% in Tanzania from 2016 to 2021.
LTPP	LTPP has three periods, short, medium and long term as follows.
	Short (2010 – 2015) Intend to construct infrastructure and energy supply
	Medium (2015 – 2020) Will facilitate the growth of natural gas industry and agroindustry
	Long (2020 – 2025) Will increase manufacturing, services and export industries

#### Table 2-2: Prediction of GDP growth rates

Note: FYDP: Five Year Development Plan 2011-2016 and FYDP II is a plan for 2016/17 – 2020/21. LTPP: Long Term Perspective Plan

By considering the above government economic strategies, the following scenarios are assumed.

- HIGH scenario: After 2025, the high economic growth by developing natural gas and the related industries will be achieved in line with the economic development policies in Vision 2025.
- BASE scenario: It is assumed that the current economic growth is driven by the main two factors; higher population growth and increasing labor productivity. After the year of 2025 the population growth rate will gradually go down and the economy will be more stable than the current growth rate.
- LOW scenario: The domestic economic conditions are assumed to be the same as the BASE scenario, however, due to busting the international political and economic conflicts, the international economy will not be encouraging. The conflicts will give negative impacts on Tanzanian economy.

When the above preconditions are considered, the GDP growth rates for each scenario are assumed as follows:

						Unit: %
	2013/15	2015/20	2020/25	2025/30	2030/35	2035/40
HIGH	7.0	8.0	8.0	8.0~10.0	8.0~10.0	8.0~10.0
BASE	7.0	7.0	7.0	6.0	6.0	5.0
LOW	7.0	6.0	6.0	5.0	5.0	4.0

#### Table 2-3: Real GDP growth rate by each scenario

Note: The GDP growth rate in above table are set by Task Force Team after discussion with MOF, Planning commission and other relevant organizations.

#### 2.2.4 Crude oil price

According to the recent international oil price trend, it is predicted that the crude oil price will not be increased drastically but it will be gradually increased in future. In this PSMP, WTI price which represents the world oil prices is predicted as below in Table 2-4.

#### Table 2-4: WTI price prediction

	2014	2015	2016	2017	2018	2019	2020	2025	2030	2035	2040
WTI price (USD/bbl)	100	50	50	68	70	75	80	89	100	112	125

Source: IEEJ (2015)

Note: All prices in the table is at 2015 price.

#### 2.3 Issue related to the load forecast

#### 2.3.1 The electric energy ratio

In this PSMP, "Electric energy ratio" is used which is different from "Electrification rate". Electric energy ratio is defined by electric energy consumption share in all kinds of final energy consumption (Total Final Energy Consumption). Electric energy ratios in some countries and regions are shown in the Table 2-5.

				Unit: %
Country/region	1980	1990	2000	2009
USA	13.3	17.5	19.5	21.4
Japan	19.0	21.5	23.5	25.6
Africa (Average)	14.9	17.7	19.9	20.8
Asia (Average)	11.7	14.0	18.4	21.7

#### Table 2-5: Electric energy ratios in some countries and regions

Source: IEEJ (2012)

Note: Electric energy ratio (%) = Electric energy consumption in a country (toe) / Final energy consumption (toe)

Electric energy ratio also can be defined by economic sectors such as Industry, Commercial & Services, Government and Residential sectors. Due to Tanzania's energy consumption pattern which is dominated by fuel woods, the Study proposes the following electric energy ratio prediction as shown in Table 2-6.

							Unit %
Sector	2012	2015	2020	2025	2030	2035	2040
Industry	6.7	7.4	8.5	9.9	11.5	13.3	15.4
Commercial	4.1	5.0	7.1	9.9	13.9	19.5	27.3
Residential	1.2	1.5	2.1	2.9	4.1	5.7	8.0
Total	2.1	2.3	3.1	4.3	5.6	7.4	9.6

#### Table 2-6: Sectoral electric energy ratio prediction

Source: Team estimation

Note: Electric energy ratio= Electric energy consumption (toe) /Final energy consumption (toe)

#### 2.3.2 Electrification rate estimation

Estimation of electrification rate is based on IEA standard. It is "Access" method defined by the following equations.

Power accessible population =  $\Sigma$  accessible village \* Population in the village Electrification rate = Power accessible population / Total population \* 100.

Due to rural electrification programs which are ongoing, electrification rate reached 41% in 2015. Government has targeted to have the electrification rate of 50% by 2020. Under the conditions, the electrification rate is 64% in 2025, 76% in 2030, and 90% in 2035.

#### 2.3.3 Transmission and Distribution (T/D) loss rate

Transmission and Distribution (T/D) loss rates in the following table is calculated by actual T/D energy loss over dispatched energy. T/D loss rates from 2001 to 2015 are the actual as recorded, and after 2016 the T/D losses are calculated based on the loss reduction target set by TANESCO. The figure shows that there is the improvement of T/D losses after 2016, and it will reach 11.4% by year 2025 and it will remain the same after year 2026.

							Unit %
Year	loss rate						
2001	26.0	2008	20.1	2015	17.5	2022	11.9
2002	23.9	2009	20.0	2016	16.5	2023	11.7
2003	22.1	2010	19.8	2017	15.5	2025	11.4
2004	24.1	2011	21.4	2018	14.5	2030	11.4
2005	25.8	2012	21.9	2019	13.7	2035	11.4
2006	25.0	2013	21.2	2020	12.4	2040	11.4
2007	20.2	2014	18.0	2021	12.2		

Source: TANESCO.

Note: T/D Loss rate = T/D energy loss / Dispatched electric energy,

Dispatch electric energy = Final electric energy demand + T/D loss

### 2.3.4 Load factor

Actual peak demand and actual power generation data obtained from TANESCO were used to calculate the load factor by using the following equation.

Load factor = Generation (MWh) / (24 hours \*365 days) / Peak demand (MW) \*100

Where, Generation = Final electric energy consumption +T/D loss + Own use

As shown in Table 2-8, future load factors are predicted by assuming that it will reach 70% after 2030.

							Unit %
Year	load factor						
2001	63.4	2009	70.0	2017	71.0	2025	70.0
2002	65.5	2010	70.0	2018	70.0	2026	70.0
2003	63.8	2011	70.0	2019	70.0	2027	70.0
2004	65.3	2012	76.0	2020	70.0	2028	70.0
2005	75.5	2013	71.0	2021	70.0	2030	70.0
2006	67.5	2014	74.5	2022	70.0	2035	70.0
2007	69.6	2015	74.0	2023	70.0	2040	70.0
2008	69.5	2016	72.0	2024	70.0		

Table 2-8: Load factor forecast

Source: TANESCO and Team compilation

Note: The future value of 70% is the target of TANESCO

## 2.3.5 Un-constrain demand

Currently, recorded power demand does not represent the actual demand due to unmet demand because of insufficient power supply. Therefore, un-constrained demand should be taken into account to capture the actual power demand. The un-constrained demand is calculated by adding a potential factor to constrained demand (recorded data) as follows:

Un-constrain demand = Constrain demand  $\times$ (1 + Potential factor)

Potential factor =1- Actual demand recorded / Forecasted demand in PSMP2012 Update

The un-constrained demands are applied to industry, commercial & services, agriculture and residential sectors. It is not applied to governmental and gold mining power sectors because their demands are not constrained. The potential factors of constrained demands from 2000 to 2015 are the actual ones and from 2016 to 2040 are the estimated ones where the target is set to reach 0 in 2020. The actual and estimated potential factors are shown in Table 2-9.

Year	Potential factor	Year	Potential factor
2000-2013	0.10	2017	0.15
2014	0.18	2018	0.10
2015	0.25	2019	0.05
2016	0.20	2020 -2040	0

#### Table 2-9: Potential factors

Note: Potential factor to be '0' after 2020 means that the power shortage is eliminated.

#### 2.3.6 Energy efficiency and conservation (EE&C) for power demand

Energy efficiency and conservation refers to measures aimed at reducing energy consumption without sacrificing productivity, level of service or increasing costs. Energy efficiency and conservation (EE&C) applies to all sectors. In PSMP2016 Update, the target effect rate is set to reach 0.5% per year after 2026 assuming that EE&C in Tanzania will be gradually disseminated in the country. The effect rate is accumulated in the forecasted period.

#### 2.4 Methodology of demand forecasts

The final energy and power demand for each sector are forecasted for 25years. Then, it is accumulated to obtain country wide final energy and power demand. After that, primary energy consumption in power sector is calculated. The outline of the demand forecast flow is as follows:





For establishing the forecasting equations, the future energy consumption intensities for each sector in relation to GDP are determined. Energy consumption intensity for residential sector is correlated to energy consumption per capita. These intensities are estimated by using the past trends.

Future demands are calculated by using the following procedures.

#### Table 2-10: Procedures of fuel energy & electric power demand forecasts

(1) Forecast total final energy	consumption by sector
---------------------------------	-----------------------

(2) Forecast electric power and fuel energy demand by sector

(3) Sum up all power and fuel energy demand in the whole country

(4) Estimate Transmission and Distribution loss and Load factor

(5) Estimate peak demand, power generation, export and additional demands

(6) Estimate domestic fuel energy consumption

(7) Estimate power and fuel energy consumption per GDP, and per capita

(8) Forecast regional power demand

#### 2.5 Domestic Power Demand Forecasts

#### 2.5.1 Power demand forecasts by scenario case

Using the above preconditions and method, the dispatched electric energy demands of Tanzania are shown in Table 2-11.

			Unit GWh
Year	High	Base	Low
2015	6,310	6,310	6,310
2016	7,870	7,820	7,640
2017	9,070	8,970	8,650
2018	10,460	10,270	9,780
2019	12,040	11,740	11,060
2020	13,840	13,440	12,470
2025	24,640	22,430	19,450
2030	45,270	36,000	29,250
2035	82,830	57,340	43,660
2040	145,470	87,890	63,090
2040/2015	13.4 %	11.1 %	9.6 %

#### Table 2-11: Power demand forecasts (Dispatched energy)

The peak power demand forecasts of Tanzania are shown in Table 2-12

			Unit MW
Year	High	Base	Low
2015	974	974	974
2016	1,280	1,270	1,250
2017	1,480	1,460	1,410
2018	1,700	1,680	1,600
2019	1,960	1,920	1,800
2020	2,260	2,190	2,030
2025	4,020	3,660	3,170
2030	7,380	5,870	4,770
2035	13,510	9,350	7,120
2040	23,720	14,330	10,290
2040/2015	13.6 %	11.4 %	9.9 %

#### Table 2-12: Peak power demand forecasts

#### 2.6 Power demand including export and additional demand

The government of Tanzania has a policy of accelerating industrial development that triggers expansion of power generation capacity up to 4,915MW by year 2020. Comparing the high case peak demand of 2,260MW in 2020 and the generation capacity target of 4,915MW, the gap between the demand and the generation target is huge.

The demand forecast should be increased to meet Government Target, therefore, some additional demands such as power export, industrial renovation and backup for captive generators for large scale industries are added outside the econometric model. However, should industrial development fail to match increasing power supply infrastructure related to accelerated generation capacity, this may trigger increase in electricity supply cost due to idle capacity.

The details of the selected factories and mining sites are as follows;

						Unit: MW
	Geita : Gold	Mara :	Njombe:	Mtwara :	Industrial	
Year	Mining Co.	Two Gold	Iron	DANGOTE	renovation	Total
		mining Co.*	Smelting			
2015	28	9		34		71
2016	28	9		34		71
2017	28	9		34		71
2018	28	9		34		71
2019	28	9		34		71
2020	45	22	337	67	570	1041
2021	45	22	337	67	570	1041
2022	45	22	337	67	570	1041
2023	45	22	337	67	570	1041
2024	45	22	337	67	570	1041
2025	45	22	337	67	570	1041
2030	45	22	337	67	570	1041
2035	45	22	337	67	570	1041
2040	45	22	337	67	570	1041

 Table 2-13: Additional power demand by rural factories and mining sites

Source: MEM、TANESCO and Regional demand survey

Note: \* Mara Two Gold mining are "Buhemba Gold Mining" and "Kiabakari Gold Mining"

The total power demand and capacity including domestic demand, export and additional power demands are as the following table.

								ι	Jnit: MW
Cases		Demand items	Unit	2015	2020	2025	2030	2035	2040
Base	Peak demand	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 (Inc. Loss)	MW	0	685	677	677	677	677
		Total	MW	1,045	3,916	5,377	7,590	11,069	16,050
	Installed capacity	Domestic demand	MW	1,267	2,847	4,757	7,633	12,156	18,631
	(Peak*1.3)	Additional demand	MW	92	1,353	1,353	1,353	1,353	1,353
		Export (Inc. Loss)	MW	0	890	880	880	880	880
		Total	MW	1,359	5,091	6,991	9,867	14,389	20,865
High	Peak demand	Domestic demand	MW	974	2,256	4,017	7,381	13,508	23,724
		Additional demand	MW	71	1,041	1,041	1,041	1,041	1,041
		Export (Inc. Loss)	MW	0	685	677	677	677	677
		Total	MW	1,045	3,981	5,736	9,100	15,226	25,443
	Installed capacity	Domestic demand	MW	1,267	2,932	5,223	9,596	17,560	30,842
	(Peak*1.3)	Additional demand	MW	92	1,353	1,353	1,353	1,353	1,353
		Export (Inc. Loss)	MW	0	890	880	880	880	880
		Total	MW	1,359	5,176	7,456	11,829	19,794	33,075
Low	Peak demand	Domestic demand	MW	974	2,035	3,172	4,769	7,120	10,289
		Additional demand	MW	71	1,041	1,041	1,041	1,041	1,041
		Export (Inc. Loss)	MW	0	685	677	677	677	677
		Total	MW	1,045	3,760	4,891	6,487	8,838	12,007
	Installed capacity	Domestic demand	MW	1,267	2,645	4,124	6,199	9,256	13,376
	(Peak*1.3)	Additional demand	MW	92	1,353	1,353	1,353	1,353	1,353
		Export (Inc. Loss)	MW	0	890	880	880	880	880
		Total	MW	1,359	4,889	6,358	8,433	11,490	15,609

#### Table 2-14: Domestic, export and additional demands of Tanzania

Source: Analysis by the Task Force Team

Note: Total installed generation capacity in Base case is more than 4,920 MW in 2020.

The growth rate of the above total power demand and capacity are shown in Table 2-15. The growth rates of peak demand and capacity from year 2015 to 2020 are comparatively higher than others due to accelerated industrial development.

Table 2-15:	Growth rate	of the above	e total power	demand and	d capacity

									<u>Unit: %</u>
Cases		Demand items	2010/15	2015/20	2020/25	2025/30	2030/35	2035/40	2015/40
Base	Peak demand	Domestic demand	3.4	17.6	10.8	9.9	9.8	8.9	11.4
		Additional demand	0.0	71.1	0.0	0.0	0.0	0.0	11.3
		Export (Inc. Loss)	0.0	0.0	-0.2	0.0	0.0	0.0	0.0
		Total	0.0	30.2	6.5	7.1	7.8	7.7	11.5
	Installed capacity	Domestic demand	3.4	17.6	10.8	9.9	9.8	8.9	11.4
	(Peak*1.3)	Additional demand	0.0	71.1	0.0	0.0	0.0	0.0	11.3
		Export (Inc. Loss)	0.0	0.0	-0.2	0.0	0.0	0.0	0.0
		Total	0.0	30.2	6.5	7.1	7.8	7.7	11.5
High	Peak demand	Domestic demand	3.4	18.3	12.2	12.9	12.8	11.9	13.6
		Additional demand	0.0	71.1	0.0	0.0	0.0	0.0	11.3
		Export (Inc. Loss)	0.0	0.0	-0.2	0.0	0.0	0.0	0.0
		Total	0.0	30.7	7.6	9.7	10.8	10.8	13.6
	Installed capacity	Domestic demand	3.4	18.3	12.2	12.9	12.8	11.9	13.6
	(Peak*1.3)	Additional demand	0.0	71.1	0.0	0.0	0.0	0.0	11.3
		Export (Inc. Loss)	0.0	0.0	-0.2	0.0	0.0	0.0	0.0
		Total	0.0	30.7	7.6	9.7	10.8	10.8	13.6
Low	Peak demand	Domestic demand	3.4	15.9	9.3	8.5	8.3	7.6	9.9
		Additional demand	0.0	71.1	0.0	0.0	0.0	0.0	11.3
		Export (Inc. Loss)	0.0	0.0	-0.2	0.0	0.0	0.0	0.0
		Total	0.0	29.2	5.4	5.8	6.4	6.3	10.3
	Installed capacity	Domestic demand	3.4	15.9	9.3	8.5	8.3	7.6	9.9
	(Peak*1.3)	Additional demand	0.0	71.1	0.0	0.0	0.0	0.0	11.3
		Export (Inc. Loss)	0.0	0.0	-0.2	0.0	0.0	0.0	0.0
		Total	0.0	29.2	5.4	5.8	6.4	6.3	10.3

Source : Analysis by the Task Force Team

Note: Export growth rate is flat from 2020 to 2040, so the growth rate is 0

#### 2.7 Power Demand Growth Factors

The power demand growths of Tanzania are expected in aspects of industry and residential sectors. The following table shows the main factors for the rapid power demand growth in

Tanzania from 2016 up to 2040.

Table 2-16: Main f	factors for	power dema	nd growth
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1	The past GDP growth rate of Tanzania was average 7% per year, and the future GDP growth rate will be continued with the same GDP growth rate. Gas development, establishment of transportation infrastructure, increase of Foreign Direct Investment, level of education, construction of communication facilities and construction of modern households are major drivers for continued GDP growth. The power demand growth rates for industrial and commercial sectors are expected to reach 18% per year from 2015 to 2020 while the growth rates are 11% for industry and 13% for commercial sector afterward.
2	Gas intensive business will be promoted by the development of gas infrastructure such as chemical, LNG and transportation industries. Such industries consume a lot of electric power for their production activities.
3	Currently, wood and charcoal is the main source of energy in rural area in Tanzania. According to IEA database 2013, the share of the wood based energy in total final energy consumption is around 80%. In the future, wood and charcoal will be replaced by electric power, gas and petroleum products in line with urbanization of Tanzania. Therefore, the power consumption in residential sector will increases a lot. The share of wood and charcoal in final energy consumption will decrease up to 49% in 2040. The growth rate of power demand in residential sector will increase with average 11% per year from 2015 to 2040.
4	Since the electrification rate of Tanzania in 2015 is 41%, there is a room for increasing the electrification rate. The future electrification rates are assumed to be more than 50% in 2020 and 90% in 2035. Power consumption per capita is 137 kWh in 2016, it is rather small compared to other developing countries such as Kenya, Ghana and Zambia. In the future, it will become 240 kWh / capita in 2020 and 1,050 kWh / capita in 2040.
5	Currently, power supply in Tanzania cannot meet the demand. Such imbalance has to be solved as soon as possible. During the period when the shortage is gradually relieved, power demand will grow at higher rate than normal. In PSMP2016, it is assumed that the power shortage will be relieved toward the year 2020.

# 2.8 Annual power demand forecast

Energy demands, peak demand and power consumption per capita are as the following tables.

#### 2.8.1 Power demand

Base case 2015-2030		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
T/D loss	S%	17.5	16.5	15.5	14.5	13.7	12.4	12.2	11.9	11.7	11.4	11.4	11.4	11.4	11.4	11.4	11.4
Own use ratio to Generation	S%	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
T/D loss (GWh)	GWh	1,080	1,290	1,390	1,500	1,610	1,670	1,810	1,960	2,130	2,310	2,560	2,810	3,090	3,400	3,740	4,100
Own use	GWh	130	190	210	240	280	320	350	390	430	480	530	580	640	710	780	850
Load Factor	%	74.0	72.0	71.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Generation	MW	1,000	1,270	1,480	1,720	1,970	2,240	2,480	2,750	3,050	3,380	3,740	4,120	4,530	4,980	5,470	6,010
Installed capacity	MW	1,500	1,590	1,850	2,150	2,460	2,800	3,100	3,440	3,810	4,220	4,680	5,150	5,660	6,220	6,840	7,510
Power energy demand	GWh	6,320	7,860	9,010	10,320	11,810	13,430	14,890	16,490	18,270	20,230	22,440	24,680	27,140	29,830	32,780	36,000
Peak power demand	MW	974	1,250	1,450	1,680	1,930	2,190	2,430	2,690	2,980	3,300	3,660	4,030	4,430	4,860	5,340	5,870
Base case 2031-2040		2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2015/20	2020/25	2025/30	2030/35	2035/40	2015/40
T/D loss	S%	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	-6.7	-1.7	0.0	0.0	0.0	-1.7
Own use ratio to Generation	S%	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	0.0	0.0	0.0	0.0	0.0	0.0
T/D loss (GWh)	GWh	4,510	4,950	5,430	5,960	6,540	7,120	7,760	8,450	9,200	10,020	9.1	9.0	9.9	9.8	8.9	9.3
Own use	GWh	940	1,030	1,130	1,240	1,360	1,480	1,610	1,760	1,910	2,080	19.7	10.8	9.9	9.8	8.9	11.8
Load Factor	%	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	-1.1	0.0	0.0	0.0	0.0	-0.2
Generation	MW	6,600	7,240	7,950	8,720	9,570	10,420	11,360	12,370	13,470	14,660	17.6	10.8	9.9	9.8	8.9	11.4
Installed capacity	MW	8,250	9,050	9,940	10,900	11,960	13,030	14,190	15,460	16,840	18,330	13.3	10.8	9.9	9.8	8.9	10.5
Power energy demand	GWh	39,540	43,410	47,640	52,270	57,340	62,480	68,060	74,130	80,720	87,880	16.3	10.8	9.9	9.8	8.9	11.1
Peak power demand	MW	6,450	7,080	7,770	8,520	9,350	10,190	11,100	12,090	13,160	14,330	17.6	10.8	9.9	9.8	8.9	11.4

Table 2-17: Power demand (Base)

Source: Study results of PSMP2016

#### 2.8.2 Sectoral power demand and contribution

3.2

31.5

17.1

S%

S%

S%

2.2

32.3

15.4

1.9

33.0

14.5

1.7

33.8

13.7

1.6

34.5

12.4

2.5

31.4

16.4

											•						
														Uni	t: GWh	Contributi	on: %
Base 2015-2030	Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Total	GWh	6,320	7,860	9,010	10,320	11,790	13,440	14,880	16,480	18,270	20,220	22,430	24,670	27,130	29,840	32,780	36,00
Agriculture.Fishery	GWh	0	0	0	0	0	0	0	0	0	0	0	0	0	10	10	1
Industry	GWh	2,410	3,160	3,650	4,210	4,850	5,590	6,210	6,900	7,680	8,540	9,510	10,440	11,450	12,570	13,790	15,14
Commercial & Services	GWh	300	340	400	480	570	680	770	870	1,000	1,130	1,290	1,450	1,640	1,850	2,090	2,35
Zanzibar	GWh	340	400	460	520	580	650	710	780	850	920	990	1,050	1,110	1,180	1,240	1,31
Gold	GWh	200	200	200	200	200	210	210	210	210	210	210	210	220	220	220	22
Residential	GWh	1,990	2,470	2,910	3,410	3,980	4,640	5,170	5,760	6,400	7,110	7,870	8,710	9,620	10,610	11,690	12,87
T/D loss	GWh	1,080	1,290	1,390	1,500	1,610	1,670	1,810	1,960	2,130	2,310	2,560	2,810	3,090	3,400	3,740	4,10
Total	S%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100
Agriculture.Fishery	S%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Industry	S%	38.1	40.2	40.5	40.8	41.1	41.6	41.7	41.9	42.0	42.2	42.4	42.3	42.2	42.1	42.1	42
Commercial & Services	S%	4.7	4.3	4.4	4.7	4.8	5.1	5.2	5.3	5.5	5.6	5.8	5.9	6.0	6.2	6.4	6
Zanzibar	S%	54	51	51	5.0	49	4.8	4.8	47	47	45	44	43	41	40	3.8	3

1.4

34.7

12.2

1.3

35.0

11.9

1.1

35.0

11.7

1.0

35.2

11.4

0.9

35.1

11.4

0.9

35.3

11.4

0.8

35.5

11.4

0.7

35.6

11.4

0.7

35.7

11.4

#### Table 2-18: Sectoral power demand and contribution (Base)

2030

36,000 10

15,140

2,350

1.310

4,100 100.0

0.0

6.5

3.6

0.6

35.8

11.4

42.1

220 12,870

Zanzibar

Residential

T/D loss

Gold

Base 2031-2040	Unit	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2015/20	2020/25	2025/30	2030/35	2035/40	2015/40
Total	GWh	39 550	43 400	47 630	52 260	57 340	62 470	68 060	74 130	80 710	87 890	16.3	10.8	9.9	9.8	8.9	11 1
Agriculture Fisherv	GWh	10	10,400	10	10	10	20	20	20	20	30	0.0	0.0	0.0	0.0	24.6	0.0
Industry	GWh	16,640	18,270	20.070	22,060	24,240	26,330	28,610	31,100	33,790	36,730	18.3	11.2	9.7	9.9	8.7	11.5
Commercial & Services	GWh	2,650	2,990	3.370	3,800	4,280	4,790	5.350	5,980	6,680	7,470	17.8	13.7	12.7	12.7	11.8	13.7
Zanzibar	GWh	1.380	1.440	1.510	1.580	1.650	1.700	1.760	1.810	1.870	1.920	13.8	8.8	5.8	4.7	3.1	7.2
Gold	GWh	220	220	220	220	230	230	230	230	230	230	1.0	0.0	0.9	0.9	0.0	0.6
Residential	GWh	14.140	15.520	17.020	18.630	20.390	22.280	24.330	26.540	28.920	31.490	18.4	11.1	10.3	9.6	9.1	11.7
T/D loss	GWh	4,510	4,950	5,430	5,960	6,540	7,120	7,760	8,450	9,200	10,020	9.1	8.9	9.9	9.8	8.9	9.3
Total	S%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0						
Agriculture.Fishery	S%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		~~~~~~			******	
Industry	S%	42.1	42.1	42.1	42.2	42.3	42.1	42.0	42.0	41.9	41.8						
Commercial & Services	S%	6.7	6.9	7.1	7.3	7.5	7.7	7.9	8.1	8.3	8.5						
Zanzibar	S%	3.5	3.3	3.2	3.0	2.9	2.7	2.6	2.4	2.3	2.2						
Gold	S%	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.3						
Residential	S%	35.8	35.8	35.7	35.6	35.6	35.7	35.7	35.8	35.8	35.8						00 000 000 000 000 000 000 000 000 000
T/D loss	S%	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4						

Source: Study results of PSMP2016

#### 2.8.3 Big power consumers and new projects in Tanzanian regions

#### Table 2-19: Big power consumers by regional survey

#### Table 2-20: New projects by regional survey

		Unit	2015	2020	2021	2022	2023	2024	2025		Region	Unit	2015	2020	2021	2022	2023	2024	2025
2	Arusha	MW	23.0	26.0	26.0	26.0	26.0	26.0	26.0		2 Arusha	MW	1.2	42.9	43.6	44.2	44.9	45.5	46.2
7	Dar es Salaam	MW	128.0	155.0	158.0	163.0	166.0	167.0	172.0		7 Dar es Salaam	MW	92.0	119.0	126.2	133.4	140.6	147.8	155.0
1	Dodoma	MW	28.0	31.0	31.0	31.0	31.0	31.0	31.0		1 Dodoma	MW	0.0	15.3	15.3	15.3	15.3	15.3	15.3
11	Iringa +Njombe	MW	12.3	15.8	15.8	15.8	15.8	15.8	15.8		11 Iringa +Njombe	MW	0.0	0.5	0.6	0.6	0.7	0.7	0.8
18	Kagera	MW	12.0	8.0	8.0	8.0	10.0	13.0	14.0		18 Kagera	MW	1.4	51.8	60.1	68.4	76.6	84.9	93.2
16	Kigoma	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0		16 Kigoma	MW	0.0	11.5	12.9	14.3	15.7	17.1	18.5
3	Kilimanjaro	MW	6.0	10.0	10.0	10.0	10.0	10.0	10.0		3 Kilimanjaro	MW	4.6	14.6	14.6	14.6	14.6	14.6	14.6
8	Lindi	MW	1.0	2.0	2.0	2.0	2.0	2.0	2.0		8 Lindi	MW	0.0	8.9	9.8	10.8	11.8	12.7	13.7
21	Manyara	MW	1.8	3.1	3.1	3.1	3.1	3.1	3.1		21 Manyara	MW	7.0	16.0	16.0	16.0	16.0	16.0	16.0
20	Mara	MW	16.0	28.5	30.5	30.5	31.6	31.6	31.6		20 Mara	MW	0.0	4.0	4.4	4.8	5.2	5.6	6.0
12	Mbeya	MW	17.7	28.7	29.7	29.7	29.7	30.0	30.0		12 Mbeya	MW	15.0	51.0	55.0	59.0	63.0	67.0	71.0
5	Morogoro	MW	21.1	28.0	28.0	28.0	28.0	28.0	28.0		5 Morogoro	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	Mtwara	MW	4.0	5.0	6.0	7.0	8.0	9.0	10.0		9 Mtwara	MW	0.0	2.2	2.2	2.2	2.2	2.2	2.2
19	Mwanza +Geita	MW	23.0	40.0	44.0	45.0	45.0	49.0	57.0		19 Mwanza +Geita	MW	7.5	54.0	58.1	62.3	66.4	70.6	74.7
6	Pwani	MW	30.0	55.0	56.0	58.0	59.0	60.0	62.0	_	6 Pwani	MW	1.8	32.0	42.6	53.2	63.8	74.4	85.0
15	Rukwa +Katavi	MW	2.0	2.0	2.0	2.0	2.0	2.0	2.0		15 Rukwa +Katavi	MW	1.7	13.8	15.0	16.2	17.4	18.6	19.8
10	Ruvuma	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0		10 Ruvuma	MW	0.0	2.5	4.0	5.5	7.0	8.5	10.0
17	Shinyanga+ Simiyu	MW	94.0	103.0	106.0	106.0	106.0	106.0	106.0		17 Shinyanga+ Simiyu	MW	0.0	3.6	4.0	4.4	4.8	5.2	5.6
13	Singida	MW	2.0	3.0	3.0	3.0	3.0	3.0	3.0		13 Singida	MW	0.3	0.7	0.7	0.7	0.7	0.7	0.7
14	Tabora	MW	2.0	2.0	2.0	2.0	2.0	2.0	2.0		14 Tabora	MW	0.0	15.0	16.7	18.4	20.1	21.8	23.5
4	Tanga	MW	32.0	57.0	57.0	57.0	57.0	57.0	57.0		4 Tanga	MW	10.0	20.0	20.0	20.0	20.0	20.0	20.0
22	Zanzibar	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0		22 Zanzibar	MW	7.0	10.0	10.0	10.0	10.0	10.0	10.0
	total	MW	455.9	603.0	618.0	627.0	635.1	645.4	662.4		total	MW	149.5	489.1	531.6	574.1	616.7	659.2	701.7

Source: Regional demand survey conducted by BICO (Bureau for Industrial Cooperation) in October - December 2015 Note: The tables are the original data from the Regional survey

# 2.8.4 Regional population

# Table 2-21: Regional population

															Unit	: 1000 p	erson
	Region names	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1	1 Dodoma	2,234	2,281	2,329	2,376	2,424	2,472	2,519	2,567	2,613	2,660	2,706	2,752	2,798	2,843	2,887	2,932
2	2 Arusha	1,857	1,909	1,962	2,015	2,068	2,121	2,174	2,227	2,280	2,333	2,386	2,439	2,491	2,544	2,596	2,647
3	3 Kilimanjaro	1,739	1,770	1,801	1,832	1,863	1,893	1,924	1,954	1,984	2,014	2,044	2,073	2,101	2,130	2,158	2,186
2	1 Tanga	2,204	2,254	2,304	2,355	2,405	2,438	2,470	2,501	2,532	2,563	2,594	2,624	2,653	2,683	2,711	2,740
5	5 Morogoro	2,400	2,457	2,516	2,574	2,632	2,683	2,733	2,783	2,832	2,881	2,930	2,978	3,026	3,074	3,121	3,167
6	6 Pwani	1,181	1,207	1,233	1,260	1,286	1,312	1,338	1,364	1,390	1,416	1,441	1,467	1,492	1,517	1,541	1,566
7	7 Dar es Salaam	5,269	5,573	5,895	6,227	6,568	6,913	7,259	7,606	7,954	8,302	8,649	8,994	9,336	9,676	10,013	10,346
8	3 Lindi	892	900	909	917	925	933	941	949	956	963	971	978	985	991	998	1,005
9	9 Mtwara	1,324	1,340	1,357	1,373	1,389	1,405	1,421	1,436	1,451	1,466	1,481	1,496	1,510	1,524	1,538	1,552
10	Ruvuma	1,478	1,510	1,542	1,574	1,606	1,639	1,671	1,703	1,735	1,767	1,798	1,829	1,860	1,891	1,922	1,952
11	I Iringa +Njombe	1,699	1,716	1,733	1,749	1,766	1,782	1,797	1,812	1,827	1,842	1,857	1,871	1,885	1,899	1,912	1,925
12	2 Mbeya	2,965	3,047	3,131	3,214	3,298	3,354	3,409	3,463	3,517	3,570	3,623	3,675	3,726	3,777	3,828	3,878
13	3 Singida	1,481	1,516	1,552	1,587	1,622	1,658	1,694	1,730	1,765	1,800	1,835	1,870	1,905	1,939	1,973	2,007
14	1 Tabora	2,527	2,602	2,679	2,757	2,834	2,911	2,988	3,064	3,141	3,218	3,294	3,371	3,447	3,523	3,599	3,674
15	5 Rukwa +Katavi	1,747	1,805	1,863	1,923	1,982	2,042	2,102	2,162	2,222	2,282	2,343	2,403	2,463	2,524	2,584	2,644
16	6 Kigoma	2,306	2,362	2,419	2,476	2,533	2,589	2,645	2,701	2,756	2,811	2,866	2,921	2,975	3,029	3,082	3,135
17	7 Shinyanga+ Simiyu	3,329	3,395	3,461	3,528	3,593	3,703	3,813	3,923	4,034	4,145	4,256	4,367	4,478	4,590	4,701	4,812
18	B Kagera	2,733	2,820	2,911	3,002	3,093	3,151	3,209	3,266	3,322	3,378	3,434	3,489	3,543	3,597	3,651	3,704
19	9 Mwanza +Geita	4,962	5,105	5,252	5,370	5,464	5,690	5,919	6,151	6,386	6,624	6,865	7,109	7,354	7,602	7,852	8,096
20	Mara	1,894	1,941	1,989	2,037	2,085	2,134	2,183	2,232	2,280	2,328	2,376	2,424	2,472	2,519	2,566	2,613
21	1 Manyara	1,585	1,636	1,689	1,742	1,795	1,838	1,882	1,925	1,968	2,011	2,054	2,097	2,139	2,181	2,223	2,265
	Mainland total	47,807	49,146	50,527	51,888	53,235	54,660	56,089	57,518	58,948	60,377	61,802	63,225	64,642	66,053	67,457	68,846
22	2 Zanzibar total	1,439	1,483	1,528	1,577	1,626	1,679	1,709	1,740	1,771	1,804	1,836	1,870	1,904	1,938	1,974	2,024
	Total	49,246	50,629	52,055	53,465	54,861	56,339	57,798	59,258	60,720	62,180	63,639	65,094	66,545	67,991	69,431	70,869
	Region names	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2015/20	2020/25	2025/30	2030/35	2035/40	2015/40
	Region names	2031 2.975	2032 3.019	2033 3.061	2034 3.104	2035 3.146	2036 3.187	2037 3.228	2038 3.268	2039 3.308	<u>2040</u> 3.347	<u>2015/20</u> 2.0	<u>2020/25</u> 1.8	<u>2025/30</u> 1.6	2030/35 1.4	2035/40 1.3	<u>2015/40</u> 1.6
1	Region names Dodoma Arusha	2031 2,975 2,699	2032 3,019 2.750	2033 3,061 2,801	2034 3,104 2.851	2035 3,146 2,902	2036 3,187 2,951	2037 3,228 3.001	2038 3,268 3.050	2039 3,308 3.098	<u>2040</u> 3,347 3.146	2015/20 2.0 2.7	2020/25 1.8 2.4	2025/30 1.6 2.1	2030/35 1.4 1.9	2035/40 1.3 1.6	2015/40 1.6 2.1
1	Region names I Dodoma 2 Arusha 3 Kilimaniaro	2031 2,975 2,699 2,213	2032 3,019 2,750 2,240	2033 3,061 2,801 2,267	2034 3,104 2,851 2,293	2035 3,146 2,902 2,319	2036 3,187 2,951 2,345	2037 3,228 3,001 2,370	2038 3,268 3,050 2,395	2039 3,308 3,098 2,420	2040 3,347 3,146 2,444	2015/20 2.0 2.7 1.7	2020/25 1.8 2.4 1.5	2025/30 1.6 2.1 1.4	2030/35 1.4 1.9 1.2	2035/40 1.3 1.6 1.1	2015/40 1.6 2.1 1.4
	Region names I Dodoma 2 Arusha 3 Kilimanjaro 4 Tanga	2031 2,975 2,699 2,213 2,768	2032 3,019 2,750 2,240 2,795	2033 3,061 2,801 2,267 2,822	2034 3,104 2,851 2,293 2,849	2035 3,146 2,902 2,319 2,875	2036 3,187 2,951 2,345 2,900	2037 3,228 3,001 2,370 2,925	2038 3,268 3,050 2,395 2,948	2039 3,308 3,098 2,420 2,971	2040 3,347 3,146 2,444 2,993	2015/20 2.0 2.7 1.7 2.0	2020/25 1.8 2.4 1.5 1.2	2025/30 1.6 2.1 1.4 1.1	2030/35 1.4 1.9 1.2 1.0	2035/40 1.3 1.6 1.1 0.8	2015/40 1.6 2.1 1.4 1.2
	Region names 1 Dodoma 2 Arusha 3 Kilimanjaro 4 Tanga Morogoro	2031 2,975 2,699 2,213 2,768 3,213	2032 3,019 2,750 2,240 2,795 3,259	2033 3,061 2,801 2,267 2,822 3,304	2034 3,104 2,851 2,293 2,849 3,348	2035 3,146 2,902 2,319 2,875 3,392	2036 3,187 2,951 2,345 2,900 3,435	2037 3,228 3,001 2,370 2,925 3,476	2038 3,268 3,050 2,395 2,948 3,516	2039 3,308 3,098 2,420 2,971 3,554	2040 3,347 3,146 2,444 2,993 3,591	2015/20 2.0 2.7 1.7 2.0 2.2	2020/25 1.8 2.4 1.5 1.2 1.8	2025/30 1.6 2.1 1.4 1.1 1.6	2030/35 1.4 1.9 1.2 1.0 1.4	2035/40 1.3 1.6 1.1 0.8 1.1	2015/40 1.6 2.1 1.4 1.2 1.6
	Region names Dodoma ZArusha Kilimanjaro Tanga Morogoro Pwani	2031 2,975 2,699 2,213 2,768 3,213 1,590	2032 3,019 2,750 2,240 2,795 3,259 1,614	2033 3,061 2,801 2,267 2,822 3,304 1,638	2034 3,104 2,851 2,293 2,849 3,348 1,662	2035 3,146 2,902 2,319 2,875 3,392 1,685	2036 3,187 2,951 2,345 2,900 3,435 1,707	2037 3,228 3,001 2,370 2,925 3,476 1,729	2038 3,268 3,050 2,395 2,948 3,516 1,750	2039 3,308 3,098 2,420 2,971 3,554 1,771	2040 3,347 3,146 2,444 2,993 3,591 1,790	2015/20 2.0 2.7 1.7 2.0 2.2 2.1	2020/25 1.8 2.4 1.5 1.2 1.8 1.9	2025/30 1.6 2.1 1.4 1.1 1.6 1.7	2030/35 1.4 1.9 1.2 1.0 1.4 1.5	2035/40 1.3 1.6 1.1 0.8 1.1 1.2	2015/40 1.6 2.1 1.4 1.2 1.6 1.7
	Region names Dodoma 2 Arusha 3 Kilimanjaro 4 Tanga 5 Morogoro 9 Pwani 7 Dar es Salaam	2031 2,975 2,699 2,213 2,768 3,213 1,590 10,675	2032 3,019 2,750 2,240 2,795 3,259 1,614 10,999	2033 3,061 2,801 2,267 2,822 3,304 1,638 11,318	2034 3,104 2,851 2,293 2,849 3,348 1,662 11,632	2035 3,146 2,902 2,319 2,875 3,392 1,685 11,940	2036 3,187 2,951 2,345 2,900 3,435 1,707 12,242	2037 3,228 3,001 2,370 2,925 3,476 1,729 12,538	2038 3,268 3,050 2,395 2,948 3,516 1,750 12,828	2039 3,308 3,098 2,420 2,971 3,554 1,771 13,111	2040 3,347 3,146 2,444 2,993 3,591 1,790 13,387	2015/20 2.0 2.7 1.7 2.0 2.2 2.1 5.6	2020/25 1.8 2.4 1.5 1.2 1.8 1.9 4.6	2025/30 1.6 2.1 1.4 1.1 1.6 1.7 3.6	2030/35 1.4 1.9 1.2 1.0 1.4 1.5 2.9	2035/40 1.3 1.6 1.1 0.8 1.1 1.2 2.3	2015/40 1.6 2.1 1.4 1.2 1.6 1.7 3.8
1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Region names Dodoma Carusha Kilimanjaro Tanga Morogoro Pwani Dar es Salaam Lindi	2031 2,975 2,699 2,213 2,768 3,213 1,590 10,675 1,011	2032 3,019 2,750 2,240 2,795 3,259 1,614 10,999 1,018	2033 3,061 2,801 2,267 2,822 3,304 1,638 11,318 1,024	2034 3,104 2,851 2,293 2,849 3,348 1,662 11,632 1,030	2035 3,146 2,902 2,319 2,875 3,392 1,685 11,940 1,036	2036 3,187 2,951 2,345 2,900 3,435 1,707 12,242 1,042	2037 3,228 3,001 2,370 2,925 3,476 1,729 12,538 1,048	2038 3,268 3,050 2,395 2,948 3,516 1,750 12,828 1,053	2039 3,308 3,098 2,420 2,971 3,554 1,771 13,111 1,059	2040 3,347 3,146 2,444 2,993 3,591 1,790 13,387 1,064	2015/20 2.0 2.7 1.7 2.0 2.2 2.1 5.6 0.9	2020/25 1.8 2.4 1.5 1.2 1.8 1.9 4.6 0.8	2025/30 1.6 2.1 1.4 1.1 1.6 1.7 3.6 0.7	2030/35 1.4 1.9 1.2 1.0 1.4 1.5 2.9 0.6	2035/40 1.3 1.6 1.1 0.8 1.1 1.2 2.3 0.5	2015/40 1.6 2.1 1.4 1.2 1.6 1.7 3.8 0.7
1 2 2 2 5 6 7 7 8	Region names Dodoma Arusha Arusha Kilimanjaro Tanga Morogoro Powani Dar es Salaam Lindi Mtwara	2031 2,975 2,699 2,213 2,768 3,213 1,590 10,675 1,011 1,565	2032 3,019 2,750 2,240 2,795 3,259 1,614 10,999 1,018 1,578	2033 3,061 2,801 2,267 2,822 3,304 1,638 11,318 1,024 1,591	2034 3,104 2,851 2,293 2,849 3,348 1,662 11,632 1,030 1,604	2035 3,146 2,902 2,319 2,875 3,392 1,685 11,940 1,036 1,617	2036 3,187 2,951 2,345 2,900 3,435 1,707 12,242 1,042 1,629	2037 3,228 3,001 2,370 2,925 3,476 1,729 12,538 1,048 1,641	2038 3,268 3,050 2,395 2,948 3,516 1,750 12,828 1,053 1,653	2039 3,308 3,098 2,420 2,971 3,554 1,771 13,111 1,059 1,665	2040 3,347 3,146 2,444 2,993 3,591 1,790 13,387 1,064 1,676	2015/20 2.0 2.7 1.7 2.0 2.2 2.1 5.6 0.9 1.2	2020/25 1.8 2.4 1.5 1.2 1.8 1.9 4.6 0.8 1.1	2025/30 1.6 2.1 1.4 1.1 1.6 1.7 3.6 0.7 0.9	2030/35 1.4 1.9 1.2 1.0 1.4 1.5 2.9 0.6 0.8	2035/40 1.3 1.6 1.1 0.8 1.1 1.2 2.3 0.5 0.7	2015/40 1.6 2.1 1.4 1.2 1.6 1.7 3.8 0.7 0.9
1 2 2 5 6 7 7 8 8 9 9 10	Region names Dodoma Arusha Kilimanjaro Tanga Morogoro S Pwani Dar es Salaam Lindi Mtwara Ruvuma	2031 2,975 2,699 2,213 2,768 3,213 1,590 10,675 1,011 1,565 1,982	2032 3,019 2,750 2,240 2,795 3,259 1,614 10,999 1,018 1,578 2,011	2033 3,061 2,801 2,267 2,822 3,304 1,638 11,318 1,024 1,591 2,040	2034 3,104 2,851 2,293 2,849 3,348 1,662 11,632 1,604 1,604 2,069	2035 3,146 2,902 2,319 2,875 3,392 1,685 11,940 1,940 1,036 1,617 2,098	2036 3,187 2,951 2,345 2,900 3,435 1,707 12,242 1,042 1,629 2,126	2037 3,228 3,001 2,370 2,925 3,476 1,729 12,538 1,048 1,641 2,154	2038 3,268 3,050 2,395 2,948 3,516 1,750 12,828 1,053 1,653 2,182	2039 3,308 3,098 2,420 2,971 3,554 1,771 13,111 1,059 1,665 2,209	2040 3,347 3,146 2,444 2,993 3,591 1,790 13,387 1,064 1,676 2,236	2015/20 2.0 2.7 1.7 2.0 2.2 2.1 5.6 0.9 1.2 2.1	2020/25 1.8 2.4 1.5 1.2 1.8 1.9 4.6 0.8 1.1 1.9	2025/30 1.6 2.1 1.4 1.1 1.6 1.7 3.6 0.7 0.9 1.7	2030/35 1.4 1.9 1.2 1.0 1.4 1.5 2.9 0.6 0.8 1.5	2035/40 1.3 1.6 1.1 0.8 1.1 1.2 2.3 0.5 0.7 1.3	2015/40 1.6 2.1 1.4 1.2 1.6 1.7 3.8 0.7 0.9 1.7
1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Region names Dodoma ZArusha Kilimanjaro Kilimanjaro Morogoro Devani Dar es Salaam Lindi Mtwara Ruvuma Iringa +Njombe	2031 2,975 2,669 2,213 2,768 3,213 1,590 10,675 1,011 1,565 1,982 1,938	2032 3,019 2,750 2,240 2,795 3,259 1,614 10,999 1,018 1,578 2,011 1,951	2033 3,061 2,801 2,267 2,822 3,304 1,638 11,318 1,024 1,591 2,040 1,964	2034 3,104 2,851 2,293 3,348 1,662 11,632 1,030 1,604 2,069 1,976	2035 3,146 2,902 2,319 2,875 3,392 1,685 11,940 1,036 1,617 2,098 1,988	2036 3,187 2,951 2,345 2,900 3,435 1,707 12,242 1,042 1,629 2,126 2,000	2037 3,228 3,001 2,370 2,925 3,476 1,729 12,538 1,048 1,641 2,154 2,011	2038 3,268 3,050 2,395 2,948 3,516 1,750 12,828 1,053 1,653 2,182 2,023	2039 3,308 3,098 2,420 2,971 3,554 1,771 13,111 1,059 1,665 2,209 2,034	2040 3,347 3,146 2,444 2,993 3,591 1,790 13,387 1,064 1,676 2,236 2,045	2015/20 2.0 2.7 1.7 2.0 2.2 2.1 5.6 0.9 1.2 2.1 1.0	2020/25 1.8 2.4 1.5 1.2 1.8 1.9 4.6 0.8 1.1 1.9 0.8	2025/30 1.6 2.1 1.4 1.1 1.6 1.7 3.6 0.7 0.9 1.7 0.7	2030/35 1.4 1.9 1.2 1.0 1.4 1.5 2.9 0.6 0.8 1.5 0.6	2035/40 1.3 1.6 1.1 0.8 1.1 1.2 2.3 0.5 0.7 1.3 0.6	2015/40 1.6 2.1 1.4 1.2 1.6 1.7 3.8 0.7 0.9 1.7 0.7
1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Region names Dodoma Arusha Arusha Kilimanjaro Tanga Morogoro Powani Dar es Salaam Lindi Mtwara Ruvuma Iringa +Njombe Mose	2031 2,975 2,699 2,213 2,768 3,213 1,590 10,675 1,011 1,565 1,982 1,982 1,982 3,927	2032 3,019 2,750 2,240 2,795 3,259 1,614 10,999 1,018 1,578 2,011 1,951 3,975	2033 3,061 2,801 2,267 2,822 3,304 1,638 11,318 1,024 1,591 2,040 1,964 4,023	2034 3,104 2,851 2,293 2,849 3,348 1,662 11,632 1,030 1,604 2,069 1,976 4,070	2035 3,146 2,902 2,319 2,875 3,392 1,685 11,940 1,036 1,617 2,098 1,988 1,988	2036 3,187 2,951 2,345 2,900 3,435 1,707 12,242 1,042 1,629 2,126 2,000 4,162	2037 3,228 3,001 2,370 2,925 3,476 1,729 12,538 1,048 1,641 2,154 2,011 4,206	2038 3,268 3,050 2,395 2,948 3,516 1,750 12,828 1,053 1,653 2,182 2,023 4,248	2039 3,308 3,098 2,420 2,971 3,554 1,771 13,111 1,059 1,665 2,209 2,034 4,288	2040 3,347 3,146 2,444 2,993 3,591 1,790 13,387 1,064 1,676 2,236 2,045 4,328	2015/20 2.0 2.7 1.7 2.0 2.2 2.1 5.6 0.9 1.2 2.1 1.0 2.5	2020/25 1.8 2.4 1.5 1.2 1.8 1.9 4.6 0.8 1.1 1.9 0.8 1.1 1.9 0.8 1.1	2025/30 1.6 2.1 1.4 1.1 1.6 1.7 3.6 0.7 0.9 1.7 0.7 1.4	2030/35 1.4 1.9 1.2 1.0 1.4 1.5 2.9 0.6 0.8 1.5 0.6 1.2	2035/40 1.3 1.6 1.1 0.8 1.1 1.2 2.3 0.5 0.7 1.3 0.6 1.0	2015/40 1.6 2.1 1.4 1.2 1.6 1.7 3.8 0.7 0.9 1.7 0.7 0.7 1.5
1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Region names Dodoma Arusha Arusha Kilimanjaro Tanga Morogoro Pwani Dar es Salaam Lindi Mtwara Ruvuma Iringa + Njombe Mbeya Singida	2031 2,975 2,699 2,213 2,768 3,213 1,590 10,675 1,011 1,565 1,982 1,938 3,927 2,041	2032 3,019 2,750 2,240 2,795 3,259 1,614 10,999 1,018 1,578 2,011 1,951 3,975 2,074	2033 3,061 2,267 2,822 3,304 1,638 11,318 1,024 1,591 2,040 1,964 4,023 2,107	2034 3,104 2,851 2,293 2,849 3,348 1,662 11,632 1,604 2,069 1,976 4,070 2,139	2035 3,146 2,902 2,319 2,875 3,392 1,685 11,940 1,036 1,617 2,098 1,988 4,117 2,172	2036 3,187 2,951 2,345 2,900 3,435 1,707 12,242 1,629 2,126 2,000 4,162 2,204	2037 3,228 3,001 2,370 2,925 3,476 1,729 12,538 1,048 1,641 2,154 2,011 4,206 2,235	2038 3,268 3,050 2,395 2,948 3,516 1,750 12,828 1,053 1,653 2,182 2,023 4,248 2,267	2039 3,308 3,098 2,420 2,971 3,554 1,771 13,111 1,059 1,665 2,209 2,034 4,288 2,298	2040 3,347 3,146 2,444 2,993 3,591 1,790 13,387 1,064 1,676 2,236 2,045 4,328 2,328	2015/20 2.0 2.7 1.7 2.0 2.2 2.1 5.6 0.9 1.2 2.1 1.0 2.5 2.3	2020/25 1.8 2.4 1.5 1.2 1.8 1.9 4.6 0.8 1.1 1.9 0.8 1.1 1.9 0.8 1.1 2.0	2025/30 1.6 2.1 1.4 1.1 1.6 1.7 3.6 0.7 0.9 1.7 0.7 1.4 1.8	2030/35 1.4 1.9 1.2 1.0 1.4 1.5 2.9 0.6 0.8 1.5 0.6 1.2 1.6	2035/40 1.3 1.6 1.1 0.8 1.1 1.2 2.3 0.5 0.7 1.3 0.6 1.0 1.4	2015/40 1.6 2.1 1.4 1.2 1.6 1.7 3.8 0.7 0.9 1.7 0.7 1.5 1.8
1 2 2 2 5 6 6 7 7 7 8 8 9 9 7 7 7 7 7 7 7 7 7 7 7 7 7	Region names         Dodoma         Arusha         Alilimanjaro         Kilimanjaro         Tanga         Morogoro         Pwani         Dar es Salaam         Lindi         Mtwara         Ruvuma         Iringa +Njombe         Mbya         Singida         Tabora	2031 2,975 2,699 2,213 2,768 3,213 1,590 10,675 1,011 1,565 1,982 1,938 3,927 2,041 3,749	2032 3,019 2,750 2,240 2,795 3,259 1,614 10,999 1,018 1,578 2,011 1,951 3,975 2,074 3,824	2033 3,061 2,267 2,822 3,304 1,638 11,318 1,024 1,591 2,040 1,964 4,023 2,107 3,898	2034 3,104 2,851 2,293 3,348 1,662 11,632 1,632 1,632 1,604 2,069 1,976 4,070 2,139 3,972	2035 3,146 2,902 2,319 2,875 3,392 1,685 11,940 1,036 1,617 2,098 1,988 4,117 2,172 4,045	2036 3,187 2,345 2,345 2,900 3,435 1,707 12,242 1,042 1,629 2,126 2,000 4,162 2,204 4,118	2037 3,228 3,001 2,370 2,925 3,476 1,729 12,538 1,048 1,641 2,154 2,011 4,206 2,235 4,190	2038 3,268 3,050 2,395 2,395 3,516 1,750 12,828 1,053 2,182 2,023 4,248 2,267 4,262	2039 3,308 3,098 2,420 2,971 3,554 1,771 13,111 1,059 1,665 2,209 2,034 4,288 2,298 4,333	2040 3,347 3,146 2,444 2,993 3,591 1,790 13,387 1,064 1,676 2,236 2,045 4,328 2,328 4,404	2015/20 2.0 2.7 1.7 2.0 2.2 2.1 5.6 0.9 1.2 2.1 1.0 2.5 2.3 2.3 2.9	2020/25 1.8 2.4 1.5 1.2 1.8 1.9 4.6 0.8 1.1 1.9 0.8 1.6 2.0 2.5	2025/30 1.6 2.1 1.4 1.1 1.6 1.7 3.6 0.7 0.9 1.7 0.9 1.7 0.7 1.4 1.8 2.2	2030/35 1.4 1.9 1.2 1.0 1.4 1.5 2.9 0.6 0.8 1.5 0.6 1.2 1.6 1.9	2035/40 1.3 1.6 1.1 0.8 1.1 1.2 2.3 0.5 0.7 1.3 0.6 1.0 1.4 1.7	2015/40 1.6 2.1 1.4 1.2 1.6 1.7 3.8 0.7 0.9 1.7 0.7 1.5 1.8 2.2
1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Region names         Dodoma         2 Arusha         3 Kilimanjaro         4 Tanga         5 Morogoro         5 Pwani         7 Dar es Salaam         3 Lindi         9 Ruvuma         Iringa +Njombe         2 Mbeya         3 Singida         4 Tabora         Rukwa +Katavi	2031 2,975 2,699 2,213 2,768 3,213 1,590 10,675 1,911 1,565 1,982 1,938 3,927 2,041 3,749 2,705	2032 3,019 2,750 2,240 2,795 3,259 1,614 10,999 1,018 1,578 2,011 1,951 3,975 2,074 3,824 2,765	2033 3,061 2,801 2,267 2,822 3,304 1,638 11,318 1,024 1,591 2,040 1,964 4,023 2,107 3,898 2,824	2034 3,104 2,851 2,293 2,849 3,348 1,662 11,632 1,030 1,604 2,069 1,976 4,070 2,139 3,972 2,884	2035 3,146 2,902 2,319 2,875 3,392 1,685 11,940 1,036 1,617 2,098 1,988 4,117 2,172 4,045 2,943	2036 3,187 2,951 2,345 2,900 3,435 1,707 12,242 1,042 1,629 2,126 2,000 4,162 2,204 4,118 3,000	2037 3,228 3,001 2,370 2,925 3,476 1,729 12,538 1,048 1,641 2,154 2,011 4,206 2,235 4,190 3,057	2038 3,268 3,050 2,395 2,948 3,516 1,750 12,828 1,053 1,653 2,182 2,023 4,248 2,267 4,262 3,113	2039 3,308 3,098 2,420 2,971 3,554 1,771 13,111 1,059 1,665 2,209 2,034 4,288 2,298 4,333 3,168	2040 3,347 3,146 2,444 2,993 3,591 1,790 13,387 1,064 2,238 2,045 4,328 2,328 2,328 4,404 3,222	2015/20 2.0 2.7 1.7 2.0 2.2 2.1 5.6 0.9 1.2 2.1 1.0 2.5 2.3 2.9 3.2	2020/25 1.8 2.4 1.5 1.2 1.8 1.9 4.6 0.8 1.1 1.9 0.8 1.6 2.0 2.5 2.8	2025/30 1.6 2.1 1.4 1.1 1.6 1.7 3.6 0.7 0.9 1.7 0.7 1.4 1.8 2.2 2.5	2030/35 1.4 1.9 1.2 1.0 1.4 1.5 2.9 0.6 0.8 1.5 0.6 1.2 1.6 1.9 2.2	2035/40 1.3 1.6 1.1 0.8 1.1 1.2 2.3 0.5 0.7 1.3 0.6 1.0 1.4 1.7 1.8	2015/40 1.6 2.1 1.4 1.2 1.6 1.7 3.8 0.7 0.9 1.7 0.7 1.5 1.8 2.2 2.5
1 2 2 5 6 7 7 8 8 9 10 11 12 12 12 12 12 12	Region names Dodoma Arusha Arusha Arusha Kilimanjaro Tanga Morogoro Pwani Dar es Salaam Lindi Mtwara Ruvuma Iringa +Njombe Moya Singida Tabora Rukwa +Katavi Kigoma	2031 2,975 2,699 2,213 2,768 3,213 1,590 10,675 1,011 1,565 1,982 1,982 1,938 3,927 2,041 3,749 2,705 3,188	2032 3,019 2,750 2,240 2,795 3,2259 1,614 10,999 1,018 1,578 2,011 1,951 3,975 2,074 3,824 2,765 3,240	2033 3,061 2,801 2,267 2,822 3,304 1,638 11,318 1,024 1,591 2,040 1,964 4,023 2,107 3,898 2,824 3,291	2034 3,104 2,851 2,293 3,348 1,662 11,632 1,030 1,604 2,069 1,976 4,070 2,139 3,972 2,884 3,343	2035 3,146 2,902 2,319 2,875 3,392 1,685 11,940 1,036 1,617 2,098 1,988 1,988 4,117 2,172 4,045 2,943 3,393	2036 3,187 2,951 2,345 1,707 12,242 1,042 1,629 2,126 2,000 4,162 2,204 4,118 3,000 3,442	2037 3,228 3,001 2,370 1,729 12,538 1,048 1,641 2,154 2,011 4,206 2,235 4,190 3,057 3,490	2038 3,268 3,050 2,395 2,948 3,516 1,750 12,828 1,053 1,653 2,182 2,023 4,248 2,267 4,262 3,113 3,536	2039 3,308 3,098 2,420 2,971 3,554 1,771 13,111 1,059 1,665 2,209 2,034 4,288 2,298 4,333 3,168 3,581	2040 3,347 3,146 2,444 2,993 3,591 1,790 13,387 1,064 1,676 2,236 2,045 4,328 2,328 4,404 3,222 3,624	2015/20 2.0 2.7 1.7 2.0 2.2 2.1 5.6 0.9 1.2 2.1 1.0 2.5 2.3 2.9 3.2 2.3	2020/25 1.8 2.4 1.5 1.2 1.8 1.9 4.6 0.8 1.1 1.9 0.8 1.6 2.0 2.5 2.8 2.1	2025/30 1.6 2.1 1.4 1.1 1.6 1.7 3.6 0.7 0.9 1.7 0.7 1.4 1.8 2.2 2.5 1.8	2030/35 1.4 1.9 1.2 1.0 1.4 1.5 2.9 0.6 0.8 1.5 0.6 1.2 1.6 1.9 2.2 1.6	2035/40 1.3 1.6 1.1 0.8 1.1 1.2 2.3 0.5 0.7 1.3 0.6 1.0 1.4 1.7 1.8 1.3	2015/40 1.6 2.1 1.4 1.2 1.6 1.7 3.8 0.7 0.9 1.7 0.7 1.5 1.8 2.2 1.8
1 2 5 6 7 7 8 8 9 10 11 12 13 14 12 15 16 17	Region names         Dodoma         Jodama         Arusha         Kilimanjaro         Tanga         Morogoro         Pwani         Dar es Salaam         Lindi         Mtwara         Ruvuma         Iringa + Njombe         Singida         Tabora         Rukwa + Katavi         Skigoma         Shinyanga+ Simiyu	2031 2,975 2,699 2,213 2,768 3,213 1,590 10,675 1,011 1,565 1,982 1,938 3,927 2,041 3,749 2,705 3,188 4,923	2032 3,019 2,750 2,240 2,795 3,259 1,614 10,999 1,018 1,578 2,011 1,951 3,975 2,074 3,824 2,765 3,240 5,034	2033 3,061 2,267 2,822 3,304 1,638 11,318 1,024 1,591 2,040 1,964 4,023 2,107 3,898 2,824 3,291 5,144	2034 3,104 2,851 2,293 2,849 3,348 1,662 11,632 1,604 2,069 1,976 4,070 2,139 3,972 2,884 3,343 5,254	2035 3,146 2,902 2,319 2,875 3,392 1,685 11,940 1,036 1,617 2,098 4,117 2,172 4,045 2,943 3,393 5,362	2036 3,187 2,951 2,345 2,900 3,435 1,707 12,242 1,629 2,126 2,000 4,162 2,204 4,118 3,000 3,442 5,469	2037 3,228 3,001 2,370 2,925 1,729 12,538 1,048 1,641 2,154 2,011 4,206 2,235 4,190 3,057 3,490 5,574	2038 3,268 3,050 2,395 2,948 3,516 1,750 12,828 1,053 1,653 2,182 2,023 4,248 4,248 4,248 4,267 4,262 3,113 3,536 5,677	2039 3,308 3,098 2,420 2,971 3,554 1,771 13,111 1,059 1,665 2,209 2,034 4,288 2,298 4,333 3,168 3,581 5,779	2040 3,347 3,146 2,444 2,993 3,591 1,790 13,387 1,064 1,676 2,236 2,045 4,328 2,328 4,404 3,222 3,624 5,879	2015/20 2.0 2.7 1.7 2.0 2.2 2.1 5.6 0.9 1.2 2.1 1.0 2.5 2.3 2.9 3.2 2.9 3.2 2.3 2.2	2020/25 1.8 2.4 1.5 1.2 1.8 1.9 4.6 0.8 1.1 1.9 0.8 1.1 1.9 0.8 1.6 2.0 2.5 2.8 2.1 2.8	2025/30 1.6 2.1 1.4 1.1 1.6 1.7 3.6 0.7 0.9 1.7 0.7 1.4 1.8 2.2 2.5 1.8 2.5	2030/35 1.4 1.9 1.2 1.0 1.4 1.5 2.9 0.6 0.8 1.5 0.6 1.2 1.6 1.9 2.2 1.6 2.2	2035/40 1.3 1.6 1.1 0.8 1.1 1.2 2.3 0.5 0.7 1.3 0.6 1.0 1.4 1.7 1.8 1.3 1.9	2015/40 1.6 2.1 1.4 1.2 1.6 1.7 3.8 0.7 0.9 1.7 0.7 1.5 1.8 2.2 2.5 1.8 2.3
1 2 3 5 5 7 7 8 8 8 9 7 7 7 7 7 7 7 7 7 7 7 7 7 7	Region names         Dodoma         Jodama         Arusha         Kilimanjaro         Kilimanjaro         Tanga         Morogoro         Pwani         Dar es Salaam         Lindi         Mtwara         Ruvuma         Iringa +Njombe         Mbya         Singida         Tabora         Kigoma         Shinyanga+ Simiyu         Kagera	2031 2,975 2,699 2,213 2,768 3,213 1,590 10,675 1,011 1,565 1,982 1,938 3,927 2,041 3,749 2,705 3,188 4,923 3,756	2032 3,019 2,750 2,240 2,795 3,259 1,614 10,999 1,018 1,578 2,011 1,951 3,975 2,074 3,824 2,765 3,240 5,034 3,808	2033 3,061 2,267 2,822 3,304 1,638 11,318 1,024 1,591 2,040 1,964 4,023 2,107 3,898 2,824 3,291 5,144 3,859	2034 3,104 2,851 2,293 2,849 3,348 1,662 11,632 1,604 2,069 1,976 4,070 2,139 3,972 2,884 3,343 5,254 3,910	2035 3,146 2,902 2,319 2,875 3,392 1,685 11,940 1,036 1,617 2,098 1,988 4,117 2,172 4,045 2,943 3,393 5,362 3,360	2036 3,187 2,951 2,345 2,900 3,435 1,707 12,242 1,042 1,629 2,126 2,000 4,162 2,204 4,118 3,000 3,442 5,469 4,008	2037 3,228 3,001 2,370 2,925 3,476 1,729 12,538 1,048 1,641 2,154 2,011 4,206 2,235 4,190 3,057 3,490 5,574 4,055	2038 3,268 3,050 2,395 2,948 3,516 1,750 12,828 1,053 2,182 2,023 4,248 2,267 4,262 3,113 3,536 5,677 4,100	2039 3,308 3,098 2,420 2,971 3,554 1,771 13,111 1,059 1,665 2,209 2,034 4,288 2,298 4,333 3,168 3,581 5,779 4,144	2040 3,347 3,146 2,444 2,993 3,591 1,790 13,387 1,064 1,676 2,236 2,045 4,328 2,345 4,404 3,222 3,624 5,879 4,186	2015/20 2.0 2.7 1.7 2.0 2.2 2.1 5.6 0.9 1.2 2.1 1.0 2.5 2.3 2.9 3.2 2.3 2.2 2.3 2.2 2.2 2.9	2020/25 1.8 2.4 1.5 1.2 1.8 1.9 4.6 0.8 1.1 1.9 0.8 1.6 2.0 2.5 2.8 2.1 2.8 1.7	2025/30 1.6 2.1 1.4 1.1 1.6 1.7 3.6 0.7 0.9 1.7 0.9 1.7 0.7 1.4 1.8 2.2 2.5 1.8 2.5 1.5	2030/35 1.4 1.9 1.2 1.0 1.4 1.5 2.9 0.6 0.8 1.5 0.6 1.2 1.6 1.9 2.2 1.6 2.2 1.3	2035/40 1.3 1.6 1.1 0.8 1.1 1.2 2.3 0.5 0.7 1.3 0.6 1.0 1.4 1.7 1.8 1.3 1.9 1.1	2015/40 1.6 2.1 1.4 1.2 1.6 1.7 3.8 0.7 0.9 1.7 0.7 1.5 1.8 2.2 2.5 1.8 2.3 1.7
1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Region names         Dodoma         Arusha         Arusha         Kilimanjaro         Tanga         Morogoro         Pwani         Dar es Salaam         Alindi         Mtwara         Rukvuma         Rukva +Njombe         Rukva +Katavi         Kigoma         Sinyanga+ Simiyu         Kagera         Mwanza +Geita	2031 2,975 2,699 2,213 2,768 3,213 1,590 10,675 1,901 1,565 1,982 1,982 1,982 1,988 3,927 2,041 3,749 2,705 3,188 4,923 3,756 8,334	2032 3,019 2,750 2,240 2,795 3,259 1,614 10,999 1,018 1,578 2,011 1,951 3,975 2,074 3,824 3,824 2,765 3,240 5,034 3,808 8,566	2033 3,061 2,801 2,267 2,822 3,304 1,638 11,318 1,024 1,591 2,040 1,964 4,023 2,107 3,898 2,824 3,291 5,144 3,859 8,791	2034 3,104 2,851 2,293 2,849 3,348 1,662 11,632 1,030 1,604 2,069 1,976 4,070 2,139 3,972 2,884 3,343 5,254 3,910 9,010	2035 3,146 2,902 2,319 2,875 3,392 1,685 11,940 1,036 1,617 2,098 1,988 4,117 2,172 4,045 2,943 3,393 5,362 3,960 9,221	2036 3,187 2,951 2,345 1,707 12,242 1,629 2,126 2,000 4,162 2,204 4,118 3,000 3,442 5,469 4,008 9,427	2037 3,228 3,001 2,370 1,729 12,538 1,048 1,641 2,154 2,011 4,206 2,235 4,190 3,057 3,490 5,574 4,055 9,625	2038 3,268 3,050 2,395 2,948 3,516 1,750 12,828 1,053 1,653 2,182 2,023 4,248 2,267 4,262 3,113 3,536 5,677 4,100 9,816	2039 3,308 3,098 2,420 2,971 3,554 1,771 1,059 1,665 2,209 2,034 4,288 2,298 4,333 3,168 3,581 5,779 4,144 10,001	2040 3,347 3,146 2,444 2,993 3,591 1,790 13,387 1,064 1,676 2,236 2,045 4,328 2,328 4,404 3,222 3,624 5,879 4,186 10,179	2015/20 2.0 2.7 1.7 2.0 2.2 2.1 5.6 0.9 1.2 2.1 1.0 2.5 2.3 2.9 3.2 2.3 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5	2020/25 1.8 2.4 1.5 1.2 1.8 1.9 4.6 0.8 1.1 1.9 0.8 1.6 2.0 2.5 2.8 2.1 2.8 2.1 3.8	2025/30 1.6 2.1 1.4 1.1 1.6 1.7 3.6 0.7 0.9 1.7 0.7 1.4 1.8 2.2 2.5 1.8 2.5 1.8 2.5 1.5 3.4	2030/35 1.4 1.9 1.2 1.0 1.4 1.5 2.9 0.6 0.8 1.5 0.6 1.2 1.6 1.9 2.2 1.6 2.2 1.6 2.2 1.3 2.6	2035/40 1.3 1.6 1.1 0.8 1.1 1.2 2.3 0.5 0.7 1.3 0.6 1.0 1.4 1.7 1.8 1.3 1.9 1.1 2.0	2015/40 1.6 2.1 1.4 1.2 1.6 1.7 3.8 0.7 0.9 1.7 0.7 1.5 1.8 2.2 2.5 1.8 2.3 1.8 2.3 1.7 2.9
1 2 2 2 2 2 2 2 2 2 2 2 2 2	Region names         Dodoma         Arusha         Arusha         Kilimanjaro         Tanga         Morogoro         Pwani         Dar es Salaam         Lindi         Mtwara         Ruvuma         Iringa + Njombe         Zingida         Tabora         Rukwa + Katavi         Skigoma         Shinyanga+ Simiyu         Skagera         Mwara         Mara	2031 2,975 2,699 2,213 2,768 3,213 1,590 10,675 1,011 1,565 1,982 1,938 3,927 2,041 3,749 2,705 3,188 4,923 3,756 8,334 2,659	2032 3,019 2,750 2,240 2,795 3,259 1,614 10,999 1,018 1,578 2,011 1,951 3,975 2,074 3,824 2,765 3,240 5,034 3,808 8,566 2,705	2033 3,061 2,267 2,822 3,304 1,638 11,318 1,024 1,591 2,040 1,964 4,023 2,107 3,898 2,824 3,291 5,144 3,859 8,791 2,751	2034 3,104 2,851 2,293 2,849 3,348 1,662 11,632 1,604 2,069 1,976 4,070 2,139 3,972 2,884 3,343 5,254 3,910 9,010 2,796	2035 3,146 2,902 2,319 2,875 3,392 1,685 11,940 1,036 1,617 2,098 1,988 4,117 2,172 4,045 2,943 3,393 5,362 3,960 9,221 2,841	2036 3,187 2,951 2,345 2,900 3,435 1,707 12,242 1,042 1,629 2,126 2,000 4,162 2,204 4,118 3,000 3,442 5,469 4,008 9,427 2,885	2037 3,228 3,001 2,370 2,925 3,476 1,729 12,538 1,048 1,641 2,154 2,011 4,206 2,235 4,190 3,057 3,490 5,574 4,055 9,625 2,929	2038 3,268 3,050 2,395 2,948 3,516 1,750 12,828 1,053 1,653 2,182 2,023 4,248 2,267 4,262 3,113 3,536 5,677 4,100 9,816 2,973	2039 3,308 3,098 2,420 2,971 3,554 1,771 13,111 1,059 1,665 2,209 2,034 4,288 2,298 4,333 3,168 3,581 5,779 4,144 10,001 3,016	2040 3,347 3,146 2,444 2,993 3,591 1,790 13,387 1,064 1,676 2,236 2,045 4,328 2,328 4,404 3,222 3,624 5,879 4,186 10,179 3,058	2015/20 2.0 2.7 1.7 2.0 2.2 2.1 5.6 0.9 1.2 2.1 1.0 2.5 2.3 2.9 3.2 2.3 2.2 2.3 2.2 2.3 2.2 2.3 2.2 2.3 2.2 2.3 2.2 2.3 2.2 2.3 2.2 2.3 2.2 2.3 2.2 2.3 2.2 2.3 2.2 2.3 2.2 2.3 2.2 2.3 2.2 2.3 2.2 2.3 2.2 2.3 2.3	2020/25 1.8 2.4 1.5 1.2 1.8 1.9 4.6 0.8 1.1 1.9 0.8 1.1 1.9 0.8 1.1 2.0 2.5 2.8 2.1 2.8 1.7 3.8 2.2	2025/30 1.6 2.1 1.4 1.1 1.6 1.7 3.6 0.7 0.9 1.7 0.7 1.4 1.8 2.2 2.5 1.8 2.5 1.5 3.4 1.9	2030/35 1.4 1.9 1.2 1.0 1.4 1.5 2.9 0.6 0.8 1.5 0.6 1.2 1.6 1.9 2.2 1.6 2.2 1.3 2.6 1.7	2035/40 1.3 1.6 1.1 0.8 1.1 1.2 2.3 0.5 0.7 1.3 0.6 1.0 1.4 1.7 1.8 1.3 1.9 1.1 2.0 1.5	2015/40 1.6 2.1 1.4 1.2 1.6 1.7 3.8 0.7 0.9 1.7 0.9 1.7 1.5 1.8 2.2 2.5 1.8 2.3 1.7 2.9 1.9
1 2 2 2 2 2 2 2 2 2 2 2 2 2	Region names         Dodoma         Jodoma         Arusha         Kilimanjaro         Kilimanjaro         Tanga         Morogoro         Pwani         Dar es Salaam         Lindi         Mtwara         Ruvuma         Iringa + Njombe         Singida         Tabora         Rukwa + Katavi         Kigoma         Shinyanga+ Simiyu         Kagera         Mwanza + Geita         Manyara	2031 2,975 2,699 2,213 3,2768 3,2213 1,590 10,675 1,011 1,565 1,982 1,938 3,927 2,041 3,749 2,705 3,188 4,923 3,756 8,334 2,659 2,307	2032 3,019 2,750 2,240 2,795 3,259 1,614 10,999 1,018 1,578 2,011 1,951 3,975 2,074 3,824 2,765 3,240 5,034 3,808 8,566 2,705 2,348	2033 3,061 2,267 2,822 3,304 1,638 11,318 1,024 1,591 2,040 1,964 4,023 2,107 3,898 2,824 3,291 5,144 3,859 8,791 2,751 2,389	2034 3,104 2,851 2,293 2,849 3,348 1,662 11,632 1,604 2,069 1,976 4,070 2,139 3,972 2,884 3,343 5,254 3,910 9,010 2,796 2,429	2035 3,146 2,902 2,319 2,875 3,392 1,685 11,940 1,036 1,617 2,098 1,988 4,117 2,172 4,045 2,943 3,393 5,362 3,960 9,221 2,841 2,841 2,469	2036 3,187 2,951 2,345 2,900 3,435 1,707 12,242 1,629 2,126 2,000 4,162 2,204 4,118 3,000 3,442 5,469 4,008 9,427 2,885 2,508	2037 3,228 3,001 2,370 2,925 3,476 1,729 12,538 1,048 1,641 2,154 2,011 4,206 2,235 4,190 3,057 3,490 5,574 4,055 9,625 9,625 2,929 2,545	2038 3,268 3,050 2,395 2,948 3,516 1,750 12,828 1,053 1,653 2,182 2,023 4,248 2,267 4,262 3,113 3,536 5,677 4,100 9,816 2,973 2,581	2039 3,308 3,098 2,420 2,971 3,554 1,771 13,111 1,059 1,665 2,209 2,034 4,288 2,298 4,333 3,168 3,581 5,779 4,144 10,001 3,016 2,615	2040 3,347 3,146 2,444 2,993 3,591 1,790 13,387 1,064 1,676 2,236 2,045 4,328 2,328 4,404 3,222 3,624 5,879 4,186 10,179 3,058 2,648	2015/20 2.0 2.7 1.7 2.0 2.2 2.1 5.6 5.6 0.9 1.2 2.1 1.0 2.5 2.3 2.9 3.2 2.9 3.2 2.3 2.3 2.2 2.3 2.2 2.3 2.2 3.2 2.3 3.2 2.2 3.3 2.2 2.3 3.2 2.3 3.2 2.3 3.2 2.3 3.2 2.3 3.2 2.3 3.2 2.3 3.2 2.3 3.2 2.3 3.2 2.3 3.2 2.3 3.2 2.3 3.2 3.3 2.3 3.2 2.3 3.2 3.3 3.2 2.3 3.3 3	2020/25 1.8 2.4 1.5 1.2 1.8 1.9 4.6 0.8 1.1 1.9 0.8 1.1 1.9 0.8 1.1 2.5 2.8 2.1 2.8 1.7 3.8 2.2 2.2	2025/30 1.6 2.1 1.4 1.1 1.6 1.7 3.6 0.7 0.9 1.7 0.7 1.4 1.8 2.2 2.5 1.8 2.5 1.5 3.4 1.9 2.0	2030/35 1.4 1.9 1.2 1.0 1.4 1.5 2.9 0.6 0.8 1.5 0.6 1.2 1.6 1.9 2.2 1.6 2.2 1.3 2.6 1.7 1.7	2035/40 1.3 1.6 1.1 0.8 1.1 1.2 2.3 0.5 0.7 1.3 0.6 1.0 1.4 1.7 1.8 1.3 1.9 1.1 2.0 1.5 1.4	2015/40 1.6 2.1 1.4 1.2 1.6 1.7 3.8 0.7 0.9 1.7 0.9 1.7 0.7 1.5 1.8 2.2 2.5 1.8 2.3 1.7 2.9 1.9 2.1
1 2 2 2 2 2 2 2 2 2 2 2 10 111 12 133 14 4 15 10 177 18 19 20 2 2	Region names         Dodoma         Arusha         Kilimanjaro         Kilimanjaro         Tanga         Morogoro         Pwani         Dar es Salaam         Lindi         Mtwara         Ruvuma         Iringa +Njombe         Mbya         Singida         Tabora         Kukwa +Katavi         Kigoma         Shinyanga+ Simiyu         Kagera         Mwanza +Geita         Mara         Mainland total	2031 2,975 2,699 2,213 2,768 3,213 1,590 10,675 1,011 1,565 1,982 1,938 3,927 2,041 3,749 2,705 3,188 4,923 3,756 8,334 2,659 2,307 70,218	2032 3,019 2,750 2,240 2,795 3,259 1,614 10,999 1,018 1,578 2,011 1,951 3,975 2,074 3,824 2,765 3,240 5,034 3,808 8,566 2,705 2,348 71,572	2033 3,061 2,267 2,822 3,304 1,638 11,318 1,024 1,591 2,040 1,964 4,023 2,107 3,898 2,824 3,291 5,144 3,859 8,791 2,751 2,389 72,908	2034 3,104 2,851 2,293 2,849 3,348 1,662 11,632 1,604 2,069 1,976 4,070 2,139 3,972 2,884 3,343 5,254 3,910 9,010 2,796 2,429 74,225	2035 3,146 2,902 2,319 2,875 3,392 1,685 11,940 1,036 1,617 2,098 1,988 4,117 2,172 4,045 2,943 3,393 5,362 3,3960 9,221 2,841 2,469 75,520	2036 3,187 2,951 2,345 2,900 3,435 1,707 12,242 1,629 2,126 2,000 4,162 2,204 4,118 3,000 3,442 5,469 4,008 9,427 2,885 2,508 76,788	2037 3,228 3,001 2,370 2,925 3,476 1,729 12,538 1,048 1,641 2,154 2,011 4,206 2,235 4,190 3,057 3,490 5,574 4,055 9,625 2,929 2,545 78,027	2038 3,268 3,050 2,395 2,948 3,516 1,750 12,828 1,053 2,182 2,023 4,248 2,267 4,262 3,113 3,536 5,677 4,100 9,816 2,973 2,581 79,239	2039 3,308 3,098 2,420 2,971 3,554 1,771 13,111 1,059 1,665 2,209 2,034 4,288 2,298 4,333 3,168 3,581 5,779 4,144 10,001 3,016 2,615 80,421	2040 3,347 3,146 2,444 2,993 3,591 1,790 13,387 1,064 1,676 2,236 2,045 4,328 2,328 4,404 3,222 3,624 5,879 4,186 10,179 3,058 2,648 81,575	2015/20 2.0 2.7 1.7 2.0 2.2 2.1 5.6 0.9 1.2 2.1 1.0 2.5 2.3 2.9 3.2 2.3 2.9 3.2 2.3 2.9 2.2 2.9 2.8 2.2 2.9 2.8 2.2 2.9 2.8 2.2 2.9 2.8 2.2 2.9 2.8 2.2 2.3 3.2 2.2 2.3 3.2 2.2 2.3 3.2 2.2 2	2020/25 1.8 2.4 1.5 1.2 1.8 1.9 4.6 0.8 1.1 1.9 0.8 1.6 2.0 2.5 2.8 2.1 2.8 1.7 3.8 2.2 2.2 2.5	2025/30 1.6 2.1 1.4 1.1 1.6 1.7 3.6 0.7 0.9 1.7 0.9 1.7 0.7 1.4 1.8 2.2 2.5 1.8 2.5 1.5 3.4 1.9 2.0 2.2	2030/35 1.4 1.9 1.2 1.0 1.4 1.5 2.9 0.6 0.8 1.5 0.6 1.2 1.6 1.9 2.2 1.6 1.9 2.2 1.6 1.9 2.2 1.6 1.7 1.7 1.9	2035/40 1.3 1.6 1.1 0.8 1.1 1.2 2.3 0.5 0.7 1.3 0.6 1.0 1.4 1.7 1.8 1.3 1.9 1.1 2.0 1.5 1.4 1.6	2015/40 1.6 2.1 1.4 1.2 1.6 1.7 3.8 0.7 0.9 1.7 0.9 1.7 0.7 1.5 1.8 2.2 2.5 1.8 2.3 1.7 2.9 1.9 2.1 1.9 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1
1 2 2 3 3 4 4 5 5 6 6 6 7 7 8 8 8 8 8 9 10 10 11 13 13 13 13 14 15 17 18 8 9 20 22	Region names         Dodoma         Arusha         Arusha         Kilimanjaro         Tanga         Morogoro         Pwani         Dar es Salaam         Lindi         Mwara         Ruvuma         Iringa +Njombe         ZMbeya         Singida         Tabora         Skuya +Katavi         Kigoma         Sinyanga+ Simiyu         Kagera         Mara         Maryara         Manyara         Manyara         Manyara         Manyara         Manyara         Mainland total         Zanzibar total	2031 2,975 2,699 2,213 3,2768 3,213 1,590 10,675 1,011 1,565 1,982 1,975 3,188 4,923 3,776 5,318 4,923 3,776 5,3188 4,923 3,776 5,334 2,665 1,982 2,705 3,188 4,923 3,776 5,334 2,665 1,982 2,705 2,347 2,041 2,705 2,347 2,041 2,705 2,347 2,041 2,705 2,347 2,041 2,705 2,347 2,041 2,705 2,347 2,041 2,705 2,347 2,057 2,047 2,047 2,057 2,047 2,057 2,047 2,057 2,047 2,057 2,047 2,05	2032 3,019 2,750 2,240 2,795 3,259 1,614 10,999 1,018 1,578 2,011 1,951 3,975 2,074 3,824 2,765 3,240 5,034 3,808 8,566 2,705 2,348 8,566 2,705 2,348	2033 3,061 2,801 2,267 2,822 3,304 1,638 11,318 1,024 1,591 2,040 1,964 4,023 2,107 3,898 2,824 3,291 5,144 3,859 8,791 2,751 2,389 2,751 2,389 2,2111	2034 3,104 2,851 2,293 2,849 3,348 1,662 11,632 1,030 1,604 2,069 1,976 4,070 2,139 3,972 2,884 3,343 5,254 3,343 5,254 3,910 9,010 2,796 2,429 7,4225 2,141	2035 3,146 2,902 2,319 2,875 3,392 1,685 11,940 1,036 1,617 2,098 1,988 4,117 2,172 4,045 2,943 3,393 5,362 3,960 9,221 2,841 2,841 2,469 2,5520 2,172	2036 3,187 2,951 2,900 3,435 1,707 12,242 1,042 1,629 2,126 2,000 4,162 2,204 4,118 3,000 3,442 5,469 4,008 9,427 2,885 2,508 2,508 2,202	2037 3,228 3,001 2,370 1,729 12,538 1,048 1,641 2,154 2,011 4,206 2,235 4,190 3,057 3,490 5,574 4,055 9,625 2,929 2,545 78,027 2,231	2038 3,268 3,050 2,395 2,948 3,516 1,750 12,828 1,053 1,653 2,182 2,023 4,248 2,267 4,262 3,113 3,536 5,677 4,100 9,816 2,973 2,581 2,973 2,260	2039 3,308 3,098 2,420 2,971 3,554 1,771 13,111 1,059 1,665 2,209 2,034 4,288 2,298 4,333 3,168 3,581 5,779 4,144 10,001 3,016 2,615 80,421 2,288	2040 3,347 3,146 2,444 2,993 3,591 1,790 13,387 1,064 1,676 2,236 2,045 4,328 2,328 4,404 3,222 3,624 5,879 4,186 10,179 3,058 2,648 81,575 2,315	2015/20 2.0 2.7 1.7 2.0 2.2 2.1 5.6 0.9 1.2 2.1 1.0 2.5 2.3 2.9 3.2 2.3 2.3	2020/25 1.8 2.4 1.5 1.2 1.8 1.9 4.6 0.8 1.1 1.9 0.8 1.6 2.0 2.5 2.8 2.1 2.8 1.7 3.8 2.2 2.2 2.5 1.8	2025/30 1.6 2.1 1.4 1.1 1.6 1.7 3.6 0.7 0.9 1.7 0.7 1.4 1.8 2.2 5 1.8 2.5 1.5 3.4 1.9 2.0	2030/35 1.4 1.9 1.2 1.0 1.4 1.5 2.9 0.6 0.8 1.5 0.6 1.2 1.6 1.9 2.2 1.6 2.2 1.3 2.6 1.7 1.7 1.7 1.9 1.4	2035/40 1.3 1.6 1.1 0.8 1.1 1.2 2.3 0.5 0.7 1.3 0.6 1.0 1.4 1.7 1.8 1.3 1.9 1.1 2.0 1.5 1.4 1.6 1.1 2.0 1.5 1.4 1.6 1.1 1.2 1.2 1.2 1.2 1.2 1.2 1.2	2015/40 1.6 2.1 1.4 1.2 1.6 1.7 3.8 0.7 0.9 1.7 0.7 1.5 1.8 2.2 2.5 1.8 2.3 1.7 2.9 1.9 2.1 1.9

Source: NBS for population census data in 2012

# 2.8.5 Regional electrification rate

# Table 2-22: Regional electrification rate

																ι	Init: %
		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1	Dodoma	39.4	42.0	44.7	47.6	50.7	54.0	57.5	61.3	65.2	69.5	74.0	76.3	78.6	81.0	83.5	86.0
2	Arusha	47.2	50.3	53.5	57.0	60.7	64.7	68.9	73.3	78.1	83.2	88.6	89.7	90.8	91.9	93.0	94.1
3	Kilimanjaro	82.1	83.7	85.4	87.1	88.8	90.6	92.4	94.3	96.1	98.0	100.0	100.0	100.0	100.0	100.0	100.0
4	Tanga	35.0	37.3	39.7	42.3	45.1	48.0	51.1	54.5	58.0	61.8	65.8	68.6	71.5	74.6	77.8	81.1
5	Morogoro	42.2	44.9	47.8	51.0	54.3	57.8	61.6	65.6	69.8	74.4	79.2	81.1	83.0	84.9	86.9	89.0
6	Pwani	45.8	48.8	51.9	55.3	58.9	62.8	66.8	71.2	75.8	80.7	86.0	87.3	88.6	90.0	91.3	92.7
7	Dar es Salaam	89.9	90.9	91.9	92.9	93.8	94.8	95.9	96.9	97.9	98.9	100.0	100.0	100.0	100.0	100.0	100.0
8	Lindi	14.5	15.4	16.4	17.5	18.6	19.8	21.1	22.5	24.0	25.5	27.2	29.2	31.2	33.5	35.9	38.5
g	Mtwara	14.3	15.2	16.2	17.2	18.4	19.6	20.8	22.2	23.6	25.2	26.8	28.7	30.8	33.0	35.4	37.9
10	Ruvuma	19.4	20.6	22.0	23.4	24.9	26.6	28.3	30.1	32.1	34.2	36.4	39.0	41.8	44.8	48.0	51.5
11	lringa +Njombe	30.0	32.0	34.1	36.3	38.6	41.2	43.8	46.7	49.7	53.0	56.4	59.7	63.2	67.0	70.9	75.1
12	Mbeya	38.6	41.1	43.7	46.6	49.6	52.8	56.3	59.9	63.8	68.0	72.4	74.8	77.2	79.8	82.4	85.1
13	Singida	24.1	25.6	27.3	29.1	31.0	33.0	35.1	37.4	39.8	42.4	45.2	48.4	51.9	55.6	59.6	63.9
14	Tabora	20.3	21.7	23.1	24.6	26.2	27.9	29.7	31.6	33.7	35.9	38.2	40.9	43.9	47.0	50.4	54.0
15	Rukwa +Katavi	8.1	8.6	9.2	9.8	10.4	11.1	11.8	12.6	13.4	14.3	15.2	16.3	17.5	18.7	20.1	21.5
16	Kigoma	29.6	31.5	33.6	35.8	38.1	40.6	43.2	46.0	49.0	52.2	55.6	59.0	62.5	66.3	70.3	74.6
17	Shinyanga+ Simiyu	24.1	25.6	27.3	29.1	31.0	33.0	35.1	37.4	39.8	42.4	45.2	48.4	51.9	55.6	59.6	63.9
18	Kagera	10.4	11.1	11.8	12.6	13.4	14.3	15.2	16.2	17.3	18.4	19.6	21.0	22.5	24.1	25.9	27.7
19	Mwanza +Geita	41.2	43.9	46.8	49.8	53.0	56.5	60.2	64.1	68.2	72.7	77.4	79.4	81.5	83.6	85.8	88.0
20	Mara	31.5	33.6	35.8	38.1	40.6	43.2	46.0	49.0	52.2	55.6	59.2	62.4	65.7	69.3	73.0	76.9
21	Manyara	45.4	48.3	51.5	54.8	58.4	62.2	66.2	70.5	75.1	80.0	85.2	86.6	88.0	89.4	90.8	92.3
22	Mainland total	39.0	41.0	43.2	45.4	47.8	50.3	53.0	55.7	58.7	61.7	65.0	67.0	69.1	71.3	73.5	75.9

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		2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2015/20	2020/25	2025/30	2030/35	2035/40	2015/40
1	Dodoma	88.7	91.4	94.2	97.0	100.0	100.0	100.0	100.0	100.0	100.0	6.5	6.5	3.1	3.1	0.0	3.8
2	Arusha	95.3	96.4	97.6	98.8	100.0	100.0	100.0	100.0	100.0	100.0	6.5	6.5	1.2	1.2	0.0	3.1
з	Kilimanjaro	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	2.0	2.0	0.0	0.0	0.0	0.8
4	Tanga	84.6	88.2	92.0	95.9	100.0	100.0	100.0	100.0	100.0	100.0	6.5	6.5	4.3	4.3	0.0	4.3
5	Morogoro	91.1	93.2	95.4	97.7	100.0	100.0	100.0	100.0	100.0	100.0	6.5	6.5	2.4	2.4	0.0	3.5
e	Pwani	94.1	95.6	97.0	98.5	100.0	100.0	100.0	100.0	100.0	100.0	6.5	6.5	1.5	1.5	0.0	3.2
7	Dar es Salaam	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	1.1	1.1	0.0	0.0	0.0	0.4
8	Lindi	41.2	44.2	47.4	50.8	54.4	57.8	61.4	65.3	69.4	73.8	6.5	6.5	7.2	7.2	6.3	6.7
g	Mtwara	40.6	43.5	46.7	50.0	53.6	57.0	60.7	64.6	68.8	73.2	6.5	6.5	7.2	7.2	6.4	6.8
10	Ruvuma	55.2	59.1	63.4	67.9	72.8	75.1	77.6	80.1	82.7	85.3	6.5	6.5	7.2	7.2	3.2	6.1
11	lringa +Njombe	79.5	84.2	89.2	94.4	100.0	100.0	100.0	100.0	100.0	100.0	6.5	6.5	5.9	5.9	0.0	4.9
12	Mbeya	87.9	90.8	93.7	96.8	100.0	100.0	100.0	100.0	100.0	100.0	6.5	6.5	3.3	3.3	0.0	3.9
13	Singida	68.5	73.4	78.7	84.3	90.4	91.3	92.2	93.2	94.1	95.1	6.5	6.5	7.2	7.2	1.0	5.6
14	Tabora	57.9	62.1	66.5	71.3	76.4	78.5	80.6	82.8	85.1	87.4	6.5	6.5	7.2	7.2	2.7	6.0
15	Rukwa +Katavi	23.0	24.7	26.5	28.4	30.4	34.2	38.6	43.5	48.9	55.1	6.5	6.5	7.2	7.2	12.6	8.0
16	Kigoma	79.1	83.9	88.9	94.3	100.0	100.0	100.0	100.0	100.0	100.0	6.5	6.5	6.0	6.0	0.0	5.0
17	Shinyanga+ Simiyu	68.5	73.4	78.7	84.3	90.4	91.3	92.2	93.2	94.1	95.1	6.5	6.5	7.2	7.2	1.0	5.6
18	Kagera	29.7	31.8	34.1	36.6	39.2	43.0	47.3	51.9	57.0	62.6	6.5	6.5	7.2	7.2	9.8	7.4
19	Mwanza +Geita	90.3	92.6	95.0	97.5	100.0	100.0	100.0	100.0	100.0	100.0	6.5	6.5	2.6	2.6	0.0	3.6
20	Mara	81.1	85.4	90.0	94.9	100.0	100.0	100.0	100.0	100.0	100.0	6.5	6.5	5.4	5.4	0.0	4.7
21	Manyara	93.8	95.3	96.8	98.4	100.0	100.0	100.0	100.0	100.0	100.0	6.5	6.5	1.6	1.6	0.0	3.2
22	Mainland total	78.4	81.0	83.7	86.5	89.5	90.3	91.1	91.9	92.9	93.8	5.2	5.2	3.2	3.3	1.0	3.6
<u> </u>		-															

Source: Study results of Task Force Team

# 2.8.6 Regional power demand

# Table 2-23: Regional power demand (Base case)

																Unit	GWh
		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1	Dodoma	132	158	179	204	232	270	291	314	341	369	401	441	485	533	586	644
2	Arusha	356	483	587	708	857	987	1,077	1,180	1,297	1,427	1,569	1,716	1,876	2,048	2,237	2,442
3	Kilimaniaro	157	199	226	266	316	348	368	391	417	444	473	513	556	603	653	708
4	Tanga	285	333	368	413	463	640	692	751	818	893	973	1,074	1,186	1.308	1,443	1,591
5	Morogoro	251	304	335	375	420	502	551	608	671	741	818	898	985	1.079	1.182	1.294
6	Pwani	158	257	309	368	426	482	569	674	788	915	1.062	1.165	1.278	1,402	1.538	1.687
7	Dar es Salaam	2 973	3 539	3 930	4 383	4 888	5 353	5 883	6 494	7 146	7 836	8 626	9 468	10 378	11 362	12 433	13 590
, 8	Lindi	17	31	44	58	72	95	107	120	135	151	168	186	206	228	253	280
9	Mtwara	43	58	53	68	77	94	109	127	148	171	197	219	244	272	303	337
10	Ruvuma	31	36	47	50	72	86	111	140	171	205	242	215	303	340	380	426
11	Iringa +Niombe	114	132	144	165	182	216	235	258	282	310	340	378	420	467	510	577
12	Mbova	211	307	366	426	402	556	610	684	759	840	977	1 019	1 121	1 232	1 354	1 / 99
12	Sincida	211		500			220	019	106	117	120	144	1,019	1,121	1,252	1,337	2,700
13	Jiliyua	125	175	242	204	272	00	90	100	642	130	015	101	1 042	1 170	1 222	1 509
14	Rulano - Katavi	125	20	242	504	5/3	72	501	307	102	115	120	922	1,043	1,179	1,333	1,300
15		19	30	39	51	127	154	177	32	103	262	120	220	130	170	190	210
10	Chimunga L Cimituu	20		/Z	90	702	154	700	203	231	1 027	290	1 270	1 410	1 507	1 776	1 097
1/	Shinyanga+ Simiyu	451	232	5/9	106	702	/13	790	203	940	1,037	1,130	1,270	1,419	1,56/	1,770	1,967
10	Nagera	207	109	152	190	203	260	1 071	353	416	494	1 776	020	091	2 204	044	933
19	Mwanza +Geita	307	415	528	631	741	938	1,0/1	1,199	1,335	1,524	1,776	1,963	2,168	2,394	2,644	2,917
20	Mara	159	190	222	257	295	387	439	482	541	595		/28	810	900	1,001	1,113
21	Mainland total	Z4	30	35	43	50	10 740	14 124	15 (70	17 272	10.250	79	22 574	90	97	21 455	24 606
		5,942	/,41/	8,510	9,759	11,181	12,740	14,134	15,670	17,373	19,258	21,394	23,574	25,963	28,576	31,455	34,606
22	Zanzibar	3/5	443	504	564	624	689	/52	824	896	970	1,044	1,110	1,176	1,252	1,320	1,398
	LOTAL						1 2 71 70 1			10 /611	/////2/	////	//	// / //		31115	36 111/21
	1 Otdi	0,517	7,859	9,014	10,322	11,000	13,420	14,880	10,494	16,209	20,220	22,433	24,004	27,139	29,020	52,775	50,004
	- Cear	2031	2032	2033	2034	2035	2036	2037	2038	2039	20,220	2015/20	2020/25	2025/30	2030/35	2035/40	2015/40
1	Dodoma	2031 708	2032 780	9,014 2033 857	<u>2034</u> 943	2035 1.037	2036 1.125	2037 1.210	2038 1.301	2039 1,400	20,223 2040 1,506	2015/20 15.4	24,084 2020/25 8.2	27,139 2025/30 9.9	29,828 2030/35 10.0	<u>2035/40</u> 7.8	<u>2015/40</u> 10.2
1	Dodoma Arusha	2031 708 2.664	7,839 2032 780 2,905	9,014 2033 857 3,166	2034 943 3,449	2035 1,037 3,756	2036 1,125 4,084	14,888 2037 1,210 4,440	2038 1,301 4,825	2039 1,400 5,241	20,228 2040 1,506 5,691	2015/20 15.4 22.6	2020/25 8.2 9.7	2025/30 9.9 9.3	2030/35 10.0 9.0	2035/40 7.8 8.7	2015/40 10.2 11.7
1 2 3	Dodoma Arusha Kilimaniaro	2031 708 2,664 768	7,839 2032 780 2,905 833	9,014 2033 857 3,166 903	2034 943 3,449 979	2035 1,037 3,756 1,063	2036 1,125 4,084 1,152	2037 1,210 4,440 1,250	2038 1,301 4,825 1,355	2039 1,400 5,241 1,469	20,228 2040 1,506 5,691 1,593	2015/20 15.4 22.6 17.2	2020/25 8.2 9.7 6.4	2025/30 9.9 9.3 8.4	2030/35 10.0 9.0 8.5	2035/40 7.8 8.7 8.4	2015/40 10.2 11.7 9.7
1 2 3 4	Dodoma Arusha Kilimanjaro Tanga	2031 708 2,664 768 1.755	2032 780 2,905 833 1,935	9,014 2033 857 3,166 903 2,132	10,322 2034 943 3,449 979 2,349	2035 1,037 3,756 1,063 2,588	2036 1,125 4,084 1,152 2,803	2037 1,210 4,440 1,250 3,035	2038 1,301 4,825 1,355 3,286	2039 1,400 5,241 1,469 3,557	20,228 2040 1,506 5,691 1,593 3,849	2015/20 15.4 22.6 17.2 17.6	2020/25 8.2 9.7 6.4 8.8	2025/30 9.9 9.3 8.4 10.3	2030/35 10.0 9.0 8.5 10.2	2035/40 7.8 8.7 8.4 8.3	2015/40 10.2 11.7 9.7 11.0
1 2 3 4 5	Dodoma Arusha Kilimanjaro Tanga Morogoro	2031 708 2,664 768 1,755 1 415	7,839 2032 780 2,905 833 1,935 1,547	9,014 2033 857 3,166 903 2,132 1,689	2034 943 3,449 979 2,349 1,843	2035 1,037 3,756 1,063 2,588 2,011	2036 1,125 4,084 1,152 2,803 2,181	14,886 2037 1,210 4,440 1,250 3,035 2,365	2038 1,301 4,825 1,355 3,286 2,562	2039 1,400 5,241 1,469 3,557 2,775	20,228 2040 1,506 5,691 1,593 3,849 3,003	2015/20 15.4 22.6 17.2 17.6 14.9	2020/25 8.2 9.7 6.4 8.8 10.3	2025/30 9.9 9.3 8.4 10.3 9.6	2030/35 10.0 9.0 8.5 10.2 9.2	2035/40 7.8 8.7 8.4 8.3 8.3	2015/40 10.2 11.7 9.7 11.0 10.4
1 2 3 4 5 6	Dodoma Arusha Kiimanjaro Tanga Morogoro Pwani	2031 708 2,664 768 1,755 1,415 1.853	7,839 2032 780 2,905 833 1,935 1,547 2,036	2033 857 3,166 903 2,132 1,689 2,239	2034 943 3,449 979 2,349 1,843 2,463	2035 1,037 3,756 1,063 2,588 2,011 2,709	2036 1,125 4,084 1,152 2,803 2,181 2,944	2037 1,210 4,440 1,250 3,035 2,365 3,199	2038 1,301 4,825 1,355 3,286 2,562 3,477	2039 1,400 5,241 1,469 3,557 2,775 3,779	20,228 2040 1,506 5,691 1,593 3,849 3,003 4,110	2015/20 15.4 22.6 17.2 17.6 14.9 24.9	2020/25 8.2 9.7 6.4 8.8 10.3 17.1	2025/30 9.9 9.3 8.4 10.3 9.6 9.7	2030/35 10.0 9.0 8.5 10.2 9.2 9.9	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.3	2015/40 10.2 11.7 9.7 11.0 10.4 13.9
1 2 3 4 5 6 7	Dodoma Arusha Kiimanjaro Tanga Morogoro Pwani Dar es Sabam	0,317 2031 708 2,664 768 1,755 1,415 1,853 14.841	7,839 2032 780 2,905 833 1,935 1,547 2,036 16,196	2033 857 3,166 903 2,132 1,689 2,239 17,657	2034 943 3,449 979 2,349 1,843 2,463 19,236	2035 1,037 3,756 1,063 2,588 2,011 2,709 20,946	2036 1,125 4,084 1,152 2,803 2,181 2,944 22,875	2037 1,210 4,440 1,250 3,035 2,365 3,199 24,967	2038 1,301 4,825 1,355 3,286 2,562 3,477 27,237	2039 1,400 5,241 1,469 3,557 2,775 3,779 29,692	20,223 2040 1,506 5,691 1,593 3,849 3,003 4,110 32,352	2015/20 15.4 22.6 17.2 17.6 14.9 24.9 12.5	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1	2015/40 10.2 11.7 9.7 11.0 10.4 13.9 10.0
1 2 3 4 5 6 7 7 8	Dodoma Arusha Kilmanjaro Tanga Morogoro Pwani Dar es Sakam Lindi	0,317 2031 708 2,664 768 1,755 1,415 1,853 14,841 311	2,905 2,905 833 1,935 1,547 2,036 16,196 344	2033 857 3,166 903 2,132 1,689 2,239 17,657 382	2034 943 3,449 979 2,349 1,843 2,463 19,236 424	2035 1,037 3,756 1,063 2,588 2,011 2,709 20,946 471	2036 1,125 4,084 1,152 2,803 2,181 2,944 22,875 519	2037 1,210 4,440 1,250 3,035 2,365 3,199 24,967 572	2038 1,301 4,825 1,355 3,286 2,562 3,477 27,237 632	2039 1,400 5,241 1,469 3,557 2,775 3,779 29,692 697	20,223 2040 1,506 5,691 1,593 3,849 3,003 4,110 32,352 770	2015/20 15.4 22.6 17.2 17.6 14.9 24.9 12.5 40.5	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1 10.4	2015/40 10.2 11.7 9.7 11.0 10.4 13.9 10.0 16.4
1 2 3 4 5 6 6 7 7 8 9 9	Dodoma Arusha Kilmanjaro Tanga Morogoro Pwani Dar es Sabaam Lindi Mtwara	2031 708 2,664 768 1,755 1,415 1,853 14,841 311 376	2032 780 2,905 833 1,935 1,547 2,036 16,196 16,196 344 419	9,014 2033 857 3,166 903 2,132 1,689 2,239 17,657 382 467	2034 943 3,449 979 2,349 1,843 2,463 19,236 424 521	2035 1,037 3,756 1,063 2,588 2,011 2,709 20,946 471 580	2036 1,125 4,084 1,152 2,803 2,181 2,944 22,875 519 646	2037 1,210 4,440 1,250 3,035 2,365 3,199 24,967 572 720	2038 1,301 4,825 1,355 3,286 2,562 3,477 27,237 632 803	2039 1,400 5,241 1,469 3,557 2,775 3,779 29,692 697 896	20,220 2040 1,506 5,691 1,593 3,849 3,003 4,110 32,352 770 999	2015/20 15.4 22.6 17.2 17.6 14.9 24.9 12.5 40.5 16.8	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 11.5	2035/40 7.8 8.7 8.4 8.3 8.3 8.7 9.1 10.4 11.5	2015/40 10.2 11.7 9.7 11.0 10.4 13.9 10.0 16.4 13.4
1 2 3 4 5 6 7 8 9 9 10	Dodoma Arusha Kiimanjaro Tanga Morogoro Pwani Dar es Sakaam Lindi Mtwara Ruvuma	2031 708 2,664 7,68 1,755 1,415 1,853 14,841 311 376 477	2032 780 2,905 833 1,935 1,547 2,036 16,196 344 419 535	2033 857 3,166 903 2,132 1,689 2,239 17,657 382 467 599	10,322 2034 943 3,449 979 2,349 1,843 2,463 19,236 424 521 670	2035 1,037 3,756 1,063 2,588 2,011 2,709 20,946 471 580 750	2036 1,125 4,084 1,152 2,803 2,181 2,944 22,875 519 646 828	2037 1,210 4,440 1,250 3,035 2,365 3,199 24,967 572 720 914	2038 1,301 4,825 1,355 3,286 2,562 3,477 27,237 632 803 1,008	2039 1,400 5,241 1,469 3,557 2,775 3,779 29,692 697 896 1,112	20,223 2040 1,506 5,691 1,593 3,849 3,003 4,110 32,352 770 999 92 2,226	2015/20 15.4 22.6 17.2 17.6 14.9 24.9 12.5 40.5 16.8 22.6	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 11.5 12.0	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.3	2015/40 10.2 11.7 9.7 11.0 10.4 13.9 10.0 16.4 13.4 13.4
1 2 3 4 5 6 7 8 9 9 9 10 11	Dodoma Arusha Kilimanjaro Tanga Morogoro Pwani Dar es Sakam Lindi Mtwara Ruvuma Iringa + Niombe	2031 708 2,664 768 1,755 1,415 1,853 14,841 311 376 477 642	2032 780 2,905 833 1,935 1,547 2,036 16,196 344 419 535 713	2033 857 3,166 903 2,132 1,689 2,239 17,657 382 467 599 791	10,322 2034 943 3,449 979 2,349 1,843 2,463 19,236 424 521 670 877	2035 1,037 3,756 1,063 2,588 2,011 2,709 20,946 471 580 750 973	2036 1,125 4,084 1,152 2,803 2,181 2,944 22,875 519 646 828 1,051	2037 1,210 4,440 1,250 3,035 2,365 3,199 24,967 572 720 914 1,136	2038 1,301 4,825 1,355 3,286 2,562 3,477 27,237 632 803 1,008 1,227	2039 1,400 5,241 1,469 3,557 2,775 3,779 29,692 697 896 1,112 1,325	20,223 2040 1,506 5,691 1,593 3,849 3,003 4,110 32,352 770 999 1,226 1,430	2015/20 15.4 22.6 17.2 17.6 14.9 12.5 40.5 16.8 22.6 13.6	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 11.5 12.0 11.0	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 9.1 10.4 11.5 10.3 8.0	2015/40 10.2 11.7 9.7 11.0 10.4 13.9 10.0 16.4 13.4 15.8 10.6
1 2 3 4 5 6 6 7 8 8 9 9 10 11 12	Dodoma Arusha Kilimanjaro Tanga Morogoro Pwani Dar es Sabaam Lindi Mtwara Ruvuma Iringa +Njombe Mbeya	2031 708 2,664 768 1,755 1,415 1,853 14,841 311 376 477 642 1,636	2032 780 2,905 833 1,935 1,547 2,036 16,196 344 419 535 713 1,799	2033 857 3,166 903 2,132 1,689 2,239 17,657 382 467 599 791 1,978	10,322 2034 943 3,449 979 2,349 1,843 2,463 19,236 424 521 670 877 2,176	2035 1,037 3,756 1,063 2,588 2,011 2,709 20,946 471 580 750 973 2,392	2036 1,125 4,084 1,152 2,803 2,181 2,944 22,875 519 646 828 1,051 2,595	2037 1,210 4,440 1,250 3,035 2,365 3,199 24,967 572 720 914 1,136 2,815	2038 1,301 4,825 1,355 3,286 2,562 3,477 27,237 632 803 1,008 1,227 3,053	2039 1,400 5,241 1,469 3,557 2,775 3,779 29,692 697 896 1,112 1,325 3,310	20,223 2040 1,506 5,691 1,593 3,849 3,003 4,110 32,352 770 999 1,226 1,430 3,590	2015/20 15.4 22.6 17.2 17.6 14.9 24.9 12.5 40.5 16.8 22.6 13.6 21.4	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2 9.9	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 11.5 12.0 11.0 10.0	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5	2015/40 10.2 11.7 9.7 11.0 10.4 13.9 10.0 16.4 13.4 15.8 10.6 12.0
1 2 3 4 4 5 6 7 8 8 9 10 10 11 12 13	Dodoma Arusha Kilimanjaro Tanga Morogoro Pwani Dar es Salaam Lindi Mtwara Ruvuma Iringa + Njombe Mbeya Singida	2031 708 2,664 768 1,755 1,415 1,853 14,841 311 376 477 642 1,636 287	2032 780 2,905 833 1,935 1,547 2,036 16,196 344 419 535 713 1,799 322	2033 857 3,166 903 2,132 1,689 2,239 17,657 382 467 599 791 1,978 362	10,322 2034 943 3,449 979 2,349 1,843 2,463 19,236 424 521 670 877 2,176 406	2035 1,037 3,756 1,063 2,588 2,011 2,709 20,946 471 580 750 973 2,392 455	2036 1,125 4,084 1,152 2,803 2,181 2,944 22,875 519 646 828 1,051 2,595 495	2037 1,210 4,440 1,250 3,035 2,365 3,199 24,967 572 720 914 1,136 2,815 539	2038 1,301 4,825 1,355 3,286 2,562 3,477 27,237 632 803 1,008 1,227 3,053 587	2039 1,400 5,241 1,469 3,557 2,775 3,779 29,692 697 896 1,112 1,325 3,310 638	20,220 2040 1,506 5,691 1,593 3,849 3,003 4,110 32,352 770 999 1,226 1,430 3,590 693	2015/20 15.4 22.6 17.2 17.6 14.9 24.9 12.5 40.5 16.8 22.6 13.6 21.4 16.9	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2 9.9 9.12.2	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 11.5 12.0 11.0 11.0 10.0 12.2	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.3 9.1 10.4 11.5 10.3 8.0 8.5 8.8	2015/40 10.2 11.7 9.7 11.0 10.4 13.9 10.0 16.4 13.4 13.4 15.8 10.6 12.0 12.1
1 2 3 3 4 4 5 6 6 7 7 8 8 9 9 10 11 11 12 13 14	Dodoma Arusha Kiimanjaro Tanga Morogoro Pwani Dar es Sakaam Lindi Mtwara Ruvuma Iringa +Njombe Mbeya Singida Tabora	2031 708 2,664 768 1,755 1,415 1,853 14,841 311 376 477 642 1,636 287 1,704	2032 780 2,905 833 1,935 1,547 2,036 16,196 344 419 535 713 1,799 322 1,926	2033 857 3,166 903 2,132 1,689 2,239 17,657 382 467 599 791 1,978 362 2,174	10,322 2034 943 3,449 979 2,349 1,843 2,463 19,236 424 521 670 877 2,176 406 2,453	2035 1,037 3,756 1,063 2,588 2,011 2,709 20,946 471 580 750 750 973 2,392 455 2,767	2036 1,125 4,084 1,152 2,803 2,181 2,944 22,875 519 646 828 1,051 2,595 495 3,066	14,886 2037 1,210 4,440 1,250 3,035 2,365 2,365 3,199 24,967 572 720 914 1,136 2,815 539 3,398	10,494 2038 1,301 4,825 1,355 3,286 2,562 3,477 27,237 632 803 1,008 1,227 3,053 587 3,764	2039 1,400 5,241 1,469 3,557 2,775 3,779 29,692 697 896 1,112 1,325 3,310 638 4,167	20,223 2040 1,506 5,691 1,593 3,849 3,003 4,110 32,352 770 999 1,226 1,430 3,590 693 4,611	2015/20 15.4 22.6 17.2 17.6 14.9 24.9 12.5 40.5 16.8 22.6 13.6 21.4 16.9 28.8	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4 13.1	2025/30 9.9 9.3 8.4 10.3 9.7 9.5 10.7 11.4 12.0 11.2 9.9 12.2 13.1	2030/35 10.0 9.0 9.0 9.2 9.9 9.0 10.9 11.5 12.0 11.0 11.0 11.0 12.2 12.9	2035/40 7.8 8.7 8.4 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 8.8 8.10.8	2015/40 10.2 11.7 9.7 11.0 10.4 13.9 10.0 16.4 13.4 15.8 10.6 12.0 12.1 15.5
1 2 3 3 4 4 5 6 7 7 8 8 9 9 10 11 1 12 13 14	Dodoma Arusha Kiimanjaro Tanga Morogoro Pwani Dar es Sakaam Lindi Mtwara Ruvuma Iringa + Njombe Mbeya Singida Tabora Rukwa + Katavi	2031 708 2,664 768 1,755 1,415 14,853 14,841 311 376 477 642 1,636 287 1,704 243	2032 780 2,905 833 1,935 1,547 2,036 16,196 344 419 535 713 1,799 322 1,926 271	2033 857 3,166 903 2,132 1,689 2,239 17,657 382 467 599 791 1,978 362 2,174 302	10,322 2034 943 3,449 979 2,349 1,843 2,463 19,236 424 521 670 877 2,176 406 2,453 337	2035 1,037 3,756 1,063 2,588 2,011 2,709 20,946 471 580 750 973 2,392 455 2,767 376	2036 1,125 4,084 1,152 2,803 2,181 2,944 22,875 519 646 828 1,051 2,595 495 3,066 426	2037 1,210 4,440 1,250 3,035 2,365 3,199 24,967 572 720 914 1,136 2,815 539 3,398 483	2038 1,301 4,825 1,355 3,286 2,562 3,477 27,237 632 803 1,008 1,227 3,053 587 3,764 550	2039 1,400 5,241 1,469 3,557 2,775 29,692 697 896 1,112 1,325 3,310 638 4,167 629	20,223 2040 1,506 5,691 1,593 3,849 3,003 4,110 32,352 770 999 1,226 1,430 3,590 693 4,611 721	2015/20 15.4 22.6 17.2 17.6 14.9 12.5 40.5 16.8 22.6 13.6 21.4 16.9 28.8 31.4	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4 13.1 11.9	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2 9.9 12.2 13.1 11.2	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 11.5 12.0 11.0 11.0 10.0 12.2 12.9 11.5	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 8.8 8.10.8 13.9	2015/40 10.2 11.7 9.7 11.0 10.4 13.9 10.0 16.4 13.4 15.8 10.6 12.0 12.1 15.5 15.7
1 2 3 3 4 5 6 6 7 7 7 7 8 9 9 10 11 12 2 13 14 15 16	Dodoma Arusha Kiimanjaro Tanga Morogoro Pwani Dar es Sabaam Lindi Mtwara Ruvuma Iringa + Njombe Mtwara Ruvuma Singida Tabora Rukwa + Katavi Kiaoma	0,317 2031 708 2,664 768 1,755 1,415 1,853 14,841 376 477 642 1,636 287 1,704 243 556	2032 780 2,905 833 1,935 1,547 2,036 16,196 344 419 535 713 1,799 322 1,926 271 618	9,014 2033 857 3,166 903 2,132 1,689 2,239 17,657 382 467 599 791 1,978 362 2,174 302 687	10,322 2034 943 3,449 979 2,349 1,843 2,463 19,236 424 521 670 877 2,176 406 2,453 337 763	2035 1,037 3,756 1,063 2,588 2,011 2,709 20,946 471 580 750 973 2,392 455 2,767 376 848	2036 1,125 4,084 1,152 2,803 2,181 2,944 22,875 519 646 828 1,051 2,595 495 3,066 426 921	2037 1,210 4,440 1,250 3,035 2,365 3,199 24,967 572 720 914 1,136 2,815 539 3,398 483 1,000	2038 1,301 4,825 1,355 3,286 2,562 3,477 27,237 632 803 1,008 1,227 3,053 587 3,764 550 1,086	2039 1,400 5,241 1,469 3,557 2,775 3,779 29,692 697 1,112 1,325 3,310 638 4,167 629 1,178	20,220 2040 1,506 5,691 1,593 3,849 3,003 4,110 32,352 770 999 1,226 1,430 3,590 693 4,611 721 1,278	2015/20 15.4 22.6 17.2 17.6 14.9 24.9 12.5 40.5 16.8 22.6 13.6 21.4 16.9 28.8 31.4 40.7	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4 13.1 11.9 13.9	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2 9.9 9.12.2 13.1 11.2 11.0	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.9 9.0 10.9 11.5 12.0 11.0 10.0 10.0 12.2 12.9 11.5 11.1	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 8.8 10.8 13.9 8.5	2015/40 10.2 11.7 9.7 11.0 10.4 13.9 10.0 16.4 13.4 15.8 10.6 12.0 12.1 15.5 15.7 16.5
1 2 3 3 4 5 6 6 7 7 8 9 9 10 0 11 11 12 13 14 4 15 16 17	Dodoma Arusha Kiimanjaro Tanga Morogoro Pwani Dar es Sabam Lindi Mtwara Ruvuma Tringa +Njombe Mbeya Singida Tabora Rukwa +Katavi Kigoma Shinyanga + Simiyu	0,317 2031 708 2,664 768 1,755 1,415 1,853 14,841 311 376 477 642 1,636 287 1,704 243 556 2,225	2032 780 2,905 833 1,935 1,547 2,036 16,196 344 419 535 713 1,799 322 1,926 271 271 618 2,492	2033 857 3,166 903 2,132 1,689 2,239 17,657 382 467 599 791 1,978 362 2,174 362 2,174 302 687 2,792	10,322 2034 943 3,449 979 2,349 1,843 14,843 14,236 424 521 670 877 2,176 406 2,453 337 763 3,127	2035 1,037 3,756 1,063 2,588 2,011 2,709 20,946 471 580 750 973 2,392 455 2,767 376 848 848 83,503	2036 1,125 4,084 1,152 2,803 2,181 2,944 22,875 519 646 828 1,051 2,595 495 3,066 426 921 3,829	2037 1,210 4,440 1,250 3,035 2,365 2,365 2,365 2,365 24,967 572 720 914 1,136 2,815 539 3,398 483 1,000 4,185	10,494 2038 1,301 4,825 1,355 3,286 2,562 3,477 27,237 632 803 1,008 1,227 3,053 587 3,764 550 1,086 4,572	2039 1,400 5,241 1,469 3,557 2,775 3,779 29,692 697 896 1,112 1,325 3,310 638 4,167 629 1,178 4,994	20,223 2040 1,506 5,691 1,593 3,849 3,003 4,110 32,352 770 999 1,226 1,430 3,590 693 4,611 721 1,278 5,453	2015/20 15.4 22.6 17.2 17.6 14.9 12.5 16.8 22.6 13.6 21.4 16.9 28.8 31.4 40.7 9.6	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4 13.1 11.9 13.9 9,8	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2 9.9 12.2 13.1 11.2 11.2 11.2 11.1 11.2	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 11.5 12.0 11.0 12.2 12.9 11.5 12.1 11.1 12.2	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 8.8 8.0 8.5 8.8 8 10.8 13.9 8.5 9.3	2015/40 10.2 11.7 9.7 11.0 10.4 13.9 10.0 16.4 13.4 13.4 15.8 10.6 12.0 12.1 15.5 15.7 16.5 10.5
1 2 3 3 4 4 5 6 6 7 7 8 8 9 9 100 111 12 13 14 4 15 16 6 17 7	Dodoma Arusha Kiimanjaro Tanga Morogoro Pwani Dar es Sabaam Lindi Mtwara Ruvuma Iringa + Njombe Mbeya Singida Tabora Rukwa + Katavi Kigoma Shinyanga + Simiyu Kaqera	2031 708 2,664 768 1,755 1,415 1,853 14,841 311 376 477 642 1,636 287 1,704 243 556 2,225 2,225 1,033	2032 780 2,905 833 1,935 1,547 2,036 16,196 344 419 535 713 1,799 322 1,926 271 618 2,492 1,144	2033 857 3,166 903 2,132 1,689 2,239 17,657 382 467 599 791 1,978 362 2,174 302 687 2,792 2,792	10,322 2034 943 3,449 979 2,349 1,843 2,463 19,236 424 521 670 877 2,176 406 2,453 337 763 3,127 1,407	2035 1,037 3,756 1,063 2,588 2,011 2,709 20,946 471 580 750 750 973 2,392 455 2,767 376 848 3,503 1,560	2036 1,125 4,084 1,152 2,803 2,181 2,944 22,875 519 646 828 1,051 2,595 495 3,066 426 921 3,829 1,724	14,886 2037 1,210 4,440 1,250 3,035 2,365 2,365 3,199 24,967 572 720 914 1,136 2,815 539 3,398 483 1,000 4,185 1,908	2038 1,301 4,825 1,355 3,286 2,562 3,477 27,237 632 803 1,008 1,227 3,053 587 3,764 550 1,086 4,572 2,115	2039 1,400 5,241 1,469 3,557 2,775 3,779 29,692 697 896 1,112 1,325 3,310 638 4,167 629 1,178 4,994 2,347	20,223 2040 1,506 5,691 1,593 3,849 3,003 4,110 32,352 770 999 1,226 1,430 3,590 693 4,611 721 1,278 5,453 2,610	2015/20 15.4 22.6 17.2 17.6 14.9 24.9 12.5 40.5 16.8 22.6 13.6 21.4 16.9 28.8 31.4 40.7 9.6 33.0	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4 13.1 11.9 13.9 9.8 16.9	2025/30 9.9 9.3 8.4 10.3 9.7 9.7 9.5 10.7 11.4 12.0 11.2 9.9 9.2 13.1 11.2 13.1 11.2 13.1 11.2 13.1 11.0 11.8 10.5	2030/35 10.0 9.0 9.0 9.2 9.9 9.0 10.9 11.5 12.0 11.0 11.0 11.0 11.0 11.2 12.9 11.5 11.1 11.1 12.0 10.8	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 8.8 8.0 8.5 8.8 10.8 13.9 8.5 9.3 10.8	2015/40 10.2 11.7 9.7 11.0 10.4 13.9 10.0 16.4 13.4 15.8 10.6 12.0 12.1 15.5 15.7 16.5 10.5 10.5 16.1
1 2 3 3 4 5 6 6 7 7 8 9 9 10 11 12 13 13 14 15 16 6 177 18	Dodoma Arusha Kilimanjaro Tanga Morogoro Pwani Dar es Sakaam Lindi Mtwara Ruvuma Iringa + Njombe Mbeya Singida Tabora Rukwa + Katavi Kigoma Shinyanga + Simiyu Kagera Mwanza + Geita	0,317 2031 708 2,664 768 1,755 1,415 1,853 14,841 376 477 642 1,636 287 1,704 243 556 2,225 1,033 3,219	2032 780 2,905 833 1,935 1,547 2,036 16,196 344 419 535 713 1,799 322 1,926 271 618 2,492 1,144 3,549	2033 857 3,166 903 2,132 1,689 2,239 17,657 382 467 599 791 1,978 362 2,174 302 687 2,792 1,268 3,912	10,322 2034 943 3,449 979 2,349 1,843 2,463 19,236 424 521 670 877 2,176 406 2,453 337 763 3,127 1,407 4,310	2035 1,037 3,756 1,063 2,588 2,011 2,709 20,946 471 580 750 973 2,392 455 2,767 376 848 848 3,503 1,560 4,746	2036 1,125 4,084 1,152 2,803 2,181 2,944 22,875 519 646 828 1,051 2,595 495 3,066 426 921 3,829 921 3,829 1,724 5,168	2037 1,210 4,440 1,250 3,035 2,365 3,199 24,967 572 720 914 1,136 2,815 539 3,398 4,83 1,000 4,185 1,908 5,625	2038 1,301 4,825 1,355 3,286 2,562 3,477 27,237 632 803 1,008 1,227 3,053 587 3,764 550 1,086 4,572 2,115 6,120	2039 1,400 5,241 1,469 3,557 2,775 3,779 29,692 697 896 1,112 1,325 3,310 638 4,167 629 1,178 4,994 2,347 6,656	20,228 2040 1,506 5,691 1,593 3,849 3,003 4,110 32,352 770 999 1,226 1,430 693 4,611 721 1,278 5,453 2,610 7,238	2015/20 15.4 22.6 17.2 17.6 14.9 24.9 12.5 40.5 16.8 22.6 13.6 21.4 16.9 28.8 31.4 40.7 9.6 33.0 25.1	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4 13.1 11.9 13.9 9.8 16.9 13.6	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2 11.2 11.2 11.0 11.8 10.5 10.4	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.9 10.9 11.5 12.0 11.0 10.0 12.2 12.9 11.5 12.0 11.0 10.0 12.2 12.9 11.5 12.0 11.0 10.0 10.2 11.5 11.5 12.0 10.0 10.5 10.2 10.5 10.2 10.5 10.2 10.5 10.2 10.5 10.2 10.5 10.2 10.9 10.5 10.2 10.9 10.0 10.5 10.0 10.0 10.0 10.0 10.0 10.0 10.5 10.0 10	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 8.8 10.8 8.5 8.8 13.9 8.5 9.3 10.8 8.8 8.8	2015/40 10.2 11.7 9.7 11.0 10.4 13.9 10.0 16.4 13.4 15.8 10.6 12.0 12.1 15.5 15.7 16.5 10.5 16.1 13.5
1 2 3 3 4 5 6 6 7 7 8 9 9 10 11 11 12 13 14 15 16 17 18 19 9 200	Dodoma Arusha Kilimanjaro Tanga Morogoro Pwani Dar es Salaam Lindi Mtwara Ruvuma Iringa + Njombe Mbeya Singida Tabora Rukwa + Katavi Kigoma Shinyanga + Simiyu Kagera Mwanza + Gelta	2031 708 2,664 768 1,755 1,415 1,853 14,841 311 376 477 642 1,636 287 1,704 243 556 2,225 1,033 3,219 1,237	2032 780 2,905 833 1,935 1,547 2,036 16,196 344 419 535 713 1,799 322 1,926 271 618 2,492 1,144 3,549 1,375	2033 857 3,166 903 2,132 1,689 17,657 382 467 599 791 1,978 362 2,174 302 687 2,174 302 687 2,792 1,268 3,912	10,322 2034 943 3,449 979 2,349 1,843 2,463 19,236 424 521 670 877 2,176 406 2,453 337 763 3,127 1,407 4,310 1,697	2035 1,037 3,756 1,063 2,588 2,011 2,709 20,946 471 580 750 973 2,392 455 2,767 376 848 848 3,503 1,560 4,746 1,884	2036 1,125 4,084 1,152 2,803 2,181 2,944 22,875 519 646 828 1,051 2,595 495 3,066 426 921 3,829 1,724 5,168 2,047	2037 1,210 4,440 1,250 3,035 2,365 3,199 24,967 572 720 914 1,136 2,815 539 3,398 483 1,000 4,185 1,908 5,625	2038 1,301 4,825 1,355 3,286 2,562 3,477 27,237 632 803 1,008 1,227 3,053 587 3,764 550 1,086 4,572 2,115 6,120 2,415	2039 1,400 5,241 1,469 3,557 2,775 3,779 29,692 697 896 1,112 1,325 3,310 638 4,167 629 1,178 4,994 2,347 6,656	20,220 2040 1,506 5,691 1,593 3,849 3,003 4,110 32,352 770 999 1,226 1,430 3,590 693 4,611 721 1,278 5,453 2,610 7,238 2,846	2015/20 15.4 22.6 17.2 17.6 14.9 24.9 12.5 40.5 16.8 22.6 13.6 21.4 16.9 28.8 31.4 40.7 9.6 33.0 25.1 19.5	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4 13.1 11.9 9.8 10.4 13.9 13.9 9.8 16.9 13.6 11.1	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2 9.9 12.2 13.1 11.2 13.1 11.2 11.0 11.8 10.5 10.4	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 10.5 12.0 11.5 11.5 12.0 11.5 12.0 11.5 12.0 11.5 11.5 11.5 12.0 11.5 12.0 11.5 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.5 11.5 11.5 11.5 11.5 11.5 11.5 11.5 11.5 11.5 11.5 11.5 11.5 11.5 11.5 11.1 11.5 11.1 11.5 11.5 11.5 11.5 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 8.8 10.8 13.9 8.5 9.3 10.8 8.8 8.8 8.8 8.5 9.3 10.8 8.5 8.5 9.3 10.8 8.5 8.5 8.5 8.5 8.5 8.5 8.5 8.5 8.5 8	2015/40 10.2 11.7 9.7 11.0 10.4 13.9 10.0 16.4 13.4 15.8 10.6 12.0 12.1 15.5 15.5 15.5 16.5 10.5 16.1 13.5 12.2
1 2 3 3 4 5 6 6 7 7 8 9 9 10 11 11 12 13 14 4 15 16 177 18 19 20 21	Dodoma Arusha Kiimanjaro Tanga Morogoro Pwani Dar es Sabam Lindi Mtwara Ruvuma Tringa +Njombe Mbeya Singida Tabora Rukwa +Katavi Kigoma Shinyanga + Simiyu Kagera Mwanza +Geita Maryara	2031 708 2,664 768 1,755 1,415 1,853 14,841 311 376 477 642 1,636 287 1,704 243 556 2,225 1,033 3,219 1,237 118	2032 780 2,905 833 1,935 1,547 2,036 16,196 344 419 535 713 1,799 322 1,926 271 618 2,492 1,144 3,549 1,375 127	2033 857 3,166 903 2,132 1,689 2,239 17,657 382 467 599 791 1,978 362 2,174 302 687 2,792 1,268 3,912 1,528 136	10,322 2034 943 3,449 979 2,349 1,843 19,236 424 521 670 877 2,176 406 2,453 337 763 3,127 1,407 4,310 1,697 145	2035 1,037 3,756 1,063 2,588 2,011 2,709 20,946 471 580 750 973 2,392 455 2,767 376 848 3,503 1,560 4,746 1,884	2036 1,125 4,084 1,152 2,803 2,181 2,944 22,875 519 646 828 1,051 2,595 495 3,066 426 921 3,829 1,724 5,168 2,047 166	2037 1,210 4,440 1,250 3,035 2,365 2,365 2,365 2,365 24,967 572 720 914 1,136 2,815 539 3,398 483 1,000 4,185 1,908 5,625 2,224 176	2038 1,301 4,825 1,355 3,286 2,562 3,477 27,237 632 803 1,008 1,227 3,053 587 3,764 550 1,086 4,572 2,115 6,120 2,415 188	2039 1,400 5,241 1,469 3,557 2,775 3,779 29,692 697 896 1,112 1,325 3,310 638 4,167 629 1,178 4,994 2,347 6,656 2,622 200	20,223 2040 1,506 5,691 1,593 3,849 3,003 4,110 32,352 770 999 1,226 1,430 3,590 693 4,611 721 1,278 5,453 2,610 7,238 2,846 213	2015/20 15.4 22.6 17.2 17.6 14.9 24.9 12.5 40.5 16.8 22.6 13.6 21.4 16.9 28.8 31.4 40.7 9.6 33.0 25.1 19.5 19.2	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4 13.1 11.9 13.9 9.8 16.9 13.6 11.1 6.5	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2 9.9 12.2 13.1 11.2 11.2 11.0 11.8 10.5 10.4 11.2 7.0	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 11.5 12.0 11.0 12.2 12.9 11.5 11.1 12.0 10.0 10.2 12.2 12.9 11.5 12.0 10.8 10.8 10.7 10.8 10.7 10.8 10.7 10.8 10.7 10.8 10.7 10.8 10.7 10.8 10.7 10.8 10.7 10.8 10.7 10.7 10.8 10.7 10.8 10.7 10.7 10.8 10.7 10.7 10.8 10.7 10.7 10.8 10.7 10.8 10.7 10.7 10.8 10.7 10.7 10.8 10.7 10.7 10.8 10.7 10.7 10.8 10.7 10.7 10.8 10.7 10.7 10.8 10.8 10.7 10.8 10.8 10.7 10.8 10.	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 8.8 8.0 8.5 8.8 8.10.8 13.9 8.5 9.3 10.8 8.5 8.8 8.8 6.5	2015/40 10.2 11.7 9.7 11.0 10.4 13.9 10.0 16.4 13.4 15.8 10.6 12.0 12.1 15.5 15.7 16.5 15.7 16.5 10.5 16.1 13.5 2.2 9.1
1 2 3 3 4 4 5 6 6 7 7 8 8 9 9 10 0 111 12 13 14 4 15 16 16 17 7 8 8 9 9 20 0 21	Dodoma Arusha Kiimanjaro Tanga Morogoro Pwani Dar es Sakaam Lindi Mtwara Ruvuma Iringa +Njombe Mbeya Singida Tabora Rukwa +Katavi Kigoma Shinyanga + Simiyu Kagera Mwanza +Geita Mara Manyara Mainland total	2031 708 2,664 768 1,755 1,415 1,853 14,841 311 376 477 642 1,636 287 1,704 243 556 2,225 1,033 3,219 1,237 118 38,068	2032 780 2,905 833 1,935 1,547 2,036 16,196 344 419 535 713 1,799 322 1,926 271 618 2,492 1,144 3,549 1,375 127 41,866	2033 857 3,166 903 2,132 1,689 2,239 17,657 382 467 599 791 1,978 362 2,174 302 687 2,792 2,792 1,268 3,912 1,528 3,912 1,528 3,612 2,622	10,322 2034 943 3,449 979 2,349 1,843 2,463 19,236 424 521 670 877 2,176 406 2,453 337 763 3,127 1,407 4,310 1,697 145 50,577	2035 1,037 3,756 1,063 2,588 2,011 2,709 20,946 471 580 750 973 2,392 455 2,767 376 848 3,503 1,560 4,746 1,884 156 55,571	2036 1,125 4,084 1,152 2,803 2,181 2,944 22,875 519 646 828 1,051 2,595 495 3,066 426 921 3,829 1,724 5,168 2,047 166 60,648	14,886 2037 1,210 4,440 1,250 3,035 2,365 2,365 3,199 24,967 572 720 914 1,136 2,815 539 914 1,136 2,815 539 3,398 483 1,000 4,185 1,908 5,625 2,224 176 66,159	2038 1,301 4,825 1,355 3,286 2,562 3,477 27,237 632 803 1,008 1,227 3,053 587 3,764 550 1,086 4,572 2,115 6,120 2,415 188 72,164	2039 1,400 5,241 1,469 3,557 2,775 3,779 29,692 697 896 1,112 1,325 3,310 638 4,167 629 1,178 4,994 2,347 6,656 2,622 200 78,6682	20,228 2040 1,506 5,691 1,593 3,849 3,003 4,110 32,352 770 999 1,226 1,430 3,590 693 4,611 721 1,278 5,453 2,610 7,238 2,846 213 85,783	2015/20 15.4 22.6 17.2 17.6 14.9 24.9 12.5 40.5 16.8 22.6 13.6 21.4 16.9 28.8 31.4 40.7 9.6 33.0 25.1 19.5 19.2 16.5	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4 13.1 11.9 13.9 9.8 16.9 13.6 11.1 6.5 10.9	2025/30 9.9 9.3 8.4 10.3 9.5 10.7 11.4 12.0 11.2 9.9 12.2 13.1 11.2 13.1 11.2 13.1 11.2 11.0 11.8 10.5 10.4 11.2 10.4 11.2 10.5 10.4 11.2 10.5 10.4 11.2 10.5 10.4 11.2 10.5 10.5 10.4 11.2 10.5 10.5 10.5 10.5 10.5 10.5 10.5 10.5	2030/35 10.0 9.0 9.0 9.2 9.9 9.9 9.0 10.9 11.5 12.0 11.0 11.0 11.0 12.2 12.9 11.5 11.1 11.1 12.0 10.8 10.2 11.1 1.5 11.1 1.5 11.1 1.5 11.1 1.5 1.5	2035/40 7.8 8.7 8.4 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 8.8 8.0 8.5 8.8 10.8 13.9 8.5 9.3 10.8 8.5 9.3 10.8 8.5 9.3 9.5 9.1	2015/40 10.2 11.7 9.7 11.0 10.4 13.9 10.0 16.4 13.4 15.8 10.6 12.0 12.1 15.5 15.7 16.5 10.5 10.5 16.1 13.5 12.2 9.1 11.3
1 2 3 3 4 5 6 6 7 7 8 9 9 10 11 12 2 13 14 15 16 6 177 18 19 9 20 20 21	Dodoma Arusha Kilimanjaro Tanga Morogoro Pwani Dar es Salaam Lindi Mtwara Ruvuma Iringa + Njombe Mbeya Singida Tabora Rukwa + Katavi Kigoma Shinyanga + Simiyu Kagera Mwanza + Geita Mara Manyara Manjand total Zanzibar	0,317           2031           708           2,664           768           1,755           1,415           1,853           14,841           311           376           477           642           1,636           287           1,704           243           556           2,225           1,033           3,219           1,237           118           38,068           1,475	2032 780 2,905 833 1,935 1,547 2,036 16,196 344 419 535 713 1,799 322 1,926 271 618 2,492 1,144 3,549 1,375 127 41,866 1,542	2033 857 3,166 903 2,132 1,689 2,239 17,657 382 467 599 791 1,978 362 2,174 302 687 2,792 1,978 3,912 1,528 3,912 1,528 136 46,022 1,617	10,322 2034 943 3,449 979 2,349 1,843 2,463 19,236 424 521 670 877 2,176 406 2,453 337 763 3,127 1,407 4,310 1,697 145 50,577 1,692	2035 1,037 3,756 1,063 2,588 2,011 2,709 20,946 471 580 750 973 2,392 455 2,767 376 848 848 3,503 1,560 4,746 1,884 156 55,571 1,767	2036 1,125 4,084 1,152 2,803 2,181 2,944 22,875 519 646 828 1,051 2,595 495 3,066 426 921 3,829 1,724 5,168 2,047 166 60,648 1,828	2037 1,210 4,440 1,250 3,035 2,365 3,199 24,967 572 720 914 1,136 2,815 539 3,398 483 1,000 4,185 1,908 4,185 1,908	2038 1,301 4,825 1,355 3,286 2,562 3,477 27,237 632 803 1,008 1,227 3,053 587 3,764 550 1,086 4,572 2,115 6,120 2,415 188 72,164 1,962	2039 1,400 5,241 1,469 3,557 2,775 3,779 29,692 697 1,112 1,325 3,310 638 4,167 638 4,167 629 1,1178 4,994 2,347 6,656 2,662 2,000 78,682 2,036	20,228 2040 1,506 5,691 1,593 3,849 3,003 4,110 32,352 770 999 1,226 1,430 693 4,611 721 1,278 5,453 2,610 7,238 2,846 213 85,783 2,098	2015/20 15.4 22.6 17.2 17.6 14.9 24.9 12.5 40.5 16.8 22.6 13.6 21.4 16.9 28.8 31.4 40.7 9.6 33.0 25.1 19.5 19.2 16.5 12.9	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4 13.1 11.9 9.5 10.8 10.4 13.1 11.9 9.8 16.9 13.6 11.1 6.5 5.6 5.8 8.7	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2 9.9 9.2 12.2 13.1 11.2 11.2 11.0 11.8 10.5 10.4 11.2 10.4 11.2 10.4 11.2 10.4	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.9 9.0 10.9 11.5 12.0 11.0 10.0 12.2 12.9 11.5 12.0 11.0 10.0 10.2 11.5 12.0 11.0 10.0 10.2 11.5 12.0 11.5 12.0 11.5 12.0 11.5 12.0 11.5 12.0 11.5 12.0 11.5 12.0 11.5 12.0 11.5 12.0 11.5 12.0 11.5 12.0 10.0 10.9 10.9 10.9 10.9 10.9 10.9 10.9 10.9 10.9 10.9 10.9 10.9 10.9 10.9 10.9 10.9 10.9 10.9 10.0 10.2 11.1 10.0 10.2 11.1 10.0 10.2 11.1 10.0 10.2 11.1 10.0 10.2 11.1 10.0 10.2 11.1 10.2 11.1 10.2 11.1 10.2 11.1 10.2 11.1 10.2 11.1 1.1 1.1 1.1 1.1 1.1 1.1	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 8.8 10.8 13.9 8.5 9.3 10.8 13.9 8.5 9.3 10.8 8.8 8.8 8.8 8.8 8.8 8.8 9.3 10.8 13.9 9.3 10.8 13.9 9.3 10.8 13.9 10.8 13.9 10.8 13.9 10.8 13.9 10.8 13.9 10.8 13.9 10.8 13.9 10.8 13.9 10.8 13.9 10.8 13.9 10.8 10.8 10.8 10.8 10.8 10.8 10.8 10.8	2015/40 10.2 11.7 9.7 11.0 10.4 13.9 10.0 16.4 13.9 10.0 16.4 13.4 15.8 10.6 12.0 12.1 15.5 15.7 16.5 10.5 16.5 10.5 16.5 10.5 16.5 10.5 12.2 9.1 11.3 7.1

Source: Study results of Task Force Team

# 2.8.7 Regional peak demand

# Table 2-24: Regional peak demand (Base)

															Uni	t: MW
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1 Dodoma	20	25	29	33	38	44	47	51	56	60	65	72	79	87	96	105
2 Arusha	55	77	94	116	140	161	176	192	211	233	256	280	306	334	365	398
3 Kilimanjaro	24	32	36	43	52	57	60	64	68	72	77	84	91	98	107	115
4 Tanga	44	53	59	67	76	104	113	122	133	146	159	175	193	213	235	259
5 Morogoro	39	48	54	61	69	82	90	99	109	121	133	146	161	176	193	211
6 Pwani	24	41	50	60	69	79	93	110	129	149	173	190	208	229	251	275
7 Dar es Salaam	459	561	632	715	797	873	959	1,059	1,165	1,278	1,407	1,544	1,693	1,853	2,027	2,216
8 Lindi	3	5	7	9	12	16	17	20	22	25	27	30	34	37	41	46
9 Mtwara	7	9	8	11	13	15	18	21	24	28	32	36	40	44	49	55
10 Ruvuma	5	6	8	10	12	14	18	23	28	33	39	44	49	55	62	69
11 Iringa +Njombe	18	21	23	27	30	35	38	42	46	51	55	62	69	76	85	94
12 Mbeya	33	49	59	70	80	91	101	112	124	137	151	166	183	201	221	243
13 Singida	6	8	9	10	11	14	16	17	19	21	23	26	29	33	37	42
14 Tabora	19	28	39	50	61	72	82	93	105	118	133	150	170	192	217	246
15 Rukwa +Katavi	3	5	6	8	10	12	13	15	17	19	21	23	26	29	32	36
16 Kigoma	4	7	12	16	21	25	29	33	38	43	48	54	60	66	73	82
17 Shinyanga+ Simiyu	70	85	93	102	114	116	129	141	154	169	185	207	231	259	290	324
18 Kagera	10	17	24	32	43	42	50	58	68	81	92	102	113	125	138	152
19 Mwanza +Geita	47	66	85	103	121	153	175	195	218	249	290	320	354	390	431	476
20 Mara	24	30	36	42	48	63	72	79	88	97	107	119	132	147	163	181
21 Manyara	4	5	6	7	8	9	10	11	11	12	13	14	15	16	17	18
Mainland total	917	1,176	1,368	1,591	1,823	2,078	2,305	2,555	2,833	3,141	3,489	3,844	4,234	4,660	5,130	5,644
22 Zanzibar	58	70	81	92	102	112	123	134	146	158	170	181	192	204	215	228
Total	974	1 246	1 449	1 683	1 925	2 190	2 4 2 8	2 600	2 070	3 200	3 650	4 025	4 4 2 6	4 864	5 345	5 872
		1/2 10	1,112	1,005	1,525	2,150	2,720	2,090	2,979	5,255	5,055	т,02J	1,120	7,001	5,515	5,072
	2024	1,210	1,115	1,005	1,525	2,150	2,120	2,090	2,373	3,233	3,039	7,025	2025/20	1,001	3,313	3,072
	2031	2032	2033	2034	2035	2036	2037	2,090	2,373	2040	2015/20	2020/25	2025/30	2030/35	2035/40	2015/40
1 Dodoma	2031 115	2032 127	2033 140	2034 154	2035 169	2,190 2036 184	2,120 2037 197 724	2,090 2038 212	2,373 2039 228	2040 246	2015/20 16.7	2020/25 8.2	2025/30 9.9	2030/35 10.0	2035/40 7.8	2015/40 10.5
1 Dodoma 2 Arusha	2031 115 434	2032 127 474	2033 140 516	2034 154 562	2035 169 613	2036 184 666	2037 197 724	2,890 2038 212 787	2,373 2039 228 855	2040 246 928	2015/20 16.7 24.0	2020/25 8.2 9.7	2025/30 9.9 9.3	2030/35 10.0 9.0	2035/40 7.8 8.7	2015/40 10.5 12.0
1 Dodoma 2 Arusha 3 Kiimanjaro	2031 115 434 125	2032 127 474 136	2033 140 516 147	2034 154 562 160	2035 169 613 173	2036 184 666 188	2037 197 724 204	2,690 2038 212 787 221	2,373 2039 228 855 240	2040 246 928 260	2015/20 16.7 24.0 18.6	2020/25 8.2 9.7 6.4	2025/30 9.9 9.3 8.4	2030/35 10.0 9.0 8.5	2035/40 7.8 8.7 8.4	2015/40 10.5 12.0 10.0
1 Dodoma 2 Arusha 3 Kilmanjaro 4 Tanga	2031 115 434 125 286 221	2032 127 474 136 316	2033 140 516 147 348	2034 154 562 160 383	2035 169 613 173 422	2036 184 666 188 457	2037 197 724 204 495	2,690 2038 212 787 221 536	2,373 2039 228 855 240 580	2040 246 928 260 628	2015/20 16.7 24.0 18.6 18.9	2020/25 8.2 9.7 6.4 8.8	2025/30 9.9 9.3 8.4 10.3	2030/35 10.0 9.0 8.5 10.2	2035/40 7.8 8.7 8.4 8.3	2015/40 10.5 12.0 10.0 11.2
1 Dodoma 2 Arusha 3 Kilimanjaro 4 Tanga 5 Morogoro	2031 115 434 125 286 231 202	2032 127 474 136 316 252	2033 140 516 147 348 275 265	2034 154 562 160 383 301	2035 169 613 173 422 328	2036 184 666 188 457 356	2037 197 724 204 495 386	2,090 2038 212 787 221 536 418	2,373 2039 228 855 240 580 453	2040 246 928 260 628 490	2015/20 16.7 24.0 18.6 18.9 16.1	2020/25 8.2 9.7 6.4 8.8 10.3	2025/30 9.9 9.3 8.4 10.3 9.6	2030/35 10.0 9.0 8.5 10.2 9.2	2035/40 7.8 8.7 8.4 8.3 8.3 8.3	2015/40 10.5 12.0 10.0 11.2 10.7
1 Dodoma 2 Arusha 3 Kilmanjaro 4 Tanga 5 Morogoro 6 Pwani	2031 115 434 125 286 231 302 2 2420	2032 127 474 136 316 252 332	2033 140 516 147 348 275 365 2 299	2034 154 562 160 383 301 402	2035 169 613 173 422 328 442 2 245	2,150 2036 184 666 188 457 356 480 2 2 320	2,120 2037 197 724 204 495 386 522	2,090 2038 212 787 221 536 418 567 4 142	2,373 2039 228 855 240 580 453 616	2040 246 928 260 628 490 670	2015/20 16.7 24.0 18.6 18.9 16.1 26.3 12.3	2020/25 8.2 9.7 6.4 8.8 10.3 17.1	2025/30 9.9 9.3 8.4 10.3 9.6 9.7	2030/35 10.0 9.0 8.5 10.2 9.2 9.9	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.3	2015/40 10.5 12.0 10.0 11.2 10.7 14.2
1 Dodoma 2 Arusha 3 Kilmanjaro 4 Tanga 5 Morogoro 6 Pwani 7 Dar es Salaam	2031 115 434 125 286 231 302 2,420	2032 127 474 136 316 252 332 2,641	2033 140 516 147 348 275 365 2,880	2034 154 562 160 383 301 402 3,137	2035 169 613 173 422 328 442 3,416	2,150 2036 184 666 188 457 356 480 3,730	2,120 2037 197 724 204 495 386 522 4,072	2,090 2038 212 787 221 536 418 567 4,442 4,442	2,373 2039 228 855 240 580 453 616 4,842	2040 246 928 260 628 490 670 5,276	2015/20 16.7 24.0 18.6 18.9 16.1 26.3 13.7	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.0	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1	2015/40 10.5 12.0 10.0 11.2 10.7 14.2 10.3
1 Dodoma 2 Arusha 3 Kilmanjaro 4 Tanga 5 Morogoro 6 Pwani 7 Dar es Salaam 8 Lindi 9 Mikaara	2031 115 434 125 286 231 302 2,420 51	2032 127 474 136 316 252 332 2,641 56 6	2033 140 516 147 348 275 365 2,880 62 276	2034 154 562 160 383 301 402 3,137 69	2035 169 613 173 422 328 442 3,416 77	2,150 2036 184 666 188 457 356 480 3,730 85 105	2037 197 724 204 495 386 522 4,072 93	2,030 2038 212 787 221 536 418 567 4,442 103 121	2,979 2039 228 855 240 580 453 616 4,842 114	2040 246 928 260 628 490 670 5,276 126	2015/20 16.7 24.0 18.6 18.9 16.1 26.3 13.7 42.1 19.1	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1 10.4 11.5	2015/40 10.5 12.0 10.0 11.2 10.7 14.2 10.3 16.6 12.7
1 Dodoma 2 Arusha 3 Kilmanjaro 4 Tanga 5 Morogoro 6 Pwani 7 Dar es Salaam 8 Lindi 9 Mtwara	2031 115 434 125 286 231 302 2,420 51 61	2032 127 474 136 316 252 332 2,641 56 68 8	2033 140 516 147 348 275 365 2,880 62 76 62 76	2034 154 562 160 383 301 402 3,137 69 85	2035 169 613 173 422 328 442 3,416 77 95	2,150 2036 184 666 188 457 356 480 3,730 85 105 137	2,120 2037 197 724 204 495 386 522 4,072 93 117 142	2,030 2038 212 787 221 536 418 567 4,442 103 131	2,979 2039 228 855 240 580 453 616 4,842 114 146 160	2040 246 928 260 628 490 670 5,276 126 163 200	2015/20 16.7 24.0 18.6 18.9 16.1 26.3 13.7 42.1 18.1 23.2	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 22.1	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.2	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 11.5 13.2	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.2	2015/40 10.5 12.0 10.0 11.2 10.7 14.2 10.3 16.6 13.7 16.7
1 Dodoma 2 Arusha 3 Kiimanjaro 4 Tanga 5 Morogoro 6 Pwani 7 Dar es Sakam 8 Lindi 9 Mtwara 10 Ruvuma	2031 115 434 125 286 231 302 2,420 51 61 78	2032 127 474 136 316 252 332 2,641 56 68 87 7	2033 140 516 147 348 275 365 2,880 62 76 98	2034 154 562 160 383 301 402 3,137 69 85 109	2035 169 613 173 422 328 442 3,416 77 95 122	2,130 2036 184 666 188 457 356 480 3,730 85 105 135	2,123 2037 197 724 405 386 522 4,072 93 117 149 .07	2,090 2038 212 787 221 536 418 567 4,442 103 131 164 200	2,979 2039 228 855 240 580 453 616 4,842 114 146 181 132	2040 246 928 260 628 490 670 5,276 126 163 200	2015/20 16.7 24.0 18.6 18.9 16.1 26.3 13.7 42.1 18.1 23.9 23.9 23.9 23.9 23.9 23.9 24.9 24.0 24.	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 0.5	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 14.2	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 11.5 12.0 11.5	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.3 9.1 10.4 11.5 10.3 0.0	2015/40 10.5 12.0 10.0 11.2 10.7 14.2 10.3 16.6 13.7 16.1
1     Dodoma       2     Arusha       3     Kiimanjaro       4     Tanga       5     Morogoro       6     Pwani       7     Dar es Salaam       8     Lindi       9     Mtwara       10     Ruvuma       11     Iringa + Njombe	2031 115 434 125 286 231 302 2,420 51 61 78 105 267	2032 127 474 136 316 252 332 2,641 56 68 87 116 202	2033 140 516 147 348 275 365 2,880 62 76 98 98 129 98	2034 154 562 160 383 301 402 3,137 69 85 85 109	2035 169 613 173 422 328 442 3,416 77 95 122 159 200	2,130 2036 184 666 188 457 356 480 3,730 85 105 135 171 472	2,123 2037 197 724 204 495 386 522 4,072 93 117 149 185 450	2,990 2038 212 787 221 536 418 567 4,442 103 131 164 200 409	2,973 2039 228 855 240 580 453 616 4,842 114 146 181 216 540	2040 246 928 260 628 490 670 5,276 126 163 200 233 556	2015/20 16.7 24.0 18.6 18.9 16.1 26.3 13.7 42.1 18.1 23.9 14.9 22.7	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.0	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 11.5 12.0 11.0 11.0	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 9.5	2015/40 10.5 12.0 10.0 11.2 10.7 14.2 10.3 16.6 13.7 16.1 10.9
1 Dodoma 2 Arusha 3 Kilmanjaro 4 Tanga 5 Morogoro 6 Pwani 7 Dar es Salaam 8 Lindi 9 Mtwara 10 Ruvuma 11 Iringa + Njombe 12 Mbeya	2031 115 434 125 286 231 302 2,420 51 61 78 105 267 47	2032 127 474 136 316 252 332 2,641 56 68 87 116 293 275	2033 140 516 147 348 275 365 2,880 62 76 98 129 323 50	2034 154 562 160 383 301 402 3,137 69 85 109 143 355 <i>6</i> 6	2035 169 613 173 422 328 442 3,416 77 95 122 159 390 74	2,130 2036 184 666 188 457 356 480 3,730 85 105 135 135 171 423 91	2,123 2037 197 724 204 495 386 522 4,072 93 117 149 185 459 99	2,990 2038 212 787 221 536 418 567 4,442 103 131 164 200 498 05	2,979 2039 228 855 240 580 453 616 4,842 114 146 181 216 540 104	2040 246 928 260 670 5,276 126 163 200 233 586 542 233	2015/20 16.7 24.0 18.6 18.9 16.1 26.3 13.7 42.1 18.1 23.9 14.9 22.7 18.2	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2 9.9 9	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 11.5 12.0 11.0 11.0 11.0	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 8.5	2015/40 10.5 12.0 10.0 11.2 10.7 14.2 10.3 16.6 13.7 16.1 10.9 12.3 12.2
1 Dodoma 2 Arusha 3 Kilimanjaro 4 Tanga 5 Morogoro 6 Pwani 7 Dar es Sakaam 8 Lindi 9 Mtwara 10 Ruvuma 11 Iringa + Njombe 12 Mbeya 13 Singida	2031 115 434 125 286 231 302 2,420 51 61 78 105 267 47 233	2032 127 474 136 316 252 2,641 56 68 87 116 293 53 32	2033 140 516 147 348 275 365 2,880 62 76 98 129 323 323 59 9	2034 154 562 160 383 301 402 3,137 69 85 109 143 355 66 49	2035 169 613 173 422 328 442 3,416 77 95 122 159 390 74 45	2,130 2036 184 666 188 457 356 480 3,730 85 105 135 171 423 81 500	2,123 2037 197 724 204 495 386 522 4,072 93 117 149 185 459 88 554	2,090 2038 212 787 221 536 418 567 4,442 103 131 164 200 498 96 6	2,979 2039 228 855 240 580 453 616 4,842 114 146 181 216 540 104 609	2040 246 928 260 628 490 670 5,276 126 163 200 233 586 113 586	2015/20 16.7 24.0 18.6 18.9 16.1 26.3 13.7 42.1 18.1 23.9 14.9 22.7 18.2 20.	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4 4.2 1	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2 9.9 9.12.2 12.1	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 11.5 12.0 11.0 11.0 11.0 12.2 12.0	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.3 9.1 10.4 11.5 10.3 8.0 8.5 8.8 8 8.5	2015/40 10.5 12.0 10.0 11.2 10.7 14.2 10.3 16.6 13.7 16.1 10.9 12.3 12.3 12.3
1     Dodoma       2     Arusha       3     Kiimanjaro       4     Tanga       5     Moroqoro       6     Pwani       7     Dar es Sabam       8     Lindi       9     Mtwara       10     Ruvuma       11     Iringa + Njombe       12     Mbeya       13     Singida       14     Tabora	2031 115 434 125 286 231 302 2,420 51 61 78 105 267 47 47 278	2032 127 474 136 316 252 332 2,641 56 68 87 116 293 53 314	2033 140 516 147 348 275 365 2,880 62 76 98 129 323 355 59 355 40	2034 154 562 160 383 301 402 3,137 69 85 109 143 355 66 66 400	2035 169 613 173 422 328 442 3,416 77 95 122 159 390 74 451 (1	2,130 2036 184 666 188 457 356 480 3,730 85 105 135 171 423 81 500 60	2,123 2037 197 724 204 495 386 522 4,072 93 117 149 185 459 88 88 554 370	2,990 2038 212 787 221 536 418 567 4,442 103 131 164 200 498 96 614	2,973 2039 228 855 240 580 453 616 4,842 114 146 181 216 540 104 680 403	2040 246 928 260 628 490 670 5,276 126 163 200 233 586 5113 752	2015/20 16.7 24.0 18.6 18.9 16.1 26.3 13.7 42.1 18.1 23.9 14.9 22.7 18.2 30.2 23.0 20.	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4 13.1 13.1	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2 9.9 9.9 12.2 13.1 14	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 11.5 12.0 11.0 10.0 10.0 12.2 12.9 14.5 12.0 11.0 10.9 11.5 12.0 11.5 12.0 11.5 12.0 11.5 12.0 11.5 12.0 11.5 12.0 11.5 12.0 11.5 12.0 11.5 12.0 11.5 12.0 11.5 12	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 8.8 10.8 8 10.8	2015/40 10.5 12.0 10.0 11.2 10.7 14.2 10.3 16.6 13.7 16.1 10.9 12.3 12.3 12.3 15.8
1     Dodoma       2     Arusha       3     Kiimanjaro       4     Tanga       5     Moroqoro       6     Pvvani       7     Dar es Salaam       8     Lindi       9     Mtwara       10     Ruvuma       11     Iringa + Njombe       12     Mbeya       13     Singida       14     Tabora       15     Rukwa + Katavi	2031 115 434 125 286 231 302 2,420 51 61 78 105 267 47 278 47 278 40 00	2032 127 474 136 316 252 332 2,641 56 68 87 116 293 53 314 44 44 44	2033 140 516 147 348 275 365 2,880 62 76 98 129 323 59 355 59 355 49 49	2034 154 562 160 383 301 402 3,137 69 85 109 143 355 66 400 55 5 5	2035 169 613 173 422 328 442 3,416 77 95 122 159 390 74 451 61 02	2,130 2036 184 666 188 457 356 480 3,730 85 105 135 171 423 81 500 69 152	2,123 2037 197 724 204 495 386 522 4,072 93 117 149 185 459 88 8554 554 79 204 107 107 107 107 107 107 107 107	2,990 2038 212 787 221 536 418 567 4,442 103 131 164 200 498 96 614 990	2,979 2039 228 855 240 580 453 616 4,842 114 146 181 216 540 104 680 103 403	2040 246 928 260 628 490 670 5,276 126 163 200 233 586 113 752 118	2015/20 16.7 24.0 18.6 18.9 16.1 26.3 13.7 42.1 18.1 23.9 14.9 22.7 18.2 30.2 30.2 32.8 32.8 32.8	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4 13.1 11.9 11.9	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2 9.9 12.2 13.1 11.2	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 11.5 12.0 11.0 11.0 12.2 12.9 11.5 12.4 11.5 12.0 11.5 12	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 8.8 8.5 8.8 810.8 10.9 9.1	2015/40 10.5 12.0 10.0 11.2 10.7 14.2 10.3 16.6 13.7 16.1 10.9 12.3 12.3 12.3 15.8 16.0 16.0
1     Dodoma       2     Arusha       3     Kiimanjaro       4     Tanga       5     Morogoro       6     Pwani       7     Dar es Salaam       8     Lindi       9     Mtwara       10     Ruvuma       11     Iringa +Njombe       12     Mbeya       13     Singida       14     Tabora       15     Rukwa + Katavi       16     Kigoma	2031 115 434 125 286 231 302 2,420 51 61 78 105 267 47 278 40 91 275	2032 127 474 136 316 252 332 2,641 56 68 87 116 293 53 314 44 101 402	2033 140 516 147 348 275 365 2,880 62 76 98 129 323 59 355 49 112 45	2034 154 562 160 383 301 402 3,137 69 85 109 143 355 66 400 55 124	2035 169 613 173 422 328 442 3,416 77 95 122 159 390 74 451 61 138 61	2,130 2036 184 666 188 457 356 480 3,730 85 105 135 171 423 81 500 69 150 624	2,123 2037 197 724 204 495 386 522 4,072 93 117 149 185 459 88 554 79 163 692	2,990 2038 212 787 221 536 418 567 4,442 103 131 164 200 498 96 614 90 177 746	2,973 2039 228 855 240 580 453 616 4,842 114 146 181 216 540 104 680 103 192 814	2040 246 928 260 670 5,276 126 163 200 233 586 113 752 118 208	2015/20 16.7 24.0 18.6 18.9 16.1 26.3 13.7 42.1 18.1 23.9 14.9 22.7 18.2 30.2 30.2 32.8 42.3 10.2	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4 13.1 11.9 13.9 0.0	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2 9.9 12.2 13.1 11.2 13.1 11.2	2030/35 10.0 9.0 8.5 10.2 9.9 9.9 9.0 10.9 11.5 12.0 11.0 10.0 12.2 12.9 11.5 11.1 12.5 11.5 11.1	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 8.8 8.10.8 10.8 13.9 8.5 0.2	2015/40 10.5 12.0 10.0 11.2 10.7 14.2 10.3 16.6 13.7 16.1 10.9 12.3 15.8 15.8 16.0 16.8 10.9
1       Dodoma         2       Arusha         3       Kiimanjaro         4       Tanga         5       Morogoro         6       Pwani         7       Dar es Sakaam         8       Lindi         9       Mtwara         10       Ruvuma         11       Iringa + Njombe         12       Mbeya         13       Singida         14       Tabora         15       Rukwa + Katavi         16       Kigoma         17       Shinyanga+ Simiyu         19       Kraere	2031 115 434 125 286 231 302 2,420 51 61 78 105 267 47 278 40 91 363 363	2032 127 474 136 316 252 332 2,641 56 68 87 116 293 53 314 444 101 406 165	2033 140 516 147 348 275 365 2,880 62 76 98 129 323 59 323 59 355 49 112 112 455 202	2034 154 562 160 383 301 402 3,137 69 85 109 143 355 66 400 55 124 510 322	2035 169 613 173 422 328 442 3,416 77 95 122 159 390 74 451 61 138 571 128	2,130 2036 184 666 188 457 356 480 3,730 85 105 135 135 135 135 135 135 150 69 150 624 921	2,123 2037 197 724 204 495 386 522 4,072 93 117 149 185 459 88 554 79 163 682 211	2,990 2038 212 787 221 536 418 567 4,442 103 131 164 200 498 96 614 90 177 746 245	2,373 2039 228 855 240 580 453 616 4,842 114 146 181 216 540 104 680 103 192 814 362	2040 246 928 260 628 490 670 5,276 126 163 200 233 586 113 752 118 208 889 455	2015/20 16.7 24.0 18.6 18.9 16.1 26.3 13.7 42.1 18.1 23.9 14.9 22.7 18.2 30.2 32.8 42.3 10.8 24.5 24.	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4 13.1 11.9 13.9 9.8 16.0	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2 9.9 12.2 13.1 11.2 11.0 11.8 10.5	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 10.9 11.5 12.0 11.0 10.0 11.5 12.0 11.0 11.0 11.5 12.5 12.5 12.5 11.5 12.5 11.5 12.5 11.5 12.5 11.5 12.5 11.5 12.5 11.5 12.5 11.5 11.5 12.5 11.5 1	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 8.8 10.8 13.9 8.5 9.3 10.6	2015/40 10.5 12.0 10.0 11.2 10.7 14.2 10.3 16.6 13.7 16.1 10.9 12.3 12.3 12.3 12.3 16.6 16.0 16.8 10.7 16.2 16.2 16.5 10.7 10.
1     Dodoma       2     Arusha       3     Kiimanjaro       4     Tanga       5     Morogoro       6     Pwani       7     Dar es Salaam       8     Lindi       9     Mtwara       10     Ruvuma       11     Iringa + Njombe       12     Mbeya       13     Singida       14     Tabora       15     Rukwa + Katavi       16     Kigoma       17     Shinyanga + Simiyu       18     Kagera       10     Kusera	2031           115           434           125           286           231           302           2,420           51           61           78           105           267           47           278           40           91           363           168           50	2032 127 474 136 316 252 332 2,641 56 68 87 116 293 53 314 44 101 406 187 -77 -77 -77 -77 -77 -77 -77 -	2033 140 516 147 348 275 365 2,880 62 76 98 129 323 59 323 59 355 49 112 112 455 207 67	2034 154 562 160 383 301 402 3,137 69 85 109 143 355 66 400 55 124 510 229 202 702	2035 169 613 173 422 328 442 3,416 77 95 122 159 390 74 451 61 138 571 254 77	2,130 2036 184 666 188 457 356 480 3,730 85 105 135 171 423 81 500 69 150 624 281 242	2,123 2037 197 724 204 495 386 522 4,072 93 117 149 185 459 88 554 79 163 682 311 017	2,990 2038 212 787 221 536 418 567 4,442 103 131 164 200 498 96 614 90 177 746 345 000	2,973 2039 228 855 240 580 453 616 4,842 114 146 181 216 540 104 680 103 192 814 383 1907	2040 246 928 260 628 490 670 5,276 126 163 200 233 586 113 752 118 208 889 426 889	2015/20 16.7 24.0 18.6 18.9 16.1 26.3 13.7 42.1 18.1 23.9 14.9 22.7 18.2 30.2 30.2 32.8 42.3 10.8 34.5 26.5	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4 13.1 11.9 13.9 9.8 16.9 9.8 16.9	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2 9.9 9.12.2 13.1 11.2 13.1 11.2 11.0 11.8 10.5	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 11.5 12.0 11.0 10.0 10.0 11.2 12.2 12.9 11.5 11.1 12.0 11.5 12.0 10.0 10.2 10	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 8.8 10.8 13.9 8.5 9.3 10.8 13.9 8.5 9.3	2015/40 10.5 12.0 10.0 11.2 10.7 14.2 10.3 16.6 13.7 16.1 10.9 12.3 15.8 16.8 10.7 16.8 10.7 16.4
1       Dodoma         2       Arusha         3       Kiimanjaro         4       Tanga         5       Moroqoro         6       Pvani         7       Dar es Salaam         8       Lindi         9       Mtwara         10       Ruvuma         11       Iringa + Njombe         12       Mbeya         13       Singida         14       Tabora         15       Rukwa + Katavi         16       Kigoma         17       Shinyanga+ Simiyu         18       Kagera         19       Mwanza + Geita	2031 115 434 125 286 231 302 2,420 51 61 78 105 267 47 278 40 91 363 168 525 525 267	2032 127 474 136 316 252 332 2,641 56 68 87 116 293 53 314 44 101 406 187 579 202	2033 140 516 147 348 275 365 2,880 62 76 98 129 323 59 323 59 355 49 112 455 207 638 207 638 207	2034 154 562 160 383 301 402 3,137 69 85 109 143 355 66 400 55 124 400 55 124 510 229 703	2035 169 613 173 422 328 442 3,416 77 95 122 159 390 74 451 61 138 571 254 774 264 774 264 774	2,130 2036 184 666 188 457 356 480 3,730 85 105 135 171 423 81 500 69 150 624 281 843 324	2,123 2037 197 724 204 495 386 522 4,072 93 117 149 185 459 88 554 79 163 682 311 917 262	2,990 2038 212 787 221 536 418 567 4,442 103 131 164 200 498 96 614 90 177 746 345 998 204	2,973 2039 228 855 240 580 453 616 4,842 114 146 540 104 680 103 192 814 383 1,085 240	2040 246 928 260 628 490 670 5,276 126 163 200 233 586 113 752 118 208 889 426 1,180	2015/20 16.7 24.0 18.6 18.9 16.1 26.3 13.7 42.1 18.1 23.9 14.9 22.7 18.2 30.2 32.8 42.3 10.8 34.5 26.5 20.	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4 13.1 11.9 13.9 9.8 16.9 13.6 9.8 16.9	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2 9.9 12.2 13.1 11.2 11.2 11.2 11.0 11.8 10.5 10.4	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.9 11.5 12.0 11.0 12.2 12.9 11.5 11.1 12.0 11.5 11.1 12.0 10.0 10.9 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.5 11.1 11.5 11.1 11.5 11.5 11.1 11.1 11.5 11.1 11.1 11.5 11.1 11.1 11.1 11.1 11.5 11.1 11.5 11.1 11.1 11.1 11.1 11.1 11.1 11.5 11.1 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11.1 11.5 11	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 8.8 8.0 8.5 8.8 8.10.8 13.9 8.5 9.3 10.8 8.5 9.3 10.8	2015/40 10.5 12.0 10.0 11.2 10.7 14.2 10.3 16.6 13.7 16.1 10.9 12.3 12.3 12.3 15.8 16.0 16.8 16.0 16.8 10.7 16.4 13.7
1       Dodoma         2       Arusha         3       Kiimanjaro         4       Tanga         5       Morogoro         6       Pwani         7       Dar es Sakaam         8       Lindi         9       Mtwara         10       Ruvuma         11       Iringa + Njombe         12       Mbeya         13       Singida         14       Tabora         15       Rukwa + Katavi         16       Kigoma         17       Shinyanga+ Simiyu         18       Kaqera         19       Mwanza + Geita         20       Mara         31       Mara	2031           115           434           125           286           231           302           2,420           51           61           78           105           267           47           278           40           91           363           168           525           202           10	2032 127 474 136 316 252 332 2,641 56 68 87 116 293 53 314 44 101 406 187 579 224 224	2033 140 516 147 348 275 365 2,880 62 76 98 129 323 59 355 49 112 455 207 638 249 22	2034 154 562 160 383 301 402 3,137 69 85 109 143 355 66 400 55 124 510 229 703 277 22	2035 169 613 173 422 328 442 3,416 77 95 122 159 390 74 451 61 138 571 254 774 307 25	2,130 2036 184 666 188 457 356 480 3,730 85 105 135 171 423 81 500 69 150 69 150 69 150 624 281 843 334 334	2,123 2037 197 724 204 495 386 522 4,072 93 117 149 185 459 88 554 79 163 682 311 917 363 20	2,990 2038 212 787 221 536 418 567 4,442 103 131 164 200 498 96 614 90 177 746 614 90 177 746 345 998 394 21	2,973 2039 228 855 240 580 453 616 4,842 114 146 181 216 540 104 680 103 192 814 383 1,085 428 22	2040 246 928 260 670 5,276 126 163 200 233 586 113 752 118 208 889 426 1,180	2015/20 16.7 24.0 18.6 18.9 16.1 26.3 13.7 42.1 18.1 23.9 14.9 22.7 18.2 30.2 30.2 32.8 42.3 10.8 34.5 26.5 20.9 20.5 20.9	$\begin{array}{r} 7,023\\ \hline 2020/25\\ 8.2\\ 9.7\\ 6.4\\ 8.8\\ 10.3\\ 17.1\\ 10.0\\ 12.1\\ 10.0\\ 23.1\\ 9.5\\ 10.8\\ 10.4\\ 13.1\\ 11.9\\ 13.9\\ 9.8\\ 16.9\\ 13.6\\ 11.1\\ \ell \ c \ r\end{array}$	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2 9.9 12.2 13.1 11.2 13.1 11.2 11.0 11.8 10.5 10.4	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 11.5 12.0 11.0 10.0 12.2 12.9 11.5 11.1 12.0 10.0 10.8 10.2 1.5 11.1 1.5 11.1 1.5 11.1 1.5 1.5	2035/40 7.8 8.7 8.4 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 8.8 10.8 13.9 8.5 9.3 10.8 13.9 8.5 9.3 10.8 8.5 8.8 8.5 9.3 10.8 10.	2015/40 10.5 12.0 10.0 11.2 10.7 14.2 10.3 16.6 13.7 16.1 10.9 12.3 15.8 16.0 16.8 16.0 16.8 10.7 16.4 13.7
1       Dodoma         2       Arusha         3       Kiimanjaro         4       Tanga         5       Morogoro         6       Pwani         7       Dar es Sabam         8       Lindi         9       Mtwara         10       Ruvuma         11       Iringa + Njombe         12       Mbeya         13       Singida         14       Tabora         15       Rukwa + Katavi         16       Kigoma         17       Shinyanga+ Simiyu         18       Kagera         19       Mwanza + Geita         20       Mara         21       Manyara	2031           115           434           125           286           231           302           2,420           51           61           78           105           267           47           278           40           91           363           168           525           202           19           19	2032 127 474 136 316 252 332 2,641 56 68 87 116 293 53 314 444 444 101 406 187 579 224 21 (0)2	2,119 2033 140 516 147 348 275 365 2,880 62 76 98 129 323 59 323 59 323 59 325 49 112 455 207 638 249 222 7 cc	2034 154 562 160 383 301 402 3,137 69 85 109 143 355 66 400 55 124 510 229 703 277 24	2035 169 613 173 422 328 442 3,416 77 95 122 159 390 74 451 61 138 571 138 571 254 774 307 25 0 062	2,130 2036 184 666 188 457 356 480 3,730 85 105 135 171 423 81 500 69 150 624 281 843 334 27 0 000	2,123 2037 197 724 204 495 386 522 4,072 93 117 149 185 459 88 554 79 88 554 79 163 682 311 917 363 29 29 10 724 204 204 204 204 204 204 204 2	2,990 2038 212 787 221 536 418 567 4,442 103 131 164 200 498 96 614 90 177 746 345 998 394 31 11 767	2,373 2039 228 855 240 580 453 616 4,842 114 166 540 104 680 103 192 814 383 1,085 428 33 12 021	2040 246 928 260 628 490 670 5,276 126 163 200 233 586 5113 752 118 208 889 426 1,180 464 35 200	2015/20 16.7 24.0 18.6 18.9 16.1 26.3 13.7 42.1 18.1 23.9 14.9 22.7 18.2 30.2 32.8 42.3 10.8 34.5 26.5 20.9 20.5 20.9 20.5 20.9	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4 13.1 11.9 9.8 10.4 13.1 13.9 13.9 9.8 16.9 13.6 11.1 6.5 10.2	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2 9.9 9.9 12.2 13.1 11.2 11.0 11.8 10.5 10.4 11.2 7.0 10.4	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 11.5 12.0 11.0 10.0 12.2 12.9 11.5 11.1 12.0 10.0 10.2 11.1 12.0 10.2 11.1 12.0 10.2 11.1 0.2 11.1 0.2 11.1 0.2 11.1 0.2 11.5 10.2	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 8.8 10.8 13.9 8.5 9.3 10.8 8.5 9.3 10.8 8.5 9.3 10.8 8.5 9.3 10.8 13.9 9.1 10.4 13.9 10.8 13.9 10.8 13.9 10.8 13.9 10.8 13.9 10.8 13.9 10.8 13.9 10.8 13.9 10.8 13.9 10.8 13.9 10.8 10.8 13.9 10.8 10.8 10.8 10.8 10.8 10.8 10.8 10.8	2015/40 10.5 12.0 10.0 11.2 10.7 14.2 10.3 16.6 13.7 16.1 10.9 12.3 12.3 15.8 16.8 10.7 16.8 10.7 16.4 13.7 15.9 12.3 15.8 16.8 10.7 15.5 12.0 10.7 14.2 10.7 14.2 10.7 14.2 10.7 14.2 10.7 14.2 10.7 14.2 10.7 14.2 10.7 14.2 10.7 14.2 10.7 14.2 10.7 14.2 10.7 14.2 10.7 14.2 10.7 14.2 10.7 14.2 10.7 16.1 10.7 16.1 10.7 16.1 10.7 16.2 10.7 16.1 10.7 16.2 10.7 16.1 10.7 16.2 10.7 16.1 10.7 16.2 10.7 16.1 10.7 16.2 10.7 16.1 10.7 16.2 15.8 16.8 10.7 16.4 10.7 15.8 10.7 15.8 10.7 16.4 10.7 15.8 10.7 16.4 10.7 15.8 10.7 16.4 10.7 15.8 10.7 16.4 10.7 16.4 10.7 15.8 10.7 16.4 10.7 16.4 10.7 16.4 10.7 16.4 10.7 16.4 10.7 16.4 10.7 16.4 10.7 16.4 10.7 16.4 10.7 16.4 10.7 16.4 10.7 16.4 10.7 16.4 10.7 16.4 10.7 16.4 10.7 16.4 10.7 16.4 10.7 16.4 10.7 16.4 10.7 10.
1     Dodoma       1     Dodoma       2     Arusha       3     Kiimanjaro       4     Tanga       5     Morogoro       6     Pwani       7     Dar es Salaam       8     Lindi       9     Mtwara       10     Ruvuma       11     Iringa + Njombe       12     Mbeya       13     Singida       14     Tabora       15     Rukwa + Katavi       16     Kigoma       17     Shinyanga + Simiyu       18     Kagera       19     Mwanza + Geita       20     Mara       21     Manyara       Mainkand total     21	2031           115           434           125           286           231           302           2,420           51           61           78           105           267           47           278           40           91           363           168           525           202           19           6,208           245	2032 127 474 136 316 252 332 2,641 56 68 87 116 293 53 314 44 101 406 187 579 224 21 6,827 6,827	2033 140 516 147 348 275 365 2,880 62 76 98 129 323 59 323 59 325 49 112 455 207 638 249 22 7,505 229	2034 154 562 160 383 301 402 3,137 69 85 109 143 355 66 400 55 124 510 229 703 277 24 8,248 8,248	2035 169 613 173 422 328 442 3,416 77 95 122 159 390 74 451 61 138 571 254 774 307 25 9,062 9,062	2,130 2036 184 666 188 457 356 480 3,730 85 105 135 171 423 81 500 69 150 624 281 843 334 27 9,890 9,890	2,123 2037 197 724 204 495 386 522 4,072 93 117 149 185 459 88 554 79 163 682 311 917 363 29 10,789 21 22 23 24 20 24 20 24 20 25 25 25 25 25 25 25 25 25 25	2,990 2038 212 787 221 536 418 567 4,442 103 131 164 200 498 96 614 90 177 746 345 998 394 31 11,768	2,979 2039 228 855 240 580 453 616 4,842 114 146 181 216 540 104 680 103 192 814 383 1,085 428 33 12,831 12,831 220 203 203 203 203 203 203 203	2040 246 928 260 670 5,276 126 163 200 233 586 113 752 118 208 889 426 1,180 464 35 13,989	2015/20 16.7 24.0 18.6 18.9 16.1 26.3 13.7 42.1 18.1 23.9 14.9 22.7 18.2 30.2 30.2 32.8 42.3 10.8 34.5 26.5 20.9 20.5 17.8 14.2	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4 13.1 11.9 9.8 16.9 13.6 11.1 6.5 10.9 2.5 2.5 10.8 10.4 13.1 11.1 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5	$\begin{array}{c} 2025/30\\ \hline 9.9\\ 9.3\\ 8.4\\ 10.3\\ 9.6\\ 9.7\\ 9.5\\ 10.7\\ 11.4\\ 12.0\\ 11.2\\ 9.9\\ 12.2\\ 13.1\\ 11.2\\ 11.2\\ 11.0\\ 11.8\\ 10.5\\ 10.4\\ 11.2\\ 7.0\\ 10.1\\ 12.7\\ 0\\ 10.1\\ 12.7\\ 0\\ 10.1\\ 0\\ 10.1\\ 12.7\\ 0\\ 10.1\\ 0\\ 10.1\\ 0\\ 10.1\\ 10.1\\ 0\\ 10.1\\ 0\\ 10.1\\ 0\\ 10.1\\ 0\\ 10.1\\ 0\\ 10.1\\ 0\\ 10.1\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\$	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 11.5 12.0 11.0 11.0 12.2 12.9 11.5 11.1 12.0 10.8 10.2 9.9 9.0 10.9 9.0 10.9 9.0 10.9 9.0 10.9 9.0 10.9 9.0 10.9 9.0 10.9 9.0 10.9 9.0 10.9 9.0 10.9 9.0 10.9 9.0 10.9 9.0 10.9 9.0 10.9 10.8 10.2 10.8 10.2 10.9 10.8 10.2 10.9 10.8 10.2 10.9 10.8 10.2 10.9 10.8 10.2 10.9 10.8 10.2 10.9 10.8 10.2 10.9 10.8 10.2 10.9 10.8 10.2 10.9 10.8 10.2 10.9 10.8 10.2 10.9 10.8 10.2 10.9 10.8 10.2 10.8	2035/40 7.8 8.7 8.4 8.3 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 9.3 10.8 13.9 8.5 9.3 10.8 8.8 8.8 10.8 13.9 8.5 9.3 10.8 8.5 9.3 10.8 8.5 9.3 10.8 1	2015/40 10.5 12.0 10.0 11.2 10.7 14.2 10.3 16.6 13.7 16.1 10.9 12.3 15.8 16.8 10.7 16.4 13.7 12.3 15.8 10.7 16.4 13.7 12.5 9.9 4 11.5 12.5 13.7 12.5 13.7 12.5 13.7 12.5 13.7 12.5 13.7 12.5 13.7 12.5 13.7 12.5 13.7 12.5 13.7 12.5 13.7 12.5 13.7 12.5 13.7 13.7 12.5 13.7 12.5 13.7 14.7 15.7 1
1       Dodoma         2       Arusha         3       Kiimanjaro         4       Tanga         5       Morogoro         6       Pwani         7       Dar es Sakam         8       Lindi         9       Mtwara         10       Ruvuma         11       Iringa + Njombe         12       Mbeya         13       Singida         14       Tabora         15       Rukwa + Katavi         16       Kigoma         17       Shinyanga+ Simiyu         18       Kagera         19       Mwanza + Geita         20       Mara         21       Manyara         Mainland total       22         Zanzbar       Textel	2031 115 434 125 286 231 302 2,420 51 61 78 105 267 47 278 40 91 363 168 525 202 19 6,208 240 7,400 7,400 7,400 7,400 7,80 7,80 7,80 7,80 7,80 7,80 7,80 7,80 7,80 7,900 7,900 7,900 7,900 7,900 7,800 7,900	2032 127 474 136 316 252 332 2,641 56 68 87 116 293 53 314 44 101 406 187 579 224 21 6,827 251 707	2,119 2033 140 516 147 348 275 365 2,880 62 76 98 129 323 59 355 49 112 455 207 638 249 222 7,505 264 275 264 275 265 265 226 265 227 265 227 265 207 222 7,505 265 275 265 275 275 275 265 275 275 275 275 275 275 275 27	2034 154 562 160 383 301 402 3,137 69 85 109 143 355 66 400 55 124 510 229 703 277 24 8,248 8,248 276 6 52	2035 169 613 173 422 328 442 3,416 77 95 122 159 390 74 451 61 138 571 254 774 307 25 9,062 288 0 25	2,130 2036 184 666 188 457 356 480 3,730 85 105 135 171 423 81 500 69 150 624 281 843 334 27 9,890 298 0 192	2,123 2037 197 724 204 495 386 522 4,072 93 117 149 185 459 88 554 79 163 682 311 917 363 29 10,789 310 0,789 310 14,002	2,990 2038 212 787 221 536 418 567 4,442 103 131 164 200 498 96 614 90 177 746 345 998 394 311 11,768 320 12,000	2,973 2039 228 855 240 580 453 616 4,842 114 146 540 104 103 192 814 383 1,085 428 333 12,831 332 12,851 332 12,851 332 12,851 332 12,851 332 12,851 332 12,851 14,855 12,851 12,855 12,851 12,851 12,851 12,851 12,855 12,851 12,851 12,855 12,85	2040 246 928 260 670 5,276 126 163 200 233 586 113 752 118 208 889 426 1,180 464 355 13,989 342 14 233	2015/20 16.7 24.0 18.6 18.9 16.1 26.3 13.7 42.1 18.1 23.9 14.9 22.7 18.2 30.2 32.8 42.3 10.8 34.5 26.5 20.9 20.5 17.8 14.2 14.2 14.2 14.2 14.2 15.2 16.2 15.2 17.8 14.2 15.2 17.8 14.2 15.2 17.8 14.2 15.2 17.8 14.2 15.2 17.8 14.2 17.8 14.2 17.8 14.2 17.8 14.2 17.8 14.2 17.8 14.2 17.8 14.2 17.8 14.2 17.8 14.2 17.8 14.2 17.8 14.2 17.8 14.2 17.8 14.2 17.8 14.2 17.8 14.2 17.8 17.8 17.8 17.8 17.6 17.8 17.6 17.8 17.6 17.8 17.6 17.6 17.8 17.6 17.8 17.6 17.8 17.6 17.8 17.6 17.6 17.8 17.6 17.6 17.8 17.6 17.8 17.6 17.6 17.6 17.8 17.6 17.	2020/25 8.2 9.7 6.4 8.8 10.3 17.1 10.0 12.1 16.0 23.1 9.5 10.8 10.4 13.1 11.9 13.9 9.8 16.9 13.6 11.1 6.5 10.9 8.7 7 0.7 10.2 10.2 10.2 10.2 10.2 10.2 10.2 10.2	2025/30 9.9 9.3 8.4 10.3 9.6 9.7 9.5 10.7 11.4 12.0 11.2 9.9 12.2 13.1 11.2 11.2 11.2 11.2 11.0 11.8 10.5 10.4 11.2 11.8 10.5 10.4 11.2 0.5 10.4 11.2 10.5 10.4 11.2 10.5 10.5 10.5 10.5 10.5 10.5 10.5 10.5	2030/35 10.0 9.0 8.5 10.2 9.2 9.9 9.0 10.9 11.5 12.0 11.0 12.2 12.9 11.5 11.1 12.0 10.8 10.2 12.9 11.5 11.1 12.0 10.8 10.2 12.9 11.5 11.1 1.5 11.1 9.9 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5	2035/40 7.8 8.7 8.4 8.3 8.3 8.7 9.1 10.4 11.5 10.3 8.0 8.5 8.8 8.0 8.5 8.8 10.8 13.9 8.5 9.3 10.8 13.9 8.5 9.3 10.8 6.5 9.1 3.5 9.1	2015/40 10.5 12.0 10.0 11.2 10.7 14.2 10.3 16.6 16.1 10.9 12.3 12.3 12.3 15.8 16.0 16.8 10.7 16.4 13.7 16.4 13.7 16.4 13.7 16.4 13.7 12.5 9.4 11.5 9.4

Source: Study results of Task Force Team
# 2.8.8 Power consumption per capita

# Table 2-25: Power consumption per capita (Base)

															Unit:	kWh/p	erson
		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
-	Dodoma	59	69	77	86	96	109	115	122	131	139	148	160	173	187	203	220
2	2 Arusha	192	253	299	352	415	465	495	530	569	612	658	704	753	805	862	922
	3 Kilimanjaro	90	113	126	145	170	184	191	200	210	221	232	248	265	283	303	324
4	1 Tanga	129	148	160	175	193	262	280	300	323	348	375	409	447	487	532	581
!	5 Morogoro	105	124	133	146	160	187	202	218	237	257	279	302	325	351	379	408
(	5 Pwani	134	213	251	292	331	367	425	494	567	646	737	794	857	924	998	1,077
-	7 Dar es Salaam	564	635	667	704	744	774	810	854	898	944	997	1,053	1,112	1,174	1,242	1,314
8	3 Lindi	19	34	48	63	78	102	114	127	141	157	174	191	209	230	253	279
Ģ	9 Mtwara	32	44	39	49	56	67	77	89	102	117	133	146	162	178	197	217
10	) Ruvuma	21	24	31	38	45	52	67	82	98	116	135	148	163	180	198	218
1	I Iringa +Njombe	67	77	83	94	103	121	131	142	155	168	183	202	223	246	272	300
12	2 Mbeya	71	101	117	133	149	166	182	198	215	235	256	277	301	326	354	384
13	3 Singida	27	32	35	39	43	53	57	62	67	72	78	86	95	104	115	127
14	1 Tabora	49	67	90	110	132	152	168	185	204	225	248	274	303	335	371	410
15	5 Rukwa +Katavi	11	16	21	26	31	36	39	42	46	50	55	59	64	70	76	83
16	5 Kigoma	12	20	30	40	50	60	67	75	84	93	103	113	123	134	146	160
17	7 Shinyanga+ Simiyu	135	158	167	177	195	193	207	220	234	250	267	291	317	346	378	413
18	3 Kagera	23	39	52	65	85	83	95	108	126	146	165	179	195	212	231	252
19	9 Mwanza +Geita	62	81	101	117	136	165	181	195	209	230	259	276	295	315	337	360
20	) Mara	84	98	112	126	141	181	201	216	237	256	275	300	328	357	390	426
2	l Manyara	15	19	21	25	28	31	32	34	35	37	38	40	42	44	46	49
	Mainland total	124	151	168	188	210	233	252	272	295	319	346	373	402	433	466	503
22	2 Zanzibar	261	298	330	357	384	410	440	473	506	538	569	594	618	646	669	691
	Total	128	155	173	103	215	238	258	278	301	325	353	379	408	439	472	508
	1 0 (01	120	155	175	155	215	230	230	2/0	501	020	555	0, 5	100	155	17 2	500
	1 otal	120	155	175	155	215	230	250	2/0	501	020	555	079	100	135	./ 2	500
		2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2015/20	2020/25	2025/30	2030/35	2035/40	2015/40
	L Dodoma	2031 238	2032 258	2033 280	2034 304	2035 330	2036 353	2037 375	2038 398	2039 423	2040 450	2015/20 13.1	2020/25 6.3	2025/30 7.6	2030/35 8.5	2035/40 6.4	2015/40 8.5
	Dodoma Arusha	2031 238 987	2032 258 1,056	2033 280 1,130	2034 304 1,210	2035 330 1,295	2036 353 1,384	2037 375 1,480	2038 398 1,582	2039 423 1,692	2040 450 1,809	2015/20 13.1 19.4	2020/25 6.3 7.2	2025/30 7.6 7.0	2030/35 8.5 7.0	2035/40 6.4 6.9	2015/40 8.5 9.4
	Dodoma 2 Arusha 3 Kilimanjaro	2031 238 987 347	2032 258 1,056 372	2033 280 1,130 398	2034 304 1,210 427	2035 330 1,295 458	2036 353 1,384 491	2037 375 1,480 527	2038 398 1,582 566	2039 423 1,692 607	2040 450 1,809 652	2015/20 13.1 19.4 15.3	2020/25 6.3 7.2 4.8	2025/30 7.6 7.0 6.9	2030/35 8.5 7.0 7.2	2035/40 6.4 6.9 7.3	2015/40 8.5 9.4 8.2
	l Dodoma 2 Arusha 3 Kilimanjaro 4 Tanga	2031 238 987 347 634	2032 258 1,056 372 692	2033 280 1,130 398 756	2034 304 1,210 427 825	2035 330 1,295 458 900	2036 353 1,384 491 966	2037 375 1,480 527 1,038	2038 398 1,582 566 1,115	2039 423 1,692 607 1,197	2040 450 1,809 652 1,286	2015/20 13.1 19.4 15.3 15.2	2020/25 6.3 7.2 4.8 7.4	2025/30 7.6 7.0 6.9 9.1	2030/35 8.5 7.0 7.2 9.2	2035/40 6.4 6.9 7.3 7.4	2015/40 8.5 9.4 8.2 9.6
	L Dodoma 2 Arusha 3 Kilimanjaro 4 Tanga 4 Morogoro	2031 238 987 347 634 440	2032 258 1,056 372 692 475	2033 280 1,130 398 756 511	2034 304 1,210 427 825 551	2035 330 1,295 458 900 593	2036 353 1,384 491 966 635	2037 375 1,480 527 1,038 680	2038 398 1,582 566 1,115 729	2039 423 1,692 607 1,197 781	2040 450 1,809 652 1,286 836	2015/20 13.1 19.4 15.3 15.2 12.3	2020/25 6.3 7.2 4.8 7.4 8.4	2025/30 7.6 7.0 6.9 9.1 7.9	2030/35 8.5 7.0 7.2 9.2 7.7	2035/40 6.4 6.9 7.3 7.4 7.1	2015/40 8.5 9.4 8.2 9.6 8.7
	Dodoma Dodoma Arusha Kiimanjaro Tanga Morogoro Pwani	2031 238 987 347 634 440 1,165	2032 258 1,056 372 692 475 1,261	2033 280 1,130 398 756 511 1,367	2034 304 1,210 427 825 551 1,482	2035 330 1,295 458 900 593 1,608	2036 353 1,384 491 966 635 1,724	2037 375 1,480 527 1,038 680 1,850	2038 398 1,582 566 1,115 729 1,987	2039 423 1,692 607 1,197 781 2,134	2040 450 1,809 652 1,286 836 2,296	2015/20 13.1 19.4 15.3 15.2 12.3 22.3	2020/25 6.3 7.2 4.8 7.4 8.4 15.0	2025/30 7.6 7.0 6.9 9.1 7.9 7.9	2030/35 8.5 7.0 7.2 9.2 7.7 8.3	2035/40 6.4 6.9 7.3 7.4 7.1 7.4	2015/40 8.5 9.4 8.2 9.6 8.7 12.0
	2 Dodoma 2 Arusha 3 Kilimanjaro 4 Tanga Morogoro 5 Pwani 7 Dar es Sabam	2031 238 987 347 634 440 1,165 1,390	2032 258 1,056 372 692 475 1,261 1,473	2033 280 1,130 398 756 511 1,367 1,560	2034 304 1,210 427 825 551 1,482 1,654	2035 330 1,295 458 900 593 1,608 1,754	2036 353 1,384 491 966 635 1,724 1,869	2037 375 1,480 527 1,038 680 1,850 1,991	2038 398 1,582 566 1,115 729 1,987 2,123	2039 423 1,692 607 1,197 781 2,134 2,265	2040 450 1,809 652 1,286 836 2,296 2,417	2015/20 13.1 19.4 15.3 15.2 12.3 22.3 6.5	2020/25 6.3 7.2 4.8 7.4 8.4 15.0 5.2	2025/30 7.6 7.0 6.9 9.1 7.9 7.9 7.9 5.7	2030/35 8.5 7.0 7.2 9.2 7.7 8.3 6.0	2035/40 6.4 6.9 7.3 7.4 7.1 7.4 6.6	2015/40 8.5 9.4 8.2 9.6 8.7 12.0 6.0
	2 Dodoma 2 Arusha 3 Kiimanjaro 4 Tanga 5 Morogoro 6 Pwani 7 Dar es Salaam 3 Lindi	2031 238 987 347 634 440 1,165 1,390 307	2032 258 1,056 372 692 475 1,261 1,473 338	2033 280 1,130 398 756 511 1,367 1,560 373	2034 304 1,210 427 825 551 1,482 1,654 412	213 2035 330 1,295 458 900 593 1,608 1,754 454	2036 353 1,384 491 966 635 1,724 1,869 498	2037 375 1,480 527 1,038 680 1,850 1,991 546	270 2038 398 1,582 566 1,115 729 1,987 2,123 600	2039 423 1,692 607 1,197 781 2,134 2,265 659	2040 450 1,809 652 1,286 836 2,296 2,417 724	2015/20 13.1 19.4 15.3 15.2 12.3 22.3 6.5 39.3	2020/25 6.3 7.2 4.8 7.4 8.4 15.0 5.2 11.2	2025/30 7.6 7.0 6.9 9.1 7.9 7.9 7.9 5.7 9.9	2030/35 8.5 7.0 7.2 9.2 7.7 8.3 6.0 10.3	2035/40 6.4 6.9 7.3 7.4 7.1 7.4 6.6 9.8	2015/40 8.5 9.4 8.2 9.6 8.7 12.0 6.0 15.6
	Dodoma Arusha Klimanjaro Tanga Morogoro Pwani Dar es Salaam Slindi Mtwara	2031 238 987 347 634 440 1,165 1,390 307 240	2032 258 1,056 372 692 475 1,261 1,473 338 265	2033 280 1,130 398 756 511 1,367 1,560 373 294	2034 304 1,210 427 825 551 1,482 1,654 412 325	2035 330 1,295 458 900 593 1,608 1,754 454 359	2036 353 1,384 491 966 635 1,724 1,869 498 397	2037 375 1,480 527 1,038 680 1,850 1,850 1,991 546 439	2038 398 1,582 566 1,115 729 1,987 2,123 600 486	2039 423 1,692 607 1,197 781 2,134 2,265 659 538	2040 450 1,809 652 1,286 836 2,296 2,417 724 596	2015/20 13.1 19.4 15.3 15.2 12.3 22.3 6.5 39.3 15.5	2020/25 6.3 7.2 4.8 7.4 8.4 15.0 5.2 11.2 14.8	2025/30 7.6 7.0 6.9 9.1 7.9 7.9 5.7 9.9 10.3	2030/35 8.5 7.0 7.2 9.2 7.7 8.3 6.0 10.3 10.6	2035/40 6.4 6.9 7.3 7.4 7.1 7.4 6.6 9.8 10.7	2015/40 8.5 9.4 8.2 9.6 8.7 12.0 6.0 15.6 12.3
	Dodoma Arusha Arusha Kiimanjaro Tanga Morogoro Povani Dar es Salaam Lindi Mtwara Mtwara	2031 238 987 347 634 440 1,165 1,390 307 240 241	2032 258 1,056 372 692 475 1,261 1,473 338 265 266	2033 280 1,130 398 756 511 1,367 1,560 373 294 293	2034 304 1,210 427 825 551 1,482 1,654 412 325 324	2035 330 1,295 458 900 593 1,608 1,754 454 359 358	2036 353 1,384 491 966 635 1,724 1,869 498 397 389	2037 375 1,480 527 1,038 680 1,850 1,991 546 439 424	2038 398 1,582 566 1,115 729 1,987 2,123 600 486 462	2039 423 1,692 607 1,197 781 2,134 2,265 659 538 503	2040 450 1,809 652 1,286 836 2,296 2,417 724 596 549	2015/20 13.1 19.4 15.3 15.2 12.3 22.3 6.5 39.3 15.5 20.1	2020/25 6.3 7.2 4.8 7.4 8.4 15.0 5.2 11.2 11.2 14.8 20.8	2025/30 7.6 7.0 6.9 9.1 7.9 7.9 5.7 9.9 9.9 10.3 10.1	2030/35 8.5 7.0 7.2 9.2 7.7 8.3 6.0 10.3 10.6 10.4	2035/40 6.4 6.9 7.3 7.4 7.1 7.4 6.6 9.8 10.7 8.9	2015/40 8.5 9.4 8.2 9.6 8.7 12.0 6.0 15.6 12.3 13.9
	2 Dodoma 2 Arusha 3 Kilimanjaro 4 Tanga Morogoro 5 Pwani 7 Dar es Sakam 3 Lindi 9 Mtwara 9 Ruvuma Iringa +Njombe	2031 2038 987 347 634 440 1,165 1,390 307 240 241 331	2032 258 1,056 372 475 1,261 1,473 338 265 266 365	2033 280 1,130 398 756 511 1,367 1,560 373 294 293 403	2034 304 1,210 427 825 551 1,482 1,654 412 325 324 444	2035 330 1,295 458 900 593 1,608 1,754 454 359 358 489	2036 353 1,384 491 966 635 1,724 1,869 498 397 389 526	2037 375 1,480 527 1,038 680 1,850 1,991 546 439 424 565	2038 398 1,582 566 1,115 729 1,987 2,123 600 486 462 606	2039 423 1,692 607 1,197 781 2,134 2,265 659 538 503 651	2040 450 1,809 652 1,286 836 2,296 2,417 724 596 549 699	2015/20 13.1 19.4 15.3 15.2 12.3 22.3 6.5 39.3 15.5 20.1 12.5	2020/25 6.3 7.2 4.8 7.4 8.4 15.0 5.2 11.2 14.8 20.8 8.6	2025/30 7.6 7.0 6.9 9.1 7.9 7.9 5.7 9.9 10.3 10.1 10.4	2030/35 8.5 7.0 7.2 9.2 7.7 8.3 6.0 10.3 10.6 10.4 10.3	2035/40 6.4 6.9 7.3 7.4 7.1 7.4 6.6 9.8 10.7 8.9 7.4	2015/40 8.5 9.4 8.2 9.6 8.7 12.0 6.0 15.6 12.3 13.9 9.8
	Dodoma 2 Arusha 3 Kiimanjaro 4 Tanga 5 Morogoro 5 Pwani 9 Dar es Sabaam 3 Lindi 9 Mtwara 9 Ruvuma 1 Iringa +Njombe 2 Mbeya	2031 238 987 347 634 440 1,165 1,390 307 240 241 331 417	2032 258 1,056 372 692 475 1,261 1,473 338 265 266 365 453	2033 280 1,130 398 756 511 1,367 1,560 373 294 293 403 403 492	2034 304 1,210 427 825 551 1,482 1,654 412 325 324 444 535	2035 330 1,295 458 900 593 1,608 1,754 454 359 358 489 581	2036 353 1,384 491 966 635 1,724 1,869 498 397 389 526 624	2037 375 1,480 527 1,038 680 1,850 1,991 546 439 424 565 669	2038 398 1,582 566 1,115 729 1,987 2,123 600 486 462 606 719	2039 423 1,692 607 1,197 781 2,134 2,265 659 538 503 651 772	2040 450 1,809 652 1,286 836 2,296 2,417 724 596 549 699 830	2015/20 13.1 19.4 15.3 15.2 12.3 22.3 6.5 39.3 15.5 20.1 12.5 20.1 12.5 18.4	2020/25 6.3 7.2 4.8 7.4 8.4 15.0 5.2 11.2 14.8 20.8 8.6 9.1	2025/30 7.6 7.0 6.9 9.1 7.9 5.7 9.9 10.3 10.1 10.4 8.4	2030/35 8.5 7.0 7.2 9.2 7.7 8.3 6.0 10.3 10.6 10.4 10.4 10.3 8.7	2035/40 6.4 6.9 7.3 7.4 7.1 7.4 6.6 9.8 10.7 8.9 7.4 7.4 7.4 7.4	2015/40 8.5 9.4 8.2 9.6 8.7 12.0 6.0 15.6 12.3 13.9 9.8 10.3
	Dodoma Dodoma Arusha Klimanjaro Tanga Morogoro Pwani Dar es Salaam Lindi Mtwara Ruvuma Iringa + Njombe Mbeya Singida	2031 2038 987 347 634 440 1,165 1,390 307 240 241 331 417 141	2032 258 1,056 372 692 475 1,261 1,473 338 265 266 365 266 365 453 155	2033 280 1,130 398 756 511 1,367 1,560 373 294 293 403 492 172	2034 304 1,210 427 825 551 1,482 1,654 412 325 324 444 444 535 190	2035 330 1,295 458 900 593 1,608 1,754 454 454 454 359 358 459 358 358 489 581 210	2036 353 1,384 491 966 635 1,724 1,869 498 397 389 526 624 225	2037 375 1,480 527 1,038 680 1,850 1,991 546 439 424 565 669 241	2038 398 1,582 566 1,115 729 1,987 2,123 600 486 462 606 719 259	2039 423 1,692 607 1,197 781 2,134 2,265 659 538 503 651 772 278	2040 450 1,809 652 1,286 836 2,296 2,417 724 596 549 699 830 298	2015/20 13.1 19.4 15.3 15.2 12.3 22.3 6.5 39.3 15.5 20.1 12.5 20.1 12.5 18.4 14.3	2020/25 6.3 7.2 4.8 7.4 8.4 15.0 5.2 11.2 14.8 20.8 8.6 9.1 8.1	2025/30 7.6 7.0 6.9 9.1 7.9 7.9 5.7 9.9 10.3 10.1 10.4 8.4 8.4 10.2	2030/35 8.5 7.0 7.2 9.2 7.7 8.3 6.0 10.3 10.6 10.4 10.4 10.3 8.7 10.5	2035/40 6.4 6.9 7.3 7.4 7.1 7.4 6.6 9.8 10.7 8.9 7.4 7.4 7.4 7.4 7.4	2015/40 8.5 9.4 8.2 9.6 8.7 12.0 6.0 15.6 12.3 13.9 9.8 10.3 10.1
	Dodoma 2 Arusha 3 Kilimanjaro 4 Tanga Morogoro 9 Pvani 7 Dar es Salaam 3 Lindi 9 Mtwara 9 Mtwara 1 Iringa +Njombe 2 Mbeya 3 Singida 4 Tabora	2031 2038 987 347 634 440 1,165 1,390 307 240 241 331 417 141 455	2032 258 1,056 372 475 1,261 1,473 338 265 266 365 453 155 504	2033 280 1,130 398 756 511 1,367 1,560 373 294 293 403 403 403 492 172 558	2034 304 1,210 427 825 551 1,482 1,654 412 325 324 444 535 190 618	2035 330 1,295 458 900 593 1,608 1,754 454 359 358 489 581 210 684	2036 353 1,384 491 966 635 1,724 1,869 498 397 389 526 624 624 225 745	2037 375 1,480 527 1,038 680 1,850 1,991 546 439 424 565 669 241 811	2038 398 1,582 566 1,115 729 1,987 2,123 600 486 462 606 719 259 883	2039 423 1,692 607 1,197 781 2,134 2,265 659 538 503 651 772 278 962	2040 450 1,809 652 1,286 836 2,296 2,417 724 596 549 699 830 298 1,047	2015/20 13.1 19.4 15.3 15.2 12.3 22.3 6.5 39.3 15.5 20.1 12.5 18.4 14.3 25.2	2020/25 6.3 7.2 4.8 7.4 8.4 15.0 5.2 11.2 14.8 20.8 8.6 9.1 8.1 8.1 10.3	2025/30 7.6 7.0 6.9 9.1 7.9 7.9 5.7 9.9 10.3 10.1 10.4 8.4 10.2 10.6	2030/35 8.5 7.0 7.2 9.2 7.7 8.3 6.0 10.3 10.6 10.4 10.3 8.7 10.5 10.8	2035/40 6.4 6.9 7.3 7.4 7.1 7.4 6.6 9.8 10.7 8.9 7.4 7.4 7.4 7.3 8.9	2015/40 8.5 9.4 8.2 9.6 8.7 12.0 6.0 115.6 12.3 13.9 9.8 10.3 10.1 13.0
	2 Dodoma 2 Arusha 3 Kilimanjaro 4 Tanga 9 Morogoro 5 Povani 7 Dar es Sabaam 9 Lindi 9 Mtwara 9 Ruvuma 1 Iringa +Njombe 2 Mbeya 3 Singida 1 Tabora 9 Rukwa +Katavi	2031 2038 987 347 634 440 1,165 1,390 307 240 241 331 417 141 455 90	2032 258 1,056 372 692 475 1,261 1,473 338 265 266 365 453 155 504 98	2033 280 1,130 398 756 511 1,367 1,560 373 294 293 403 403 492 172 558 107	2034 304 1,210 427 825 551 1,482 1,654 412 325 324 444 535 324 444 535 190 618 117	2035 330 1,295 458 900 593 1,608 1,754 454 359 358 489 581 210 684 128	2036 353 1,384 491 966 635 1,724 1,869 498 397 389 526 624 225 745 142	2037 375 1,480 527 1,038 680 1,850 1,991 546 439 424 565 669 241 811 158	273 2038 398 1,582 566 1,115 729 1,987 2,123 600 486 462 606 719 259 883 177	2039 423 1,692 607 1,197 781 2,134 2,265 659 538 503 651 772 278 962 198	2040 450 1,809 652 1,286 836 2,296 2,417 724 596 549 699 830 298 1,047 224	2015/20 13.1 19.4 15.3 15.2 12.3 6.5 39.3 15.5 20.1 12.5 20.1 12.5 18.4 14.3 25.2 27.3	2020/25 6.3 7.2 4.8 7.4 8.4 15.0 5.2 11.2 14.8 20.8 8.6 9.1 8.1 8.1 10.3 8.8	2025/30 7.6 7.0 6.9 9.1 7.9 7.9 5.7 9.9 10.3 10.1 10.4 8.4 10.2 10.6 8.6	2030/35 8.5 7.0 7.2 9.2 7.7 8.3 6.0 10.3 10.6 10.4 10.3 8.7 10.5 10.8 9.2	2035/40 6.4 6.9 7.3 7.4 7.1 7.4 6.6 9.8 10.7 8.9 7.4 7.4 7.4 7.4 7.3 8.9 7.4 7.4 7.3 8.9 11.8	2015/40 8.5 9.4 8.2 9.6 8.7 12.0 6.0 15.6 12.3 13.9 9.8 10.3 10.1 13.0 12.9
	Dodoma Dodoma Arusha Kiimanjaro Tanga Morogoro Povani Dar es Sabam Lindi Mtwara Ruvuma Iringa +Njombe Mbeya Singida Tabora Rukwa +Katavi Kigoma	2031 238 987 347 634 440 1,165 1,390 307 240 241 331 417 141 141 415 90 174	2032 258 1,056 372 692 475 1,261 1,473 338 265 266 365 266 365 453 155 504 98 191	2033 280 1,130 398 756 511 1,367 1,560 373 294 293 403 403 492 172 558 107 209	2034 304 1,210 427 825 551 1,482 1,654 412 325 324 444 535 324 444 535 190 618 117 228	2035 330 1,295 458 900 593 1,608 1,754 454 359 358 489 581 210 684 128 250	2036 353 1,384 491 966 635 1,724 1,869 498 397 389 526 624 225 745 745 142 268	2037 375 1,480 527 1,038 680 1,850 1,991 546 439 424 565 669 241 811 811 158 287	2038 398 1,582 566 1,115 729 1,987 2,123 600 486 462 606 719 259 883 177 307	2039 423 1,692 607 1,197 781 2,134 2,265 659 538 503 651 772 278 962 198 329	2040 450 1,809 652 1,286 836 2,296 2,417 724 596 549 699 830 298 830 298 1,047 224 353	2015/20 13.1 19.4 15.3 15.2 12.3 22.3 30.3 15.5 20.1 12.5 18.4 14.3 25.2 27.3 37.5	2020/25 6.3 7.2 4.8 7.4 8.4 15.0 5.2 11.2 14.8 20.8 8.6 9.1 8.1 10.3 8.8 11.7	2025/30 7.6 7.0 6.9 9.1 7.9 7.9 5.7 9.9 10.3 10.1 10.4 8.4 10.2 10.6 8.6 8.6 9.1	2030/35 8.5 7.0 7.2 9.2 7.7 8.3 6.0 10.3 10.6 10.4 10.3 8.7 10.5 10.8 9.2 9.4	2035/40 6.4 6.9 7.3 7.4 7.4 7.4 6.6 9.8 10.7 8.9 7.4 7.4 7.4 7.4 7.3 8.9 7.4 7.4 7.3 8.9 11.8 7.1	2015/40 8.5 9.4 8.2 9.6 8.7 12.0 6.0 15.6 12.3 13.9 9.8 10.3 10.1 13.0 12.9 14.4
	Dodoma Dodoma Arusha Kiimanjaro Tanga Morogoro Povani Dar es Salaam Lindi Mtwara Ruvuma Iringa +Njombe Mtyara Singida Tabora Rukwa +Katavi Kigoma Shinyanga+ Simiyu	2031 238 987 347 634 440 1,165 1,390 307 240 241 331 417 141 417 141 455 90 174 452	2032 258 1,056 372 692 475 1,261 1,473 338 265 266 365 266 365 266 365 453 155 504 98 191 191 495	2033 280 1,130 398 756 511 1,367 1,560 373 294 293 403 492 172 558 107 209 543	2034 304 1,210 427 825 551 1,482 1,654 412 325 324 444 535 190 618 117 228 595	2035 330 1,295 458 900 593 1,608 1,754 454 359 358 459 581 210 684 128 684 128 550 653	2036 353 1,384 491 966 635 1,724 1,869 498 397 389 526 624 225 745 624 225 745 142 268 700	2037 375 1,480 527 1,038 680 1,850 1,991 546 439 424 565 669 241 811 158 881 1158 287 751	2038 398 1,582 566 1,115 729 1,987 2,123 600 486 462 606 719 259 883 177 307 805	2039 423 1,692 607 781 2,134 2,265 659 538 503 651 772 278 962 198 329 864	2040 450 450 1,809 652 1,286 836 2,296 2,417 724 596 549 699 830 298 830 298 1,047 224 353 928	2015/20 13.1 19.4 15.3 15.2 12.3 22.3 6.5 39.3 15.5 20.1 12.5 20.1 13.5 20.1 15.5 20.1 15.5 20.1 15.5 20.1 15.5 20.1 15.5 20.1 15.5 20.7 15.5 20.7 15.5 20.7 15.5 20.7 15.5 20.7 15.5 20.7 15.5 20.7 15.5 20.7 15.5 20.7 15.5 20.7 15.5 20.7	2020/25 6.3 7.2 4.8 7.4 8.4 15.0 5.2 11.2 14.8 20.8 8.6 9.1 8.1 10.3 8.8 11.7 6.8	2025/30 7.6 7.0 6.9 9.1 7.9 7.9 5.7 9.9 10.3 10.1 10.4 8.4 10.2 10.6 8.6 9.1 9.1	2030/35 8.5 7.0 7.2 9.2 7.7 8.3 6.0 10.3 10.6 10.4 10.3 8.7 10.5 10.8 9.2 9.4 9.4 9.6	2035/40 6.4 6.9 7.3 7.4 7.1 7.4 6.6 9.8 10.7 8.9 7.4 7.4 7.4 7.4 7.3 8.9 11.8 7.1 7.3	2015/40 8.5 9.4 8.2 9.6 8.7 12.0 6.0 15.6 12.3 13.9 9.8 10.3 10.1 13.0 10.1 13.0 12.9 14.4 8.0
	2 Dodoma 2 Arusha 3 Kilimanjaro 4 Tanga Morogoro 5 Pwani 7 Dar es Salaam 3 Lindi 9 Mtwara 9 Mtwara 9 Mtwara 1 Iringa +Njombe 2 Mbeya 9 Singida 4 Tabora 5 Rukwa +Katavi 6 Kigoma 2 Shinyanga + Simiyu 9 Kagera	2031 2038 987 347 634 440 1,165 1,390 307 240 241 331 417 141 455 900 174 452 275	2032 258 1,056 372 475 1,261 1,473 338 265 266 365 453 155 504 98 191 98 191 495 300	2033 280 1,130 398 756 511 1,367 1,560 373 294 293 403 403 403 402 172 172 558 107 209 543 329	2034 304 1,210 427 825 551 1,482 1,654 412 325 324 444 535 190 618 117 228 595 360	2035 330 1,295 458 900 593 1,608 1,754 454 359 358 489 581 210 684 128 250 653 394	2036 353 1,384 491 966 635 1,724 1,869 498 397 389 526 624 225 745 225 745 142 268 700 430	2037 375 1,480 527 1,038 680 1,850 1,991 546 439 424 565 669 241 811 158 287 751 471	2038 398 1,582 566 1,115 729 1,987 2,123 600 486 462 606 719 259 883 177 307 805 516	2039 423 1,692 607 1,197 781 2,134 2,265 659 538 503 651 772 278 962 198 329 864 556	2040 450 1,809 652 1,286 836 2,296 2,417 724 596 549 699 830 298 1,047 224 353 928 623	2015/20 13.1 19.4 15.3 15.2 12.3 22.3 6.5 39.3 15.5 20.1 12.5 18.4 14.3 25.2 27.3 37.5 7.3 29.3	2020/25 6.3 7.2 4.8 7.4 8.4 15.0 5.2 11.2 14.8 20.8 8.6 9.1 10.3 8.8 11.7 6.8 14.9	2025/30 7.6 7.0 6.9 9.1 7.9 7.9 5.7 9.9 10.3 10.1 10.4 8.4 10.2 10.6 8.6 9.1 9.1 8.8	2030/35 8.5 7.0 7.2 9.2 7.7 8.3 6.0 10.3 10.6 10.4 10.3 8.7 10.5 10.8 9.2 9.4 9.6 9.4	2035/40 6.4 6.9 7.3 7.4 7.1 7.4 6.6 9.8 10.7 8.9 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4	2015/40 8.5 9.4 8.2 9.6 8.7 12.0 6.0 115.6 12.3 13.9 9.8 10.3 10.1 13.0 12.9 9.8 10.1 13.0 12.9 14.4 8.0 14.1
2 2 3 3 4 3 3 4 4 11 11 11 11 11 11 11 11 11 11 11 11	2 Dodoma 2 Arusha 3 Kilimanjaro 4 Tanga 4 Tanga 5 Morogoro 5 Povani 7 Dar es Salaam 3 Lindi 9 Mtwara 9 Mtwara 9 Ruvuma 1 ringa +Njombe 2 Mbeya 3 Singida 4 Tabora 7 Rukwa +Katavi 5 Kigoma 7 Shinyanga + Siniyu 9 Kagera 9 Mwanza +Geita	2031 2038 987 347 634 440 1,165 1,390 307 240 241 331 417 141 455 90 174 455 90 174 455 386	2032 258 1,056 372 692 475 1,261 1,473 338 265 266 365 453 155 504 98 191 98 191 495 300 414	2033 280 1,130 398 756 511 1,367 1,560 373 294 403 403 403 492 172 558 107 209 543 329 445	2034 304 1,210 427 825 551 1,482 1,654 412 325 324 444 535 190 618 117 228 595 360 478	2035 330 1,295 458 900 593 1,608 1,754 454 359 358 489 581 210 684 128 250 684 128 250 653 394 515	2036 353 1,384 491 966 635 1,724 1,869 498 397 389 526 624 225 745 225 745 142 268 745 142 268 700 700	2037 375 1,480 527 1,038 680 1,850 1,991 546 439 424 565 669 241 811 158 287 751 158 287 751 584	2038 398 1,582 566 1,115 729 1,987 2,123 600 486 462 606 719 259 883 177 307 805 516 623	2039 423 1,692 607 1,197 781 2,134 2,265 659 538 503 651 772 278 962 198 329 864 566 666	2040 450 1,809 652 1,286 836 2,296 2,417 724 596 549 699 830 298 1,047 224 353 928 623 711	2015/20 13.1 19.4 15.3 15.2 12.3 6.5 39.3 15.5 20.1 12.5 20.1 20.1 20.5 20.1 20.5 20.1 20.5 20.1 20.5 20.1 20.5 20.1 20.5 20.1 20.5 20.1 20.5 20.1 20.5 20.7 20.5 20.7 20.5 20.7 20.5 20.7 20.5 20.7 20.5 20.7 20.5 20.7 20.5	2020/25 6.3 7.2 4.8 7.4 8.4 15.0 5.2 11.2 14.8 20.8 8.6 9.1 8.1 10.3 8.8 11.7 6.8 14.9 9.4	2025/30 7.6 7.0 6.9 9.1 7.9 7.9 5.7 9.9 10.3 10.1 10.4 8.4 10.2 10.6 8.6 9.1 9.1 9.1 8.8 6.8	2030/35 8.5 7.0 7.2 9.2 7.7 8.3 6.0 10.3 10.6 10.4 10.3 8.7 10.5 10.8 9.2 9.4 9.6 9.4 7.4	2035/40 6.4 6.9 7.3 7.4 7.1 7.4 6.6 9.8 10.7 8.9 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4	2015/40 8.5 9.4 8.2 9.6 8.7 12.0 6.0 15.6 12.3 13.9 9.8 10.3 10.1 13.0 12.9 14.4 8.0 14.1 10.3
	Dodoma Dodoma Arusha Klimanjaro Tanga Morogoro Pwani Dar es Sabaam Lindi Mtwara Ruvuma Iringa + Njombe Mtwara Singida Tabora Rukwa + Katavi Kigoma Shinyanga + Simiyu Kagera Mwara	2031 2038 987 347 634 440 1,165 1,390 307 240 241 331 417 141 417 141 455 90 174 452 275 386 465	2032 258 1,056 372 692 475 1,261 1,473 338 265 266 365 266 365 266 365 266 365 266 365 155 504 98 191 495 300 414 414 508	2033 280 1,130 398 756 511 1,367 1,560 373 294 293 403 492 172 558 107 209 543 329 445 555	2034 304 1,210 427 825 551 1,482 1,654 412 325 324 444 535 190 618 117 228 595 360 478 607	2035 330 1,295 458 900 593 1,608 1,754 454 454 359 358 459 358 489 581 210 684 128 250 653 394 515 663	2036 353 1,384 491 966 635 1,724 1,869 498 397 389 526 624 225 745 142 268 700 430 430 548 710	2037 375 1,480 527 1,038 680 1,850 1,991 546 439 424 565 669 241 811 158 287 751 471 584 759	2038 398 1,582 566 1,115 729 1,987 2,123 600 486 462 606 719 259 883 177 307 805 516 623 812	2039 423 1,692 607 1,197 781 2,134 2,265 659 538 503 651 772 278 962 198 329 864 566 666 869	2040 450 1,809 652 1,286 836 2,296 2,417 724 596 549 699 830 298 1,047 224 353 928 623 928 623 711 930	2015/20 13.1 19.4 15.3 15.2 12.3 22.3 6.5 39.3 15.5 20.1 12.5 20.1 12.5 20.1 12.5 20.1 12.5 20.1 12.5 20.1 12.5 20.1 12.5 20.1 12.5 20.1 12.5 20.1 12.5 20.1 12.5 20.1 20.5 20.5 20.1 20.5 20.1 20.5 20.1 20.5 20.1 20.5 20.1 20.5 20.1 20.5 20.1 20.5 20.5 20.5 20.1 20.5	2020/25 6.3 7.2 4.8 7.4 8.4 15.0 5.2 11.2 14.8 20.8 8.6 9.1 8.1 10.3 8.8 11.7 6.8 11.7 6.8 11.9 9.4 8.7	2025/30 7.6 7.0 6.9 9.1 7.9 7.9 5.7 9.9 10.3 10.1 10.4 8.4 10.2 10.6 8.6 9.1 9.1 8.8 6.8 6.8 9.1	2030/35 8.5 7.0 7.2 9.2 7.7 8.3 6.0 10.3 10.6 10.4 10.3 10.6 10.4 10.3 10.5 10.8 9.2 9.4 9.4 9.6 9.4 9.4 7.4 9.3	2035/40 6.4 6.9 7.3 7.4 7.1 7.4 6.6 9.8 10.7 8.9 7.4 7.4 7.3 8.9 7.4 7.4 7.3 8.9 11.8 7.1 7.3 9.6 6.7 7.0	2015/40 8.5 9.4 8.2 9.6 8.7 12.0 6.0 15.6 12.3 13.9 9.8 10.1 13.0 12.9 14.4 8.0 14.1 10.3 10.1
2010 2010	Dodoma Arusha Arusha Kiimanjaro Tanga Morogoro Dar es Salaam Lindi Mtwara Ruvuma Iringa +Njombe Mbeya Singida Tabora Rukwa +Katavi Kigoma Shinyanga + Simiyu Kagera Mwanza +Geita Mara Manyara	2031 2038 987 347 634 440 1,165 1,390 307 240 241 331 417 445 90 174 455 90 174 455 275 386 465 51	2032 258 1,056 372 692 475 1,261 1,473 338 265 266 365 266 365 266 365 266 365 266 365 266 365 266 365 266 365 365 453 155 504 98 191 495 300 414 455 300 414 455 300 415 455 300 415 455 300 415 455 300 415 455 300 415 455 300 415 455 300 415 455 300 415 455 300 415 455 455 455 455 455 455 300 475 455 455 455 455 455 455 455 455 455	2033 280 1,1,130 398 756 511 1,367 1,560 373 294 293 403 403 403 402 172 558 107 209 543 329 445 555 555 57	2034 304 1,210 427 825 551 1,482 1,654 412 325 324 444 535 190 618 117 228 595 360 478 595 360 478 607 60	2035 330 1,295 458 900 593 1,608 1,754 454 454 359 358 489 581 210 684 128 250 653 394 515 663 663 63	2036 353 1,384 491 966 635 1,724 1,869 498 397 389 526 624 624 225 745 142 225 745 142 268 700 430 548 710 66	2037 375 1,480 527 1,038 680 1,991 546 439 424 565 669 241 811 158 287 751 471 584 471 584 759 69	2038 398 1,582 566 1,115 729 1,987 2,123 600 486 462 606 719 259 883 177 307 805 516 623 812 73	2039 423 1,692 607 781 2,134 2,265 659 538 503 651 772 278 962 198 329 962 198 329 864 566 666 666 666 869 777	2040 450 1,809 652 1,286 836 2,296 2,417 724 596 549 699 830 298 1,047 224 353 928 623 711 930 81	2015/20 13.1 19.4 15.3 15.2 12.3 22.3 6.5 39.3 15.5 20.1 12.5 20.1 16.7 20.3 27.3 27.3 29.3 21.7 16.7 16.7 15.7 16.7 15.7 15.7 16.7 15.7 16.7 15.7 16.7 15.7 16.7 15.7 16.7 15.7	2020/25 6.3 7.2 4.8 7.4 8.4 15.0 5.2 11.2 14.8 20.8 8.6 9.1 10.3 8.8 11.7 6.8 11.7 6.8 14.9 9.4 8.7 4.1	2025/30 7.6 7.0 6.9 9.1 7.9 7.9 5.7 9.9 10.3 10.1 10.4 8.4 10.2 10.6 8.6 9.1 9.1 9.1 8.8 6.8 9.1 9.1 4.9	2030/35 8.5 7.0 7.2 9.2 7.7 8.3 6.0 10.3 10.6 10.4 10.3 8.7 10.5 10.8 9.2 9.4 9.6 9.4 9.6 9.4 7.4 9.3 5.3	2035/40 6.4 6.9 7.3 7.4 7.1 7.4 6.6 9.8 10.7 8.9 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4	2015/40 8.5 9.4 8.2 9.6 8.7 12.0 6.0 15.6 12.3 13.9 9.8 10.3 10.1 13.0 12.9 14.4 8.0 14.1 10.3 10.1 16.9
2000 200 2000 2	2 Dodoma 2 Arusha 3 Kilimanjaro 4 Tanga Morogoro 9 Pwani 7 Dar es Sabam 3 Lindi 9 Mtwara 9 Mtwara 9 Mtwara 1 Ruvuma 1 Iringa +Njombe 9 Mbeya 3 Singida 4 Tabora 5 Rukwa +Katavi 5 Kigoma 7 Shinyanga + Simiyu 9 Kagera 9 Mwanza +Geta 1 Manyara Manyara	2031 2038 987 347 634 440 1,165 1,390 307 240 241 331 417 141 455 90 174 455 275 386 465 51 542	2032 258 1,056 372 475 1,261 1,473 338 265 266 365 453 155 504 98 191 495 300 414 508 54 54 585	2033 280 1,130 398 756 511 1,367 1,560 373 294 293 403 403 403 402 172 558 107 209 543 329 445 555 57 631	2034 304 1,210 427 825 551 1,482 1,654 412 325 324 444 535 190 618 117 228 595 360 478 607 60 60 681	213 2035 330 1,295 458 900 593 1,608 1,754 454 359 358 489 581 210 684 128 250 653 394 515 663 63 736	2036 353 1,384 491 966 635 1,724 1,869 498 397 389 526 624 225 745 225 745 142 268 700 430 548 700 430 666 790	2037 375 1,480 527 1,038 680 1,991 546 439 424 565 669 241 811 158 287 751 471 584 759 69 848	2038 398 1,582 566 1,115 729 1,987 2,123 600 486 462 606 719 259 883 177 307 805 516 623 812 73 911	2039 423 1,692 607 1,197 781 2,134 2,265 659 538 503 651 772 278 962 198 329 864 198 329 864 566 666 666 869 77 77 978	2040 450 1,809 652 1,286 836 2,296 2,417 724 596 549 699 830 298 1,047 224 353 928 623 711 930 81 1,052	2015/20 13.1 19.4 15.3 15.2 12.3 22.3 6.5 39.3 15.5 20.1 12.5 18.4 14.3 25.2 27.3 37.5 7.3 29.3 21.7 16.7 15.7 13.4	2020/25 6.3 7.2 4.8 7.4 8.4 15.0 5.2 11.2 14.8 20.8 8.6 9.1 10.3 8.8 11.7 6.8 14.9 9.4 8.7 4.1 8.2	2025/30 7.6 7.0 6.9 9.1 7.9 5.7 9.9 10.3 10.1 10.4 8.4 10.2 10.6 8.6 9.1 9.1 8.8 6.8 9.1 9.1 8.8 6.8 9.1	2030/35 8.5 7.0 7.2 9.2 7.7 8.3 6.0 10.3 10.6 10.4 10.3 8.7 10.5 10.8 9.2 9.4 9.4 9.6 9.4 7.4 9.3 5.3 7.9	2035/40 6.4 6.9 7.3 7.4 7.1 7.4 6.6 9.8 10.7 8.9 7.4 7.4 7.4 7.4 7.3 8.9 11.8 7.1 7.3 8.9 11.8 7.1 7.3 9.6 6.7 7.0 5.0 5.0	2015/40 8.5 9.4 8.2 9.6 8.7 12.0 6.0 15.6 12.3 13.9 9.8 10.3 10.1 13.0 12.9 14.4 8.0 14.1 10.3 10.1 10.3
222	Dodoma Dodoma Arusha Klimanjaro Tanga Morogoro Pwani Dar es Salaam Lindi Mtwara Ruvuma Ruvuma Ruvuma Singida Tabora Rukwa +Njombe Mbeya Singida Tabora Rukwa +Katavi Kigoma Shinyanga+ Simiyu Kagera Mwanza +Geita Mara Manyara Manhand total Zanzibar	2031 2038 987 347 634 440 1,165 1,390 307 240 241 331 417 141 417 141 417 141 455 90 174 452 275 386 465 51 542 718	2032 258 1,056 372 692 475 1,261 1,473 338 265 266 365 266 365 266 365 266 365 453 155 504 98 191 495 300 414 495 300 414 4585 741	2033 280 1,130 398 756 511 1,367 1,560 373 294 293 403 492 172 558 107 209 543 329 445 555 57 631 766	2034 304 1,210 427 825 551 1,482 1,654 412 325 324 444 535 190 618 117 228 595 360 478 607 60 681 790	2035 330 1,295 458 900 593 1,608 1,754 454 359 358 489 581 210 684 128 250 684 128 250 653 394 515 663 63 736 813	2036 353 1,384 491 966 635 1,724 1,869 498 397 389 526 624 225 745 142 268 745 142 268 700 430 430 430 548 710 66 790 830	2037 375 1,480 527 1,038 680 1,850 1,991 546 439 424 565 669 241 811 158 287 751 471 471 584 759 69 848 852	2038 398 1,582 566 1,115 729 1,987 2,123 600 486 462 606 719 259 883 177 307 805 516 623 812 73 911 868	2039 423 1,692 607 1,197 781 2,134 2,265 659 538 503 651 772 278 962 198 329 864 198 329 864 198 329 864 566 666 869 77 7978 890	2040 450 1,809 652 1,286 836 2,296 2,417 724 596 549 699 830 298 1,047 224 353 928 623 711 930 81 1,052 906	2015/20 13.1 19.4 15.3 15.2 12.3 22.3 6.5 39.3 15.5 20.1 12.5 20.1 12.5 18.4 14.3 25.2 27.3 37.5 7.3 29.3 21.7 16.7 15.7 13.4 9.5	2020/25 6.3 7.2 4.8 7.4 8.4 15.0 5.2 11.2 14.8 20.8 8.6 9.1 8.1 10.3 8.8 11.7 6.8 11.7 6.8 14.9 9.4 8.7 4.1 8.2 6.8	2025/30 7.6 7.0 6.9 9.1 7.9 7.9 5.7 9.9 10.3 10.1 10.4 8.4 10.2 10.6 8.6 8.6 9.1 9.1 9.1 8.8 6.8 6.8 9.1 4.9 7.7 7.7 4.0	2030/35 8.5 7.0 7.2 9.2 9.2 7.7 8.3 6.0 10.3 10.6 10.4 10.4 10.3 10.6 10.4 10.3 10.5 10.8 9.2 9.4 9.4 9.4 9.4 9.4 9.4 9.4 9.4 9.2 9.4 9.2 9.4 9.2 9.2 9.2 9.2 9.2 9.2 9.2 10.5 10.5 10.5 10.5 10.5 10.5 10.5 10.5	2035/40 6.4 6.9 7.3 7.4 7.1 7.4 6.6 9.8 10.7 8.9 7.4 7.4 7.4 7.3 8.9 11.8 7.1 7.3 8.9 11.8 7.1 7.3 8.9 11.8 7.1 7.3 8.9 7.4 7.4 7.3 8.9 7.4 7.4 7.3 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4	2015/40 8.5 9.4 8.2 9.6 8.7 12.0 6.0 15.6 12.3 13.9 9.8 10.1 13.0 12.9 14.4 8.0 14.1 10.3 10.1 14.1 10.3 10.1 10.3 10.1 10.3 10.1 10.3 10.1 10.3 10.1 10.3 10.1 10.3 10.1 10.3 10.1 10.3 10.1 10.3 10.1 10.3 10.1 10.3 10.1 10.3 10.1 10.3 10.1 10.3 10.3

Source: Study results of Task Force Team

#### 2.8.9 Power demand including export and additional demand

#### Table 2-26: Power energy demand including export and additional demand (Base)

			Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Additional demand	Geita : Gold Mining	Co.	MW	28	28	28	28	28	45	45	45	45	45	45	45	45	45	45	45
(including transmission	Mara :Two Gold min	ing Co.	MW	9	9	9	9	9	22	22	22	22	22	22	22	22	22	22	22
and distribution losses)	Njombe :Iron Smelti	ng	MW						337	337	337	337	337	337	337	337	337	337	337
	Mtwara : DANGOTE		MW	34	34	34	34	34	67	67	67	67	67	67	67	67	67	67	67
	Power supply for Sec	curity	MW						570	570	570	570	570	570	570	570	570	570	570
	Total		MW	71	71	71	71	71	1.041	1.041	1.041	1.041	1.041	1.041	1.041	1.041	1.041	1.041	1.041
			Linit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Power export (MW)	Kenya (400kV)		MW	2015	2010	2017	2010	2015	2020	0	2022	2023	2021	0	2020	0	2020		2030
	Mozambique (400kV	')	MW						200	200	200	200	200	200	200	200	200	200	200
	Uganda (220kV)	,	MW						100	100	100	100	100	100	100	100	100	100	100
	Malawi		MW						100	100	100	100	100	100	100	100	100	100	100
	Zambia (400k)/)		N414/						200	200	200	200	200	200	200	200	200	200	200
	Export Total (MM/)								200	200	200	200	200	200	200	200	200	200	200
	Export Total (MW)	oc (MW)							600	600	600	600	600	600	600	600	600	600	600
Casos	Export including loss	Domand itoms	Lipit	2015	2016	2017	2010	2010	2020	2021	2022	2022	2024	2025	2026	2027	2020	2020	2020
Raco	Deak domand	Demostic domand	MM	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Dase		Additional domand	M\A/	71	1,240	71	1,005	1,925	1 041	1 041	2,090	2,979	1 041	1 041	1,025	1 041	1 041	1 041	1 0/1
		Export (Inc. Locc)	M14/	/1	/1	/1	/1	/1	1,041	692	691	670	677	677	677	677	677	677	677
		Total	M\A/	1 045	1 217	1 520	1 754	1 006	2 016	4 152	4 412	4 700	5 017	5 277	5 744	6 144	6 592	7 063	7 500
	Installed capacity	Domostic domond	MAA	1,045	1,517	1,520	2,754	2,990	3,910	9,152	7,412	3,972	4 200	3,377	5,744	5,144	6 224	6.049	7,390
	(Dook*1.2)			1,207	1,020	1,004	2,100	2,303	1 252	3,130	1 252	3,073	4,200	4,/3/	3,233	3,/33	1 252	1 252	1 252
	(Peak 1.5)		1º1VV	92	92	92	92	92	1,353	1,353	1,353	1,353	1,353	1,353	1,353	1,353	1,353	1,353	1,353
		Export (Inc. Loss)		1 250	1 712	1 070	2 201	2 505	890 F 001	500	585	683	6 522	6 001	880	7 007	880	0 102	880
		Total	I I*IVV	1.359	1./1/	1.9/0	2.281	2,595	2.0911	5,397	5.7.30	6,109	0,5221	0.991	7.407	/ 48/	8.77/	9.182	48571
				_/	_/:	_,	-/	1	- /	- /	-/	.,	- / -	-/	77107	7,507	0,007		5,007
			Unit	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2010/15	2015/20	2020/25	2025/30	2030/35	2035/40
Additional demand	Geita : Gold Mining (	Co.	Unit MW	2031 45	2032 45	2033 45	2034 45	2035 45	2036 45	2037 45	2038 45	2039 45	2040 45	2010/15 0.0	2015/20 10.0	2020/25 0.0	2025/30 0.0	2030/35 0.0	2035/40 0.0
Additional demand (including transmission	Geita : Gold Mining ( Mara :Two Gold min	Co. ing Co.	Unit MW MW	2031 45 22	2032 45 22	2033 45 22	2034 45 22	2035 45 22	2036 45 22	2037 45 22	2038 45 22	2039 45 22	2040 45 22	2010/15 0.0 0.0	2015/20 10.0 19.6	2020/25 0.0 0.0	2025/30 0.0 0.0	2030/35 0.0 0.0	2035/40 0.0 0.0
Additional demand (including transmission and distribution losses)	Geita : Gold Mining ( Mara :Two Gold min Njombe :Iron Smelti	Co. ing Co. ng	Unit MW MW MW	2031 45 22 337	2032 45 22 337	2033 45 22 337	2034 45 22 337	2035 45 22 337	2036 45 22 337	2037 45 22 337	2038 45 22 337	2039 45 22 337	2040 45 22 337	2010/15 0.0 0.0 0.0	2015/20 10.0 19.6 0.0	2020/25 0.0 0.0 0.0	2025/30 0.0 0.0 0.0	2030/35 0.0 0.0 0.0	2035/40 0.0 0.0 0.0
Additional demand (including transmission and distribution losses)	Geita : Gold Mining ( Mara :Two Gold min Njombe :Iron Smelti Mtwara : DANGOTE	Co. ing Co. ng	Unit MW MW MW	2031 45 22 337 67	2032 45 22 337 67	2033 45 22 337 67	2034 45 22 337 67	2035 45 22 337 67	2036 45 22 337 67	2037 45 22 337 67	2038 45 22 337 67	2039 45 22 337 67	2040 45 22 337 67	2010/15 0.0 0.0 0.0 0.0	2015/20 10.0 19.6 0.0 14.5	2020/25 0.0 0.0 0.0 0.0	2025/30 0.0 0.0 0.0 0.0	2030/35 0.0 0.0 0.0 0.0	2035/40 0.0 0.0 0.0 0.0
Additional demand (including transmission and distribution losses)	Geita : Gold Mining ( Mara :Two Gold min Njombe :Iron Smelti Mtwara : DANGOTE Power supply for Sec Tatal	Co. ing Co. ng curity	Unit MW MW MW MW	2031 45 22 337 67 570	2032 45 22 337 67 570	2033 45 22 337 67 570	2034 45 22 337 67 570	2035 45 22 337 67 570	2036 45 22 337 67 570	2037 45 22 337 67 570	2038 45 22 337 67 570	2039 45 22 337 67 570	2040 45 22 337 67 570	2010/15 0.0 0.0 0.0 0.0 0.0	2015/20 10.0 19.6 0.0 14.5 0.0	2020/25 0.0 0.0 0.0 0.0 0.0	2025/30 0.0 0.0 0.0 0.0 0.0	2030/35 0.0 0.0 0.0 0.0 0.0 0.0	2035/40 0.0 0.0 0.0 0.0 0.0
Additional demand (including transmission and distribution losses)	Geita : Gold Mining ( Mara :Two Gold min Njombe :Iron Smelti Mtwara : DANGOTE Power supply for Sec Total	Co. ing Co. ng curity	Unit MW MW MW MW MW	2031 45 22 337 67 570 1,041 2031	2032 45 22 337 67 570 1,041 2032	2033 45 22 337 67 570 1,041 2033	2034 45 22 337 67 570 1,041 2034	2035 45 22 337 67 570 1,041 2035	2036 45 22 337 67 570 1,041 2036	2037 45 22 337 67 570 1,041 2037	2038 45 22 337 67 570 1,041 2038	2039 45 22 337 67 570 1,041 2039	2040 45 22 337 67 570 1,041 2040	2010/15 0.0 0.0 0.0 0.0 0.0 0.0 2010/15	2015/20 10.0 19.6 0.0 14.5 0.0 71.1 2015/20	2020/25 0.0 0.0 0.0 0.0 0.0 0.0 2020/25	2025/30 0.0 0.0 0.0 0.0 0.0 0.0 2025/30	2030/35 0.0 0.0 0.0 0.0 0.0 0.0 0.0 2030/35	2035/40 0.0 0.0 0.0 0.0 0.0 0.0 2035/40
Additional demand (including transmission and distribution losses) Power export (MW)	Geita : Gold Mining ( Mara :Two Gold min Njombe :Iron Smelti Mtwara : DANGOTE Power supply for Sec Total Kenya (400kV)	Co. ing Co. ng urity	Unit MW MW MW MW MW MW Unit	2031 45 22 337 67 570 1,041 2031 0	2032 45 22 337 67 570 1,041 2032 0	2033 45 22 337 67 570 1,041 2033 0	2034 45 22 337 67 570 1,041 2034 0	2035 45 22 337 67 570 1,041 2035 0	2036 45 22 337 67 570 1,041 2036	2037 45 22 337 67 570 1,041 2037 0	2038 45 22 337 67 570 1,041 2038 0	2039 45 22 337 67 570 1,041 2039 0	2040 45 22 337 67 570 1,041 2040 0	2010/15 0.0 0.0 0.0 0.0 0.0 2010/15 0.0	2015/20 10.0 19.6 0.0 14.5 0.0 71.1 2015/20 0.0	2020/25 0.0 0.0 0.0 0.0 0.0 2020/25 0.0	2025/30 0.0 0.0 0.0 0.0 0.0 2025/30 0.0	2030/35 0.0 0.0 0.0 0.0 0.0 2030/35 0.0	2035/40 0.0 0.0 0.0 0.0 0.0 2035/40 0.0
Additional demand (including transmission and distribution losses) Power export (MW)	Geita : Gold Mining ( Mara : Two Gold min Njombe : Iron Smelti Mtwara : DANGOTE Power supply for Sec Total Kenya (400kV) Mozambique (400kV	Co. ing Co. ng curity	Unit MW MW MW MW MW Unit MW	2031 45 22 337 67 570 1,041 2031 0 200	2032 45 22 337 67 570 1,041 2032 0 200	2033 45 22 337 67 570 1,041 2033 0 200	2034 45 22 337 67 570 1,041 2034 0 200	2035 45 22 337 67 570 1,041 2035 0 200	2036 45 22 337 67 570 1,041 2036 0 200	2037 45 22 337 67 570 1,041 2037 0 200	2038 45 22 337 67 570 1,041 2038 0 200	2039 45 22 337 67 570 1,041 2039 0 200	2040 45 22 337 67 570 1,041 2040 0 200	2010/15 0.0 0.0 0.0 0.0 0.0 0.0 2010/15 0.0 0.0	2015/20 10.0 19.6 0.0 14.5 0.0 71.1 2015/20 0.0 0.0	2020/25 0.0 0.0 0.0 0.0 0.0 0.0 2020/25 0.0 0.0	2025/30 0.0 0.0 0.0 0.0 0.0 0.0 2025/30 0.0 0.0	2030/35 0.0 0.0 0.0 0.0 0.0 0.0 2030/35 0.0 0.0	2035/40 0.0 0.0 0.0 0.0 0.0 2035/40 0.0 0.0
Additional demand (including transmission and distribution losses) Power export (MW)	Geita : Gold Mining ( Mara : Two Gold min Njombe : Iron Smelti Mtwara : DANGOTE Power supply for Sec Total Kenya (400kV) Mozambique (400kV) Uganda (220kV)	Co. ing Co. ng curity )	Unit MW MW MW MW MW Unit MW MW	2031 45 22 337 67 570 1,041 2031 0 200 100	2032 45 22 337 67 570 1,041 2032 0 200 100	2033 45 22 337 67 570 1,041 2033 0 200 100	2034 45 22 337 67 570 1,041 2034 0 200 100	2035 45 22 337 67 570 1,041 2035 0 200 100	2036 45 22 337 67 570 1,041 2036 0 200 100	2037 45 22 337 67 570 1,041 2037 0 200 100	2038 45 22 337 67 570 1,041 2038 0 200 100	2039 45 22 337 67 570 1,041 2039 0 200 100	2040 45 22 337 67 570 1,041 2040 0 200 100	2010/15 0.0 0.0 0.0 0.0 0.0 2010/15 0.0 0.0 0.0	2015/20 10.0 19.6 0.0 14.5 0.0 71.1 2015/20 0.0 0.0 0.0	2020/25 0.0 0.0 0.0 0.0 0.0 2020/25 0.0 0.0 0.0 0.0	2025/30 0.0 0.0 0.0 0.0 0.0 2025/30 0.0 0.0 0.0	2030/35 0.0 0.0 0.0 0.0 0.0 2030/35 0.0 0.0 0.0 0.0	2035/40 0.0 0.0 0.0 0.0 0.0 2035/40 0.0 0.0 0.0
Additional demand (including transmission and distribution losses) Power export (MW)	Geita : Gold Mining ( Mara :Two Gold min Njombe :Iron Smelti Mtwara : DANGOTE Power supply for Sec Total Kenya (400kV) Mozambique (400kV) Uganda (220kV) Malawi	Co. ing Co. ng curity	Unit MW MW MW MW MW Unit MW MW MW	2031 45 22 337 67 570 1,041 2031 0 200 100 100	2032 45 22 337 67 570 1,041 2032 0 200 100 100	2033 45 22 337 67 570 1,041 2033 0 200 100 100	2034 45 22 337 67 570 1,041 2034 0 200 100 100	2035 45 22 337 67 570 1,041 2035 0 200 100 100	2036 45 22 337 67 570 1,041 2036 0 200 100 100	2037 45 22 337 67 570 1,041 2037 0 200 100 100	2038 45 22 337 67 570 1,041 2038 0 200 100 100	2039 45 22 337 67 570 1,041 2039 0 200 100 100	2040 45 22 337 67 570 1,041 2040 0 200 100 100	2010/15 0.0 0.0 0.0 0.0 0.0 2010/15 0.0 0.0 0.0 0.0	2015/20 10.0 19.6 0.0 14.5 0.0 71.1 2015/20 0.0 0.0 0.0 0.0	2020/25 0.0 0.0 0.0 0.0 0.0 2020/25 0.0 0.0 0.0 0.0 0.0	2025/30 0.0 0.0 0.0 0.0 0.0 2025/30 0.0 0.0 0.0 0.0	2030/35 0.0 0.0 0.0 0.0 0.0 2030/35 0.0 0.0 0.0 0.0 0.0	2035/40 0.0 0.0 0.0 0.0 2035/40 0.0 0.0 0.0 0.0 0.0
Additional demand (including transmission and distribution losses) Power export (MW)	Geita : Gold Mining ( Mara :Two Gold min Njombe :Iron Smelti Mtwara : DANGOTE Power supply for Sec Total Kenya (400kV) Mozambique (400kV) Uganda (220kV) Malawi Zambia (400kV)	Co. ing Co. ng curity )	Unit MW MW MW MW MW Unit MW MW MW MW	2031 45 22 337 67 570 1,041 2031 0 200 100 100 200	2032 45 22 337 67 570 1,041 2032 0 200 100 100 200	2033 45 22 337 67 570 1,041 2033 0 200 100 100 100 200	2034 45 22 337 67 570 1,041 2034 0 200 100 100 100 200	2035 45 22 337 67 570 1,041 2035 0 200 100 100 100 200	2036 45 22 337 67 570 1,041 2036 0 200 100 100 100 200	2037 45 22 337 67 570 1,041 2037 0 200 100 100 100 200	2038 45 22 337 67 570 1,041 2038 0 200 100 100 100 200	2039 45 22 337 67 570 1,041 2039 0 200 100 100 100 200	2040 45 22 337 67 570 1,041 2040 0 200 100 100 100 200	2010/15 0.0 0.0 0.0 0.0 0.0 0.0 2010/15 0.0 0.0 0.0 0.0 0.0	2015/20 10.0 19.6 0.0 14.5 0.0 71.1 2015/20 0.0 0.0 0.0 0.0 0.0	2020/25 0.0 0.0 0.0 0.0 0.0 0.0 2020/25 0.0 0.0 0.0 0.0 0.0	2025/30 0.0 0.0 0.0 0.0 0.0 0.0 2025/30 0.0 0.0 0.0 0.0 0.0	2030/35 0.0 0.0 0.0 0.0 0.0 2030/35 0.0 0.0 0.0 0.0 0.0 0.0	2035/40 0.0 0.0 0.0 0.0 0.0 0.0 2035/40 0.0 0.0 0.0 0.0 0.0
Additional demand (including transmission and distribution losses) Power export (MW)	Geita : Gold Mining ( Mara : Two Gold min Njombe : Tron Smelti Mtwara : DANGOTE Power supply for Sec Total Kenya (400kV) Mozambique (400kV) Uganda (220kV) Malawi Zambia (400kV) Export Total (MW)	Co. ing Co. ng curity )	Unit MW MW MW MW MW Unit MW MW MW MW MW MW	2031 45 22 337 67 570 1,041 2031 0 200 100 100 100 200 600	2032 45 22 337 67 570 1,041 2032 0 200 100 200 100 200 600	2033 45 22 337 67 570 1,041 2033 0 200 100 100 100 200 600	2034 45 22 337 67 570 1,041 2034 0 2000 100 100 2000 600	2035 45 22 337 67 570 1,041 2035 0 200 100 100 200 600	2036 45 22 337 67 570 1,041 2036 0 200 100 100 100 200 600	2037 45 22 337 67 570 1,041 2037 0 200 100 100 100 200 600	2038 45 22 337 67 570 1,041 2038 0 200 100 100 200 600	2039 45 22 337 67 570 1,041 2039 0 200 100 100 100 200 600	2040 45 22 337 67 570 1,041 2040 0 2000 1000 1000 2000 600	2010/15 0.0 0.0 0.0 0.0 0.0 0.0 2010/15 0.0 0.0 0.0 0.0 0.0 0.0	2015/20 10.0 19.6 0.0 14.5 0.0 71.1 2015/20 0.0 0.0 0.0 0.0 0.0 0.0	2020/25 0.0 0.0 0.0 0.0 0.0 0.0 2020/25 0.0 0.0 0.0 0.0 0.0 0.0	2025/30 0.0 0.0 0.0 0.0 0.0 2025/30 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	2030/35 0.0 0.0 0.0 0.0 0.0 2030/35 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	2035/40 0.0 0.0 0.0 0.0 0.0 2035/40 0.0 0.0 0.0 0.0 0.0 0.0 0.0
Additional demand (including transmission and distribution losses) Power export (MW)	Geita : Gold Mining ( Mara : Two Gold min Njombe : Iron Smelti Mtwara : DANGOTE Power supply for Sec Total Kenya (400kV) Mozambique (400kV) Uganda (220kV) Malawi Zambia (400kV) Export Total (MW) Export including loss	Co. ing Co. ng curity ) beses (MW) Desemble items	Unit MW MW MW MW MW Unit MW MW MW MW MW MW MW Lusit	2031 45 22 337 67 570 1,041 2031 0 200 100 100 200 600 600 600	2032 45 22 337 67 570 1,041 2032 0 200 100 100 200 600 600 600	2033 45 22 337 67 570 1,041 2033 0 200 100 100 200 600 600 600	2034 45 22 337 67 570 1,041 2034 0 200 100 100 100 200 600 600 607	2035 45 22 337 67 570 1,041 2035 0 200 100 100 100 200 600 600 607 7	2036 45 22 337 67 570 1,041 2036 0 200 100 100 100 600 600 677	2037 45 22 337 67 570 1,041 2037 0 200 100 100 100 200 600 600 677	2038 45 22 337 67 570 1,041 2038 0 200 100 100 200 600 600 600	2039 45 22 337 67 570 1,041 2039 0 200 100 100 200 600 600 677	2040 45 22 337 67 570 1,041 2040 0 200 100 100 100 600 600 607	2010/15 0.0 0.0 0.0 0.0 0.0 2010/15 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	2015/20 10.0 19.6 0.0 14.5 0.0 71.1 2015/20 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	2020/25 0.0 0.0 0.0 0.0 0.0 0.0 2020/25 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2025/30 0.0 0.0 0.0 0.0 0.0 2025/30 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	2030/35 0.0 0.0 0.0 0.0 0.0 2030/35 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2035/40 0.0 0.0 0.0 0.0 0.0 0.0 2035/40 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
Additional demand (including transmission and distribution losses) Power export (MW) Cases	Geita : Gold Mining ( Mara : Two Gold min Njombe :Iron Smelti Mtwara : DANGOTE Power supply for Sec Total Kenya (400kV) Mozambique (400kV) Uganda (220kV) Malawi Zambia (400kV) Export Total (MW) Export Total (MW) Export Including loss Peak demand	Co. ing Co. ng curity ) bes (MW) Demand items Domestic demand	Unit MW MW MW MW MW Unit MW MW MW MW MW MW MW MW MW MW MW	2031 45 22 337 67 570 1,041 2001 0 2000 100 100 100 600 600 677 2031 6 448	2032 45 22 337 67 570 1,041 2002 0 2000 100 100 100 100 600 600 677 2032 7,079	2033 45 22 337 67 570 1,041 2033 0 200 100 100 100 100 600 600 607 607 2033 7,769	2034 45 22 337 67 570 1,041 0 200 100 100 100 200 600 600 607 607 2034 8 524	2035 45 22 337 67 570 1,041 2005 0 200 100 100 100 200 600 600 607 2035 9 351	2036 45 22 337 67 570 1,041 2036 0 200 100 100 200 600 677 2036 0 188	2037 45 22 337 67 570 1,041 2007 0 200 100 100 100 200 600 600 677 2037	2038 45 22 337 67 570 1,041 2008 0 2000 100 100 2000 600 677 2038 12.088	2039 45 22 337 67 570 1,041 2009 0 200 100 100 100 100 200 600 677 2039 13 163	2040 45 22 337 67 570 1,041 2040 0 2000 100 100 2000 600 600 677 2040	2010/15 0.0 0.0 0.0 0.0 0.0 2010/15 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2015/20 10.0 19.6 0.0 14.5 0.0 71.1 2015/20 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	2020/25 0.0 0.0 0.0 0.0 0.0 0.0 2020/25 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2025/30 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	2030/35 0.0 0.0 0.0 0.0 0.0 2030/35 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2035/40 0.0 0.0 0.0 0.0 0.0 2035/40 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0
Additional demand (including transmission and distribution losses) Power export (MW) Cases Base	Geita : Gold Mining G Mara :Two Gold min Njombe :Iron Smelti Mtwara : DANGOTE Power supply for Sec Total Kenya (400kV) Mozambique (400kV) Uganda (220kV) Malawi Zambia (400kV) Export Total (MW) Export including loss Peak demand	Co. ing Co. ng curity ) ses (MW) Demand items Domestic demand Additional demand	Unit MW MW MW MW MW Unit MW MW MW MW MW MW MW MW MW MW MW MW MW	2031 45 22 337 67 570 1,041 2031 0 2000 100 2000 600 600 677 2031 6,448 1.041	2032 45 222 333 67 570 1,041 2032 0 0 2000 1000 2000 6000 677 2032 7,079 1.041	2033 45 22 337 67 570 1,041 2033 0 0 2000 1000 2000 6000 677 2033 7,769 1.041	2034 45 22 337 67 570 1,041 2004 0 2000 1000 2000 6000 6000 677 2034 8,524 1,041	2035 45 22 337 67 570 1,041 2005 0 0 2000 1000 2000 6000 6000 6077 2035 9,351 1.041	2036 45 22 337 67 570 1,041 2036 0 2000 100 2000 600 600 600 677 2036 10,188 1.041	2037 45 22 337 67 570 1,041 2037 0 200 100 200 600 600 600 677 2037 11,099 1.041	2038 45 22 333 67 570 1,041 2038 0 2000 1000 2000 6000 6000 6077 2038 12,088	2039 45 22 337 67 570 1,041 2039 0 2000 100 2000 600 600 677 2039 13,163 1.041	2040 45 22 337 67 570 1,041 2040 0 200 100 200 600 677 2040 14,332 1,041	2010/15 2010/15 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2015/20 10.0 19.6 0.0 14.5 0.0 71.1 2015/20 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	2020/25 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2025/30 0.0 0.0 0.0 0.0 0.0 0.0 2025/30 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	2030/35 0.0 0.0 0.0 0.0 0.0 0.0 2030/35 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2035/40 0.0 0.0 0.0 0.0 0.0 2035/40 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0
Additional demand (including transmission and distribution losses) Power export (MW) Cases Base	Geita : Gold Mining ( Mara : Two Gold min Njombe : Iron Smelti Mtwara : DANGOTE Power supply for Sec Total Kenya (400kV) Mozambique (400kV) Uganda (220kV) Uganda (220kV) Malawi Zambia (400kV) Export Total (MW) Export Total (MW) Export including loss Peak demand	Co. ing Co. ng curity curity ) bes (MW) Demand items Domestic demand Additional demand Export (Inc. Loss)	Unit MW MW MW MW MW MW MW MW MW MW MW MW MW	2031 45 22 337 67 570 1,041 2031 0 200 100 100 200 600 600 677 2031 6,448 1,041 677	2032 45 22 337 67 570 1,041 2032 2032 2000 100 100 2000 600 677 2032 7,079 1,041 677	2033 45 22 337 67 570 1,041 2033 0 2000 100 2000 600 600 677 2033 7,769 1,041 677	2034 45 22 337 67 570 1,041 2034 0 2000 100 2000 600 600 677 2034 8,524 1,041 677	2035 45 22 337 67 570 1,041 2035 0 2000 100 2000 600 600 600 677 2035 9,351 1,041 677	2036 45 22 337 67 570 1,041 2036 0 2000 100 100 2000 600 677 2036 10,188 1,041 677	2037 45 22 337 67 570 1,041 2037 0 2000 100 100 2000 600 600 600 677 2037 11,099 1,041 677	2038 45 22 337 67 570 1,041 2038 0 2000 100 2000 600 600 600 600 677 2038 12,088 12,088 10,041	2039 45 22 337 67 570 1,041 2039 0 200 100 200 600 677 2039 13,163 1,041 2039	2040 45 22 337 67 570 1,041 2040 0 2040 0 2000 600 677 2040 14,332 1,041 677	2010/15 2010/15 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2015/20 10.0 19.6 0.0 14.5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	2020/25 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2025/30 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	2030/35 0.0 0.0 0.0 0.0 0.0 0.0 2030/35 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2035/40 0.0 0.0 0.0 0.0 0.0 2035/40 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0
Additional demand (including transmission and distribution losses) Power export (MW) Cases Base	Geita : Gold Mining ( Mara : Two Gold min Njombe : Iron Smetli Mtwara : DANGOTE Power supply for Sec Total Kenya (400kV) Mozambique (400kV) Uganda (220kV) Malawi Zambia (400kV) Export Total (MW) Export including loss Peak demand	Co. ing Co. ng curity curity ) bes (MW) Demand items Domestic demand Additional demand Export (Inc. Loss) Total	Unit MW MW MW MW MW MW MW MW MW MW MW MW MW	2031 45 22 337 67 570 1,041 2031 0 200 100 100 200 600 600 677 2031 6,448 1,041 677 8,167	2032 45 222 337 67 570 1,041 2032 00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2033 45 22 337 67 570 1,041 2033 0 2000 1000 2000 600 600 677 2033 7,769 1,041 677 9,487	2034 45 22 337 67 570 1,041 2034 0 2000 1000 2000 600 600 677 2034 8,524 1,041 677 10,242	2035 45 22 337 67 570 1,041 2035 0 2000 100 2000 600 600 600 677 2035 9,351 1,041 677 11,069	2036 45 22 337 67 570 1,041 2036 0 200 100 100 200 600 600 677 2036 10,188 1,041 677 11,907	2037 45 22 337 67 570 1,041 2037 0 200 100 200 600 600 600 600 607 2037 11,099 1,041 677 12,817	2038 45 22 337 67 570 1,041 2038 0 200 100 200 600 600 600 600 600 600 600 600 6	2039 45 22 337 67 570 1,041 2039 0 200 100 100 100 200 600 677 2039 13,163 1,041 677 14,882	2040 45 22 337 67 570 1,041 2040 0 2000 100 2000 600 600 600 600 600 600 600 600	2010/15 0.0 0.0 0.0 0.0 0.0 2010/15 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2015/20 10.0 19.6 0.0 14.5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	2020/25 0.0 0.0 0.0 0.0 0.0 0.0 2020/25 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2025/30 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	2030/35 0.0 0.0 0.0 0.0 0.0 2030/35 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2035/40 0.0 0.0 0.0 0.0 0.0 2035/40 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0
Additional demand (including transmission and distribution losses) Power export (MW) Cases Base	Geita : Gold Mining ( Mara : Two Gold min Njombe :Iron Smelti Mtwara : DANGOTE Power supply for Sec Total Kenya (400kV) Mazambiaue (400kV) Uganda (220kV) Malawi Zambia (400kV) Export Total (MW) Export Total (MW) Peak demand Installed capacity	Co. ing Co. ng curity curity ) Demand items Domestic demand Additional demand Additional demand Export (Inc. Loss) Total Domestic demand	Unit MW MW MW MW MW MW MW MW MW MW MW MW MW	2031 45 22 337 67 570 1,041 2001 0 2000 100 100 2000 600 600 600 607 600 600 607 600 600	2032 45 22 337 67 570 1,041 2032 0 2000 1000 2000 1000 2000 6077 2032 7,079 1,041 677 8,797 8,797	2033 45 22 337 67 570 1,041 2033 0 2000 1000 2000 600 607 7,769 1,041 677 9,487 10,099	2034 45 22 337 67 570 1,041 2034 0 200 100 200 600 600 607 2034 8,524 1,041 677 10,242 11,081	2035 45 22 337 67 570 1,041 2035 0 2000 1000 2000 6000 6070 2035 9,351 1,041 677 1,061 677 1,041	2036 45 22 337 67 570 1,041 2036 0 200 100 100 200 600 677 2036 10,188 1,041 677 11,907 13,245	2037 45 22 337 67 570 1,041 2037 0 2000 1000 2000 6000 6000 6000 677 2037 11,099 1,041 677 12,817 14,429	2038 45 22 337 67 570 1,041 2038 0 2000 1000 2000 600 6077 2038 12,088 1,041 6777 13,807 15,715	2039 45 22 337 67 570 1,041 2039 0 200 100 100 100 200 600 677 2039 13,163 1,041 677 14,882 17,113	2040 45 22 337 67 570 1,041 2040 0 200 100 200 100 200 600 677 2040 14,332 1,041 677 16,050	2010/15 2010/15 0.0 0.0 0.0 0.0 0.0 2010/15 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2015/20 10.0 19.6 0.0 14.5 0.0 71.1 2015/20 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	2020/25 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2025/30 0.0 0.0 0.0 0.0 0.0 0.0 2025/30 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	2030/35 0.0 0.0 0.0 0.0 0.0 2030/35 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2035/40 0.0 0.0 0.0 0.0 0.0 0.0 2035/40 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0
Additional demand (including transmission and distribution losses) Power export (MW) Cases Base	Geita : Gold Mining ( Mara : Two Gold min Njombe : Iron Smelti Mtwara : DANGOTE Power supply for Sec Total Kenya (400kV) Mozambique (400kV) Uganda (220kV) Malawi Zambia (400kV) Export Total (MW) Export Total (MW) Export including loss Peak demand Installed capacity (Peak*1.3)	Co. ing Co. ng curity ) bes (MW) Demand items Domestic demand Additional demand Additional demand	Unit MW MW MW MW MW MW MW MW MW MW MW MW MW	2031 45 22 337 67 570 1,041 2031 0 2000 100 2000 600 600 600 677 2031 6,448 1,041 677 8,167 8,167 8,383 1,353	2032 45 22 337 67 570 1,041 2032 0 0 2000 100 2000 6070 6070 6070 6077 2032 7,079 1,041 1 677 8,797 9,202 1,353	2033 45 22 337 67 570 1,041 2033 0 0 200 100 200 6070 6070 6070 6070 6070 6070 607	2034 45 22 337 67 570 1,041 2034 0 200 100 200 600 600 600 600 677 2034 8,524 1,041 677 10,242 11,081 1,353	2035 45 22 337 67 570 1,041 2035 0 200 100 200 600 600 600 600 600 677 2035 9,351 1,041 1,069 12,156 1,353	2036 45 22 337 67 570 1,041 2006 0 2000 100 2000 600 600 600 677 2036 10,188 1,041 677 11,907 13,245 1,353	2037 45 22 337 67 570 1,041 2037 0 2000 100 2000 600 600 600 600 677 2037 11,099 1,041 677 12,817 14,429 1,353	2038 45 22 337 67 570 1,041 2038 0 2000 100 2000 2000 6070 6070 6070 6070 10,088 1,041 1677 13,807 15,715 1,353	2039 45 22 337 67 570 1,041 2009 0 200 100 200 600 677 2039 13,163 1,041 677 14,882 17,113 1,353	2040 45 22 337 67 570 1,041 2040 0 200 200 100 200 600 600 600 677 2040 14,332 1,041 1,675 16,650 18,631 1,353	2010/15 0.0 0.0 0.0 0.0 0.0 0.0 2010/15 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2015/20 10.0 19.6 0.0 14.5 0.0 71.1 2015/20 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	02020/25           0.0.0           -0.2           6.5           10.8           0.0	2025/30 0.0 0.0 0.0 0.0 0.0 2025/30 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	2030/35 0.0 0.0 0.0 0.0 0.0 2030/35 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2035/40 0.0 0.0 0.0 0.0 0.0 2035/40 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0
Additional demand (including transmission and distribution losses) Power export (MW) Cases Base	Geita : Gold Mining ( Mara : Two Gold min Njombe : Iron Smelti Mtwara : DANGOTE Power supply for Sec Total Kenya (400kV) Mozambique (400kV) Uganda (220kV) Malawi Zambia (400kV) Export Total (MW) Export including loss Peak demand Installed capacity (Peak*1.3)	Co. ing Co. ng curity Demand items Domestic demand Additional demand Export (Inc. Loss) Total Domestic demand Additional demand Export (Inc. Loss)	Unit MW MW MW MW MW Unit MW MW MW MW MW MW MW MW MW MW MW MW MW	2031 45 22 337 67 570 1,041 2031 0 200 100 100 100 200 200 600 607 2031 6,448 1,041 6,748 1,041 6,77 8,167 8,383 1,353 880 0	2032 45 222 337 67 570 1,041 2032 2032 2000 100 100 2000 607 2002 677 2032 7,079 1,041 677 8,797 8,797 9,202 1,353 8,880	2033 45 222 337 67 570 1,041 2033 0 2000 100 2000 600 677 2033 7,769 1,041 677 9,487 10,099 1,353 880 880	2034 45 22 337 67 570 1,041 2034 0 2000 100 2000 600 600 677 2034 8,524 1,041 677 10,242 11,081 1,353 880	2035 45 22 337 67 570 1,041 2035 0 2000 100 2000 600 600 600 607 2035 9,351 1,041 677 11,069 12,156 1,353 880	2036 45 22 337 67 570 1,041 2036 0 200 100 200 600 600 600 600 600 677 2036 10,188 1,041 677 11,907 13,245 1,353 880	2037 45 22 337 67 570 1,041 2037 0 2000 100 2000 607 2037 11,099 1,041 677 12,817 14,429 1,353 880	2038 45 22 337 67 570 1,041 2038 0 2000 100 2000 607 2038 12,088 1,041 677 13,807 15,715 1,353 880 2000 2010 2010 2010 2010 2010 2010	2039 45 22 337 67 570 1,041 2039 0 200 100 100 100 200 600 600 600 677 13,163 1,041 677 14,882 17,113 1,353 880	2040 45 22 337 67 570 1,041 2040 0 2000 100 2000 607 2040 14,332 1,041 677 16,050 18,631 1,353 880 20 20	2010/15 2010/15 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2015/20 10.0 19.6 0.0 14.5 0.0 71.1 2015/20 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	2020/25 0.0 0.0 0.0 0.0 0.0 0.0 2020/25 10.8 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	2025/30 2025/30 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	2030/35 0.0 0.0 0.0 0.0 0.0 2030/35 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	2035/40 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0

Source: Study results of Task Force Team

Note: The installed capacity becomes more than 4,920 MW in 2020

#### 2.8.10 Regional peak demand including additional demand, excluding export (Base)

#### Table 2-27: Regional peak demand including additional demand, excluding export (Base)

																U	nit: IVIVV
		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1	Dodoma	20	25	29	33	38	56	5 59	63	67	71	76	83	90	97	106	116
2	Arusha	55	77	94	116	140	205	5 219	235	254	275	298	321	347	375	405	438
3	Kilimanjaro	24	32	36	43	52	72	2 75	78	82	86	90	96	103	110	118	127
4	Tanga	44	53	59	67	76	133	3 141	150	160	172	185	201	219	239	261	286
5	Morogoro	39	48	54	61	69	104	1 112	121	131	143	155	168	182	197	214	232
6	Pwani	24	41	50	60	69	100	) 116	134	154	176	202	218	236	257	279	303
7	Dar es Salaam	459	561	632	715	797	1,113	3 1,197	1,295	1,400	1,510	1,637	1,773	1,920	2,080	2,253	2,440
8	Lindi	3	5	7	9	12	20	) 22	24	26	29	32	35	38	42	46	50
9	Mtwara	41	43	42	45	47	86	5 89	92	96	100	104	108	112	117	122	128
10	Ruvuma	5	6	8	10	12	18	3 23	28	33	39	46	51	56	62	69	76
11	Iringa +Njombe	18	21	23	27	30	382	2 385	388	392	397	401	408	415	422	431	441
12	Mbeya	33	49	59	70	80	116	5 126	136	148	162	176	191	207	225	245	267
13	Singida	6	8	9	10	11	18	3 20	21	23	25	27	30	33	37	41	46
14	Tabora	19	28	39	50	61	92	2 102	113	126	140	155	173	193	216	242	271
15	Rukwa +Katavi	3	5	6	8	10	15	5 17	18	20	22	24	27	29	32	36	39
16	Kigoma	4	7	12	16	21	32	2 36	40	45	51	56	62	68	74	82	90
17	Shinyanga+ Simiyu	70	85	93	102	114	148	3 161	172	185	200	216	238	263	290	322	357
18	Kagera	10	17	24	32	43	54	1 62	70	82	95	108	117	128	140	153	168
19	Mwanza +Geita	75	94	113	131	149	240	263	284	307	339	382	413	446	483	524	569
20	Mara	33	39	45	51	57	102	2 111	118	128	137	146	158	172	187	203	222
21	Manvara	4	5	6	7	8	12	2 12	13	14	14	15	16	17	18	19	20
	Mainland total	988	1.247	1.439	1.662	1,894	3,119	3.346	3,597	3.874	4,182	4,530	4,885	5,275	5,701	6,171	6,685
22	Zanzibar	58	70	, 81	92	102	112	2 123	134	146	158	170	181	192	204	215	228
	Tatal																
	TOLAI	1,045	1,317	1,520	1,754	1,996	3,231	L 3,469	3,731	4,020	4,340	4,700	5,066	5,467	5,905	6,386	6,913
	TOLAI	1,045	1,317	1,520	1,754	1,996	3,231	1 3,469	3,731	4,020	4,340	4,700	5,066	5,467	5,905	6,386	6,913
1	Dodoma	1,045 2031	1,317 2032	1,520 2033	1,754 2034 2	1,996	3,231	L 3,469 2037 203	3,731 38 203	4,020 9 2040	4,340 2010/1	4,700 5 2015/20	5,066 2020/25	5,467 2025/30 8 7	5,905 2030/35	6,386 2035/40 7 3	6,913 2015/40
1	Dodoma Arusba	1,045 2031 126 474	1,317 2032 138 513	1,520 2033 2 150 556	1,754 2034 2 164 601	1,996 2035 20 180 651	3,231 036 194 704	L 3,469 2037 20: 208 762	3,731 38 203 222 2 825	4,020 9 2040 238 2 893 0	4,340 2010/1 56 4	4,700 5 2015/20 .6 22.5 8 30.2	5,066 2020/25 6.3 7.7	5,467 2025/30 8.7 8.1	5,905 2030/35 9.2 8.2	6,386 2035/40 7.3 8.2	6,913 2015/40 10.7 12.2
1	Dodoma Arusha Kilimaniaro	1,045 2031 126 474 137	1,317 2032 138 513 147	1,520 2033 2 150 556 158	1,754 2034 2 164 601 171	1,996 2035 20 180 651 184	3,231 036 194 704 199	L 3,469 2037 20: 208 762 215	3,731 38 203 222 3 825 4 232 4	4,020 9 2040 238 2 893 9 250 2	4,340 2010/1 56 4 66 0 70 -0	4,700 5 2015/20 .6 22.5 .8 30.2 .1 24.4	5,066 2020/25 6.3 7.7 4.4	5,467 2025/30 8.7 8.1 7.2	5,905 2030/35 9.2 8.2 7.7	6,386 2035/40 7.3 8.2 8.0	6,913 2015/40 10.7 12.2 10.1
1 2 3 4	Dodoma Arusha Kilimanjaro Tanga	1,045 2031 126 474 137 312	1,317 2032 138 513 147 342	1,520 2033 150 556 158 374	1,754 2034 2 164 601 171 410	1,996 2035 20 180 651 184 449	3,231 036 2 194 704 199 483	3,469           2037         20.           208         -           762         -           215         -           521         -	3,731 38 203 222 38 825 38 232 38 562 37	4,020 9 2040 238 2 893 9 250 2 506 6	4,340 2010/1 56 4 66 0 70 -0 53 1	4,700 5 2015/20 .6 22.5 .8 30.2 .1 24.4 .4 24.8	5,066 2020/25 6.3 7.7 4.4 6.8	5,467 2025/30 8.7 8.1 7.2 9.1	5,905 2030/35 9.2 8.2 7.7 9.4	6,386 2035/40 7.3 8.2 8.0 7.8	6,913 2015/40 10.7 12.2 10.1 11.4
1 2 3 4 5	Dodoma Arusha Kilimanjaro Tanga Morogoro	1,045 2031 126 474 137 312 252	1,317 2032 138 513 147 342 273	1,520 2033 150 556 158 374 296	1,754 2034 2 164 601 171 410 321	1,996 2035 20 180 651 184 449 349	3,231 036 194 704 199 483 376	3,469           2037         20.           208         20.           762         21.5           521         406	3,731 8 203 222 2 825 2 232 2 562 0 438 4	4,020           9         2040           238         2           893         9           250         2           606         6           473         9	4,340 2010/1 56 2 66 0 70 -0 53 1 10 2	4,700           5         2015/20           .6         22.5           .8         30.2           .1         24.4           .4         24.8           .0         21.9	5,066 2020/25 6.3 7.7 4.4 6.8 8.3	5,467 2025/30 8.7 8.1 7.2 9.1 8.4	5,905 2030/35 9.2 8.2 7.7 9.4 8.5	6,386 2035/40 7.3 8.2 8.0 7.8 7.9	6,913 2015/40 10.7 12.2 10.1 11.4 10.9
1 2 3 4 5 6	Notal Natural Kilimanjaro Tanga Morogoro Pwani	1,045 2031 126 474 137 312 252 330	1,317 2032 138 513 147 342 273 360	1,520           2033         150           556         158           374         296           393         393	1,754 2034 2 164 601 171 410 321 429	1,996 2035 20 180 651 184 449 349 470	3,231 036 194 704 199 483 376 508	3,469           2037         20:           208	3,731   8 203 222 2 825 2 232 2 562 0 438 2 595 0	4,020           9         2040           238         2           893         9           250         2           506         6           473         5           544         6	4,340           2010/1           56           66           70           53           10           203           98	4,700 5 2015/20 6 22.5 8 30.2 1 24.4 .4 24.8 0 21.9 3 32.6	5,066 2020/25 6.3 7.7 4.4 6.8 8.3 15.0	5,467 2025/30 8.7 8.1 7.2 9.1 8.4 8.5	5,905 2030/35 9.2 8.2 7.7 9.4 8.5 9.2	6,386 2035/40 7.3 8.2 8.0 7.8 7.9 8.2	6,913 2015/40 10.7 12.2 10.1 11.4 10.9 14.3
1 2 3 4 5 6 7	Dodoma Arusha Kilimanjaro Tanga Morogoro Pwani Dar es Salaam	1,045 2031 126 474 137 312 252 330 2,643	1,317 2032 138 513 147 342 273 360 2,862	1,520       2033       150       556       158       374       296       393       3,098	1,754 2034 2 164 601 171 410 321 429 3,354	1,996           2035         20           180         -           651         -           184         -           449         -           349         -           470         -	3,231 036 194 704 199 483 376 508 3,945	3,469           2037         200           208         -           762         -           215         -           521         -           406         -           549         -           4,287         4	3,731 38 203 222 2 825 2 562 2 438 2 595 0 657 5,	4,020           9         2040           238         2           893         9           250         2           506         6           473         5           544         6           057         5,4	4,340       2010/1       56       66       670       53       110       298       991	4,700 5 2015/20 6 22.5 8 30.2 1 24.4 4 24.8 0 21.9 3 32.6 5 19.4	5,066 2020/25 6.3 7.7 4.4 6.8 8.3 15.0 8.0	5,467 2025/30 8.7 8.1 7.2 9.1 8.4 8.5 8.3	5,905 2030/35 9.2 8.2 7.7 9.4 8.5 9.2 8.3	6,386 2035/40 7.3 8.2 8.0 7.8 7.9 8.2 8.6	6,913 2015/40 10.7 12.2 10.1 11.4 10.9 14.3 10.4
1 2 3 4 5 6 7 8	Dodoma Arusha Kilimanjaro Tanga Morogoro Pwani Dar es Salaam Lindi Lindi	1,045       2031       126       474       137       312       252       330       2,643       55	1,317       2032       138       513       147       342       273       360       2,862       61	1,520       2033       150       556       158       374       296       393       3,098       67	1,754 2034 2 164 601 171 410 321 429 3,354 74	1,996 2035 20 180 651 184 449 349 470 3,631 82	3,231 036 2 194 704 199 483 376 508 3,945 90	3,469           2037         200           208         -           762         -           215         -           521         -           406         -           549         -           4,287         4           98         -	3,731       88     203       222     232       825     322       232     323       562     438       595     6       657     5,0       108     2	4,020       9     204(       238     2       893     9       250     2       606     6       473     5       544     6       057     5,4       119     1	4,340           2010/1           56         4           66         0           70         -0           53         1           10         23           98         3           91         5           31         1	4,700           5         2015/20           .6         22.5           .8         30.2           .1         24.4           .4         24.8           .0         21.9           .3         32.6           .5         19.4           .1         49.2	5,066 2020/25 6.3 7.7 4.4 6.8 8.3 15.0 8.0 10.0	5,467 2025/30 8.7 8.1 7.2 9.1 8.4 8.5 8.3 9.5	5,905 9.2 8.2 7.7 9.4 8.5 9.2 8.3 10.2	6,386 2035/40 7.3 8.2 8.0 7.8 7.9 8.2 8.6 9.9	6,913 2015/40 10.7 12.2 10.1 11.4 10.9 14.3 10.4 16.8
1 2 3 4 5 6 7 8 9	Dodoma       Arusha       Kilimanjaro       Tanga       Morogoro       Pwani       Dar es Salaam       Lindi       Mtwara	2031 126 474 137 312 252 330 2,643 55 134	1,317           2032           138           513           147           342           273           360           2,862           61           141	1,520 2033 150 556 158 374 296 393 3,098 67 149	1,754 2034 2 164 601 171 410 321 429 3,354 74 158	1,996           2035         20           180         -           651         -           184         -           449         -           349         -           470         -           3,631         -           82         -           168         -	3,231 036 194 704 199 483 376 508 3,945 90 178	3,469           2037         200           208         2015           521         406           549         4,287         4           98         191         1	3,731           8         203           222         2           825         3           232         5           562         0           438         5           595         6           657         5,0           108         204	4,020           9         204(           238         2           393         9           250         2           506         6           644         6           557         5,4           119         1           220         2	4,340           2010/1           56         4           66         0           70         -0           53         1           10         2           98         3           31         1           37         50	4,700           5         2015/20           .6         22.5           .8         30.2           .1         24.4           .4         24.8           .0         21.9           .3         32.6           .5         19.4           .1         49.2           .4         16.3	5,066 2020/25 6.3 7.7 4.4 6.8 8.3 15.0 8.0 10.0 3.8	5,467 2025/30 8.7 8.1 7.2 9.1 8.4 8.5 8.3 9.5 4.1	5,905 2030/35 9.2 8.2 7.7 9.4 8.5 9.2 8.3 10.2 5.6	6,386 2035/40 7.3 8.2 8.0 7.8 7.9 8.2 8.6 9.9 7.1	6,913 2015/40 10.7 12.2 10.1 11.4 10.9 14.3 10.4 16.8 7.3
1 2 3 4 5 6 7 8 9 9 10	Initial       Dodoma       Arusha       Kilimanjaro       Tanga       Morogoro       Pwani       Dar es Salaam       Lindi       Mtwara       Ruvuma	2031 126 474 137 312 252 330 2,643 55 134 85 134	2032 138 513 147 342 273 360 2,862 61 141 94 52	1,520           2033         150           556         158           374         296           393         3,098           67         149           105         55	1,754 2034 2 164 601 171 410 321 429 3,354 74 158 117 107	1,996           2035         21           180         651           184         449           349         470           3,631         82           168         130           201         201	3,231 036 194 704 199 483 376 508 3,945 90 178 143 508	3,469           2037         20.           208         20.           762         215           215         406           549         4,287           4,287         4           98         191           157         202	3,731   38 203 222 2 825 2 562 0 438 - 595 0 657 5,1 108 2 204 2 172 2 172 2	4,020 9 204( 238 2 893 9 250 2 250 2 566 6 473 5 544 6 057 5,4 119 1 220 2 189 2	4,340 2010/1 56 4 66 0 700 53 1 10 2 98 3 91 5 31 1 37 50 08 3 00	4,700           5         2015/20           .6         22.5           .8         30.2           .1         24.4           .4         24.8           .0         21.9           .3         32.6           .5         19.4           .1         49.2           .4         16.3           .1         30.1	5,066 2020/25 6.3 7.7 4.4 6.8 8.3 15.0 8.0 10.0 3.8 20.	5,467 2025/30 8.7 8.1 7.2 9.1 8.4 8.5 8.3 9.5 4.1 10.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1	5,905 2030/35 9.2 8.2 7.7 9.4 8.5 9.2 8.3 10.2 5.6 11.2	6,386 2035/40 7.3 8.2 8.0 7.8 7.9 8.2 8.6 9.9 7.1 9.99 0.5 7.1	6,913 2015/40 10.7 12.2 10.1 11.4 10.9 14.3 10.4 16.8 7.3 16.3 16.3
1 2 3 4 5 6 7 8 9 10 11	Dodoma Arusha Kilimanjaro Tanga Morogoro Pwani Dar es Salaam Lindi Mtwara Ruvuma Iringa +Njombe	2031 126 474 137 312 252 330 2,643 55 134 85 451	1,317 2032 138 513 147 342 273 360 2,862 61 141 94 463 463	1,520           2033         1           150         556           158         374           296         393           3,098         67           149         105           476         323	1,754 2034 2 164 601 171 410 321 429 3,354 74 158 117 490 329	1,996           2035         21           180         651           184         449           349         470           3,631         82           168         130           506         415	3,231 036 194 704 199 483 376 508 3,945 90 178 178 143 518 449	3,469           2037         200           208         762           215         521           406         549           4,287         4           98         191           157         532	3,731 38 203 222 2 232 2 232 2 2562 0 438 2 555 0 657 5,0 108 2 04 2 172 5 477 2 547 2	4,020 9 204( 238 2 505 2 506 6 473 5 544 6 057 5,4 119 1 220 2 220 2 563 5 564 5 257 5,4 119 1	4,340 2010/1 56 4 66 0 70 -0 53 1 10 2 98 3 91 5 31 1 37 50 08 3 80 -2 00 -2 0	4,700 5 2015/20 .6 22.5 .8 30.2 .1 24.4 .4 24.8 .0 21.9 .3 32.6 .5 19.4 .1 49.2 .4 16.3 .1 30.1 .3 385.0 .2 2.5 .2 2.5 .5 2.5	5,066 2020/25 6.3 7.7 4.4 6.8 8.3 15.0 8.0 10.0 3.8 20.8 1.0 6.2 6.2 6.3 7.7 1.4 6.8 8.3 1.5 0 1.5 0 0 0 0 0 0 0 0 0 0 0 0 0	5,467 2025/30 8.7 8.1 7.2 9.1 8.4 8.5 8.3 9.5 4.1 10.7 1.9 0.7 9 0.7 1.9 0.7 1.9 0.7 1.9 0.7 1.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0	5,905 9.2 8.2 7.7 9.4 8.5 9.2 8.3 10.2 5.6 11.2 2.8	6,386 2035/40 7.3 8.2 8.0 7.8 7.9 8.2 8.6 9.9 7.1 9.9 2.8 0.6 0.9 0.9 0.9 0.0 0.0 0.0 0.0 0.0	6,913 2015/40 10.7 12.2 10.1 11.4 10.9 14.3 10.4 16.8 7.3 16.3 15.0 15.0
1 2 3 4 5 6 6 7 7 8 9 10 11 11 12	Dodoma Arusha Kilimanjaro Tanga Morogoro Pwani Dar es Salaam Lindi Mtwara Ruvuma Iringa +Njombe Mbeya Sinaida	2031 126 474 137 312 252 330 2,643 55 134 85 451 291 251	1,317 2032 138 513 147 342 273 360 2,862 61 141 94 463 318 57	1,520           2033         150           556         158           374         296           393         3,098           67         149           105         476           347         62	1,754 2034 2 164 601 171 410 321 429 3,354 74 158 117 490 379 71	1,996           1,095         20           180         651           184         449           349         470           3,631         82           168         130           506         415           70         70	3,231 036 194 704 199 483 376 508 3,945 90 178 143 518 448 95	3,469           2037         200           208         201           762         215           521         406           549         4,287           4,287         4           98         191           157         532           483         03	3,731 38 203 222 322 322 322 3562 438 555 505 505 505 505 108 204 204 172 547 522 100	4,020 9 204( 238 2 593 9 505 2 506 6 557 5,4 119 1 220 2 220 2 2563 5 564 6 556 6 557 5,4 19 1 20 2 563 5 564 6	4,340 2010/1 56 4 66 0 70 -0 53 1 10 2 98 3 91 5 31 1 37 50 08 3 80 -2 09 3 19 3	4,700           5         2015/20           .6         22.5           .8         30.2           .1         24.4           .4         24.8           .0         21.9           .3         32.6           .5         19.4           .1         49.2           .4         16.3           .1         30.1           .3         35.0           .7         28.8           .0         24.3	5,066 2020/25 6.3 7.7 4.4 6.8 8.3 15.0 8.0 10.0 3.88 20.8 1.0 8.8 2.08 1.0 8.8 2.08	5,467 2025/30 8.7 8.1 7.2 9.1 8.4 8.5 8.3 9.5 4.1 10.7 1.9 8.7 1.9 1.9	5,905 2030/35 9.2 8.2 7.7 9.4 8.5 9.2 8.3 10.2 5.6 11.2 2.8 9.2 2.8 9.2 11.5	6,386 2035/40 7.3 8.2 8.0 7.8 7.9 8.2 8.6 9.9 7.1 9.9 2.8 8.0 8.0 9.9 7.1 9.9 2.8 8.0 8.0 8.2 8.2 8.2 8.2 8.2 8.2 8.2 8.2	6,913 2015/40 10.7 12.2 10.1 11.4 10.9 14.3 10.4 16.8 7.3 16.3 15.0 12.4 13.5 15.0 12.4 13.5 15.0 12.4 13.5 14.5 15.
1 3 4 5 6 7 8 9 10 11 11 12 13	Initial       Dodoma       Arusha       Kilimanjaro       Tanga       Morogoro       Pwani       Dar es Salaam       Lindi       Mtwara       Ruvuma       Iringa +Njombe       Mbeya       Singida       Tabara	2031 126 474 137 312 252 330 2,643 55 134 451 291 51 202	1,317           2032           138           513           147           342           273           360           2,862           61           141           94           463           318           57           240	1,520           2033         150           556         158           374         296           393         3,098           67         149           105         476           347         63           923         323	1,754 2034 2 164 601 171 410 321 429 3,354 74 158 117 490 379 71 428	1,996           2035         21           180         -           651         -           184         -           449         -           349         -           470         -           3,631         -           82         -           168         -           506         -           415         -           79         -	3,231 036 194 704 199 483 376 508 3,945 90 178 143 518 448 85 500	3,469           2037         200           208         201           762         201           521         406           549         4,287           4,287         4           98         191           157         532           483         93	3,731   8 203 222 2 825 4 232 5 562 0 438 5 595 0 657 5, 108 2 204 1 172 5 547 9 547 9 547 9 547 9 547 9 544 1 544 1	4,020   9 204( 238 2 50 2 506 6 564 6 557 5,4 119 1 220 2 189 2 5563 5 564 6 109 1 70 1 70 1 70 1 70 1 70 1 70 1 70 1 70	4,340 2010/1 56 4 66 00 70 -0 53 1 10 2 98 3 31 1 37 50 08 3 80 -2 09 3 18 4 92 4 92	4,700           5         2015/20           .6         22.5           .8         30.2           .1         24.4           .4         24.8           .0         21.9           .3         32.6           .5         19.4           .1         49.2           .4         16.3           .1         30.1           .3         35.0           .7         28.8           .0         24.1	5,066 2020/25 6.3 7.7 4.4 6.8 8.3 15.0 8.0 10.0 3.8 20.8 1.0 8.8 1.0 8.8 1.0 8.8 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	5,467 2025/30 8.7 8.1 7.2 9.1 8.4 8.5 8.3 9.5 4.1 10.7 1.9 8.7 1.9 8.7 11.0	5,905 2030/35 9.2 8.2 7.7 9.4 8.5 9.2 8.3 10.2 5.6 11.2 2.8 9.2 2.8 9.2 11.5 5.2 2.1	6,386 2035/40 7.3 8.2 8.0 7.8 7.9 8.2 8.6 9.9 7.1 9.9 2.8 8.0 8.3 10.2 8.2 8.0 8.3 10.2 8.2 8.0 8.3 8.2 8.2 8.2 8.2 8.2 8.2 8.2 8.2	6,913 2015/40 10.7 12.2 10.1 11.4 10.9 14.3 10.4 16.8 7.3 16.3 15.0 12.4 12.5 16.0
1 1 2 3 4 5 6 7 8 9 100 111 122 133 14 15	Jodan       Arusha       Arusha       Kilimanjaro       Tanga       Morogoro       Pwani       Dar es Salaam       Lindi       Mtwara       Ruvuma       Tringa +Njombe       Mbeya       Singida       Tabora       Pukua +Katavi	1,045 2031 126 474 137 312 252 330 2,643 55 134 85 451 291 51 303 43	1,317 2032 138 513 147 342 273 360 2,862 61 141 94 463 318 57 340 48	1,520           2033         150           150         556           158         374           296         393           3,098         67           149         105           476         347           63         382           53         53	1,754 2034 2034 2014 2014 2014 2014 2014 2014 2014 201	1,996           2035         21           180         651           651         184           449         349           470         3,631           82         168           130         506           79         480           65         5	3,231 036 194 704 199 483 376 508 3,945 90 178 143 518 143 518 448 85 529 73	3,469           2037         20.           208         762           215         521           406         549           4,287         4           98         191           157         532           483         93           583         83	3,731 38 203 222 2 562 0 438 595 0 657 5, 108 172 204 172 547  522 100 644 94	4,020   9 204( 238 2 893 2 250 2 250 2 250 2 250 2 250 2 257 2 544 6 557 5,4 119 1 120 2 20 2 2189 2 2563 5 564 6 109 1 710 7 10 7	4,340 2010/1 56 2 66 C 70 -C 53 1 10 2 98 3 91 5 31 1 37 5C 08 3 80 -2 09 3 18 4 83 0 09 3 18 4 18 4 18 5 18 5 18 5 18 5 18 5 19 5	4,700 5 2015/20 6 22.5 8 30.2 1 24.4 4 24.8 0 21.9 3 32.6 5 19.4 1 49.2 4 16.3 1 30.1 3 85.0 7 28.8 0 24.1 3 36.7 8 30.2 1 30.1 3 36.7 8 30.2 1 30.1 3 36.7 8 30.2 1 30.1 3 36.7 8 30.2 1 30.1 1 30	5,066 2020/25 6.3 7.7 4.4 6.8 8.3 15.0 8.0 10.0 0 3.8 20.8 1.0 0 8.8 8.3 15.0 8.0 10.0 0 8.8 8.3 10.0 8.0 10.0 0 8.0 10.0 0 0 0 0 0 0 0 0 0 0 0 0 0	5,467 2025/30 8.7 8.1 7.2 9.1 8.4 8.5 8.3 9.5 4.1 10.7 1.9 8.7 11.0 11.8 10.0	5,905 2030/35 9.2 8.2 7.7 9.4 8.5 9.2 5.6 11.2 2.8 9.2 5.6 11.2 2.8 9.2 11.5 12.1 10.7	6,386 2035/40 7.3 8.2 8.0 7.8 7.9 8.2 8.6 9.9 7.1 9.9 2.8 8.0 8.3 10.3 13.4	6,913 2015/40 10.7 12.2 10.1 11.4 10.9 14.3 10.4 16.8 7.3 16.3 15.0 12.4 12.5 16.0 16.2
1 2 3 4 5 6 7 7 8 9 9 10 11 12 13 14 15 15	Dodoma Arusha Kilimanjaro Tanga Morogoro Pwani Dar es Salaam Lindi Mtwara Ruvuma Iringa +Njombe Mbeya Singida Tabora Rukwa +Katavi Kinoma	1,045           2031           126           474           137           312           252           330           2,643           55           134           85           451           51           303           43           99	1,317 2032 138 513 147 342 273 360 2,862 61 141 94 463 318 57 340 48 109	1,520           2033         1           150         556           158         374           296         393           3,098         67           149         105           476         347           63         382           53         121	1,754 2034 2 164 601 171 410 321 429 3,354 74 158 117 490 379 71 428 59 133	1,996           1,096           180           651           184           449           349           470           3,631           82           130           506           415           79           480           65           147	3,231 036 194 704 199 483 376 508 3,945 90 178 143 143 518 448 85 529 73 159	3,469           2037         200           208         201           762         215           521         406           549         4,287           4,287         4           98         191           157         532           483         93           583         83           83         172	3,731 38 203 222 32 23 35 562 438 595 657 5, 108 204 72 547 94 100 644 94 186	4,020 9 204( 238 2 505 2 506 6 473 5 544 6 557 5,4 119 1 220 2 289 2 563 5 564 6 664 6 109 1 710 7 107 1 201 2 201 2	4,340 2010/1 56 2 66 C 70 -C 53 1 10 2 98 3 91 5 31 1 37 5C 37 5C 380 2 380 2 80 2 18 4 83 C 22 -22 17 6	4,700           5         2015/20           .6         22.5           .1         24.4           .4         24.8           .0         21.9           .3         32.6           .5         19.4           .1         44.6           .3         32.6           .5         19.4           .1         30.1           .3         35.0           .7         28.8           .0         24.1           .3         36.7           .8         39.4           .6         49.4	5,066 2020/25 6.3 7.7 4.4 6.8 8.3 15.0 8.0 10.0 3.8 20.8 20.8 1.0 8.8 4.1 1.0 9.8 8.4 11.0 9.8 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	5,467 2025/30 8.7 8.1 7.2 9.1 8.4 8.5 8.3 9.5 4.1 10.7 1.0 1.0 1.8 10.0 9.8 7 11.0 1.8 10.0 9.8 7 10.0	5,905 2030/35 9.2 8.2 7.7 9.4 8.5 9.2 8.3 10.2 5.6 11.2 2.8 9.2 5.6 11.2 1.5 12.1 10.7 10.4	6,386 2035/40 7.3 8.2 8.0 7.8 7.9 8.2 8.6 9.9 7.1 9.9 2.8 8.0 8.0 8.2 8.6 9.9 1.1 9.9 1.1 9.9 2.8 8.0 8.3 10.3 13.4 8.1 8.3 13.4 8.1 13.4 8.1 13.4 8.1 13.4 8.1 13.4 14.4 15.4 1	6,913 2015/40 10.7 12.2 10.1 11.4 10.9 14.3 10.4 16.8 7.3 16.3 15.0 12.4 12.5 16.0 16.2 17.0
1 2 3 4 5 6 7 7 8 9 10 11 11 12 13 14 15 16 17	Dodoma Arusha Kilimanjaro Tanga Morogoro Pwani Dar es Salaam Lindi Mtwara Ruvuma Iringa +Njombe Mbeya Singida Tabora Rukwa +Katavi Kigoma	1,045           2031           126           474           137           312           252           330           2,643           55           134           85           451           291           303           43           99           396	1,317 2032 138 513 147 342 273 360 2,862 61 141 94 463 318 57 340 48 109 440	1,520           2033         150           556         158           374         296           393         3,098           67         149           105         476           347         63           382         53           121         490	1,754 2034 2 164 601 171 410 321 429 3,354 74 158 117 490 379 71 490 379 71 428 59 133 545	1,996           1,996           180           651           184           449           349           470           3,631           82           168           130           506           415           79           480           65           147           607	3,231 036 194 704 199 483 376 508 3,945 90 178 143 518 448 85 529 73 159 660	3,469           2037         200           208         201           762         215           521         406           549         4,287           4,287         4           98         191           157         532           483         93           583         83           172         718	3,731 38 202 22 32 232 362 362 438 555 6657 5,0 108 204 204 172 547 522 100 644 94 186 94 186 28	4,020 9 204( 238 2 500 2 506 6 473 5 544 6 557 5,4 119 1 220 2 563 5 564 6 057 5,4 119 1 10 7 10 7 107 1 201 2 551 5 551 5 555	4,340 2010/1 56 2 66 0 70 -0 53 1 10 2 98 3 91 5 31 1 37 50 08 3 80 -2 09 3 80 -2 09 3 80 -2 18 4 83 0 22 -2 17 6 25 2 25	4,700           5         2015/20           .6         22.5           .8         30.2           .1         24.4           .4         24.8           .0         21.9           .3         32.6           .5         19.4           .1         49.2           .4         16.3           .1         30.1           .3         365.0           .7         28.8           .0         24.1           .3         36.7           .8         39.4           .6         49.4	5,066 2020/25 6.3 7.7 4.4 6.8 8.3 15.0 8.0 10.0 8.8 20.8 10.0 8.8 10.0 8.8 4.4 11.0 9.8 11.9 7.8 7.8 7.8 7.7 7.7 7.8 7.7 7.7	5,467 2025/30 8.7 8.1 7.2 9.1 8.4 8.5 8.3 9.5 4.1 10.7 1.9 8.7 11.0 11.8 10.0 9.8 11.0 11.8 10.0 11.8 10.0 11.8 10.0 10	5,905 2030/35 9.2 8.2 7.7 9.4 8.5 9.2 8.3 10.2 5.6 11.2 2.8 9.2 11.5 12.1 10.7 10.7 10.4 11.2	6,386 2035/40 7.3 8.2 8.0 7.8 7.9 8.2 8.6 9.9 7.1 9.9 2.8 8.0 8.3 10.3 13.4 8.1 8.8 8.8 10.3 13.4 8.8 8.8 8.8 10.3 10.4 8.3 10.4 8.3 10.4 8.3 10.4 8.3 10.4 8.3 10.4 8.3 10.4 8.4 8.5 10.4	6,913 2015/40 10.7 12.2 10.1 11.4 10.9 14.3 10.4 16.8 7.3 16.3 15.0 12.4 12.5 16.0 16.2 17.0 10.9
1 2 3 4 5 6 6 7 8 9 9 10 0 111 12 13 14 4 15 16 17 18	Initial       Dodoma       Arusha       Kilimanjaro       Tanga       Morogoro       Pwani       Dar es Salaam       Lindi       Mtwara       Ruvuma       Iringa +Njombe       Mbeya       Singida       Tabora       Rukwa +Katavi       Kigoma       Shinyanga+ Simiyu	1,045           2031           126           474           137           312           252           330           2,643           55           134           85           451           291           51           303           43           99           396           184	1,317 2032 138 513 147 342 273 360 2,862 61 141 94 463 318 57 340 48 109 440 202	1,520           2033         150           556         158           374         296           393         3,098           67         149           105         476           347         63           382         53           121         490           223         23	1,754 2034 2 164 601 171 410 321 429 3,354 74 158 117 429 3,354 74 158 117 490 379 71 428 59 133 545 245	1,996           1,095         20           180         50           184         449           349         449           349         349           470         3,631           82         168           130         506           415         79           480         65           147         607           270         270	3,231 036 194 194 704 199 483 376 508 3,945 90 178 143 518 448 85 529 73 159 660 297	3,469           2037         200           208         201           762         215           521         406           549         4,287           4,287         4           98         191           157         532           483         93           583         83           172         718           328         5	3,731           38         203           222         2           825         1           522         2           562         0           438         2           595         6           657         5,0           108         204           204         2           547         5           547         5           547         5           547         5           540         4           94         1           186         7           782         4	4,020 9 204( 238 2 250 2 506 6 547 5 557 5,4 119 1 220 2 566 5 557 5,4 119 1 120 2 563 5 564 6 109 1 189 2 564 6 109 1 120 2 563 5 564 6 107 1 201 2 564 6 107 1 201 2 565 5 564 6 109 1 201 2 201	4,340 2010/1 56 4 66 0 70 -0 53 1 10 2 98 3 91 5 31 1 37 50 08 3 80 -2 09 3 18 4 83 0 22 -2 17 6 25 2 24 2 25 2 2 2 2 2 2 2 2 2 2 2 2 2 2	4,700           5         2015/20           .6         22.5           .8         30.2           .1         24.4           .4         24.8           .0         21.9           .3         32.6           .5         19.4           .1         49.2           .4         16.3           .1         30.1           .3         36.7           .8         39.4           .6         49.4           .6         16.3           .3         34.2	5,066 2020/25 6.3 7.7 4.4 6.8 8.3 15.0 8.0 10.0 3.8 20.8 1.0 8.8 1.0 8.8 1.0 9.8 1.0 9.8 1.19 7.8 14.7	5,467 2025/30 8.7 8.1 7.2 9.1 8.4 8.5 8.3 9.5 4.1 10.7 1.9 8.7 11.0 11.8 10.0 9.8 10.0 9.8 10.6 9.3	5,905 2030/35 9.2 8.2 7.7 9.4 8.5 9.2 8.3 10.2 5.6 11.2 2.8 9.2 11.5 12.1 10.7 10.4 11.2 10.7 10.4 11.2 10.7 10.4 11.2 10.7 10.4 11.2 10.7 10.4 11.2 10.7 10.4 11.2 10.7 10.4 10.7 10.4 10.7	6,386 2035/40 7.3 8.2 8.0 7.8 7.9 8.2 8.6 9.9 7.1 9.9 2.8 8.0 8.3 10.3 10.3 13.4 8.1 8.8 10.4	6,913 2015/40 10.7 12.2 10.1 11.4 10.9 14.3 10.4 16.8 7.3 16.3 15.0 12.4 12.5 16.0 16.2 17.0 10.9 16.5
1 2 3 4 5 6 7 8 9 10 11 12 2 13 14 15 16 16 17 18 19	Initial       Dodoma       Arusha       Kilimanjaro       Tanga       Morogoro       Pwani       Dar es Salaam       Lindi       Mtwara       Ruvuma       Iringa +Njombe       Mbeya       Singida       Tabora       Rukwa +Katavi       Kigoma       Shinyanga+ Simiyu       Kagera       Mwanza +Geita	1,045           2031           126           474           137           312           252           330           2,643           55           134           85           451           291           51           303           43           99           396           184           618	1,317           2032           138           513           147           342           273           360           2,862           61           141           94           463           318           57           340           48           109           440           202           672	1,520           2033         150           150         556           158         374           296         393           3,098         67           149         105           476         347           63         382           53         121           490         223           731         1	1,754 2034 2034 2034 201 164 601 171 410 321 429 3,354 74 158 117 490 379 71 428 59 133 545 245 796	1,996           180         21           180         651           184         449           349         470           3,631         82           168         130           506         79           480         65           147         607           270         868	3,231 036 194 704 199 483 376 508 3,945 90 178 143 518 448 85 529 73 159 660 297 936	3,469           2037         20.           208         20.           762         21.5           521         406           549         4.287           4,287         4           98         191           157         532           483         93           583         83           172         718           328         1,011         1	3,731 38 202 22 32 22 32 32 23 35 2 32 35 2 3 3 5 5 5 3 3 5 5 5 3 5 5 5 1 0 8 5 5 5 1 0 8 5 5 5 1 0 8 5 5 5 1 0 8 5 7 5 1 0 1 1 7 2 5 7 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	4,020           9         2040           238         2           933         2           506         6           4/73         5           544         6           557         5,4           119         1           220         2           663         5           564         6           109         1           710         7           201         2           351         5           400         4	4,340 2010/1 56 2 66 C 70 -C 53 1 10 2 98 3 91 5 31 1 37 5C 08 3 80 -2 09 3 18 4 83 0 22 -2 17 6 22 -2 17 6 22 -2 17 6 24 3 22 7 17 12 17 12 10 2 10 2 1	4,700           5         2015/20           .6         22.5           .8         30.2           .1         24.4           .4         24.8           .0         21.9           .3         32.6           .5         19.4           .1         49.2           .4         16.3           .1         30.1           .3         36.7           .8         39.4           .6         49.4           .6         16.3           .3         32.61	5,066 2020/25 6.3 7.7 4.4 6.8 8.3 15.0 8.0 10.0 0 3.8 20.8 1.0 8.8 8.4 11.0 9.8 11.9 7.8 14.7 9.8	5,467 2025/30 8.7 8.1 7.2 9.1 8.4 8.5 8.3 9.5 4.1 10.7 1.9 8.7 11.0 11.8 10.0 9.8 10.0 9.8 10.6 9.3 8.3 8.3 10.7 11.0 10.0	5,905 2030/35 9.2 8.2 7.7 9.4 8.5 9.2 5.6 11.2 2.8 9.2 11.5 12.1 10.7 10.4 11.2 10.7 10.4 8.8	6,386 2035/40 7.3 8.2 8.0 7.8 7.9 8.2 8.6 9.9 7.1 9.9 2.8 8.0 8.3 10.3 13.4 8.3 10.4 8.1 8.8 10.4 8.4 8.0 8.3 10.4 8.3 10.4 8.3 10.4 8.3 10.4 8.3 10.4 8.4 8.5 8.5 8.5 8.5 8.5 8.5 8.5 8.5	6,913 2015/40 10.7 12.2 10.1 11.4 10.9 14.3 10.4 16.8 7.3 16.3 15.0 12.4 12.5 16.0 16.2 17.0 10.9 16.5 12.0
1 2 3 4 5 6 7 7 8 9 10 11 11 22 13 14 15 16 6 17 18 19 200	Dodoma Arusha Kilimanjaro Tanga Morogoro Pwani Dar es Salaam Lindi Mtwara Ruvuma Tinga +Njombe Mbeya Singida Tabora Rukwa +Katavi Kigoma Shinyanga+ Simiyu Kagera Mwanza +Geita Mara	1,045           2031           126           474           137           312           252           330           2,643           55           134           85           451           51           303           43           99           396           184           618           242	1,317 2032 138 513 147 342 273 360 2,862 61 141 94 463 318 57 340 48 57 340 48 109 440 202 672 265	1,520           2033         1           150         556           158         374           296         393           3,098         67           149         105           476         347           63         382           53         121           490         223           731         290	1,754           2034         2           164         601           171         410           321         429           3,354         74           158         117           490         71           428         59           545         245           796         318	1,996           2035         21           180         651           184         449           349         470           3,631         82           130         506           415         79           480         65           147         607           270         868           349         349	3,231 036 194 704 199 483 376 508 3,945 90 178 143 518 448 85 529 73 159 660 297 936 375	3,469           2037         200           208         201           762         215           521         521           406         549           4,287         4           98         191           157         532           483         93           583         83           172         718           328         1,011         1	3,731 38 202 22 23 23 25 24 23 25 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	4,020           9         204(           238         2           393         52           506         6           4773         5           544         6           557         5,4           119         1           220         22           289         22           563         5           564         6           109         1           7100         7           107         1           201         22           2021         2           3551         9           400         4           179         1,2	4,340 2010/1 56 2 66 C 70 -C 53 1 10 2 98 3 91 5 31 1 53 3 91 5 31 3 91 5 31 4 37 5C 08 3 80 -2 09 3 80 -2 09 3 18 4 83 C 22 -2 17 6 25 2 43 2 73 12 55 2 55	4,700           5         2015/20           .6         22.5           .1         24.4           .4         24.8           .0         21.9           .3         32.6           .5         19.4           .1         49.2           .4         16.3           .1         30.1           .3         32.6           .7         28.8           .0         24.1           .3         36.7           .8         39.4           .6         49.4           .6         16.3           .3         41.2           .3         26.1           .3         22	5,066 2020/25 6.3 7.7 4.4 6.8 8.3 15.0 8.0 10.0 3.8 20.8 1.0 8.8 1.0 9.8 8.4 11.0 9.8 8.4 11.9 7.8 14.7 9.8 7.4	5,467 2025/30 8.7 8.1 7.2 9.1 8.4 8.5 8.3 9.5 4.1 10.7 11.0 11.8 10.0 9.8 10.6 9.3 8.3 8.3 8.3 8.3 8.3 8.5 4.1 10.7 11.0 11.8 10.0 10.5 10.0 10	5,905 2030/35 9.2 8.2 7.7 9.4 8.5 9.2 8.3 10.2 5.6 11.2 2.8 9.2 5.6 11.2 11.5 12.1 10.7 10.4 11.2 10.4 11.2 10.4 11.2 10.4 11.2 10.4 11.2 10.4 11.2 10.4 11.2 10.4 11.2 10.4 11.2 10.4 10.5 10.4 10.4 10.4 10.4 10.4 10.5 10.4 10.4 10.4 10.5 10.4 10.4 10.5 10.4 10.4 10.5 10.4 10.4 10.5 10.4 10.5 10.4 10.5 10.4 10.5 10.4 10.5 10.4 10.5 10.4 10.5 10.4 10.5 10.4 10.5 10.4 10.5 10.4 10.5 10.5 10.4 10.5 1	6,386 2035/40 7.3 8.2 8.0 7.8 7.9 8.2 8.6 9.9 7.1 9.9 2.8 8.0 8.3 10.3 10.3 10.3 10.3 10.4 8.1 8.8 10.4 8.0 7.7	6,913 2015/40 10.7 12.2 10.1 11.4 10.9 14.3 10.4 16.8 7.3 16.3 15.0 12.4 12.5 16.0 12.4 12.5 16.0 16.2 17.0 10.9 16.5 12.0 11.5
1 2 3 4 5 6 7 7 8 9 9 10 111 12 133 14 15 16 177 18 19 9 20 21	Dodoma Dodoma Arusha Kilimanjaro Tanga Morogoro Pwani Dar es Salaam Lindi Mtwara Ruvuma Ruvuma Iringa +Njombe Mbeya Singida Tabora Rukwa +Katavi Kigoma Shinyanga + Simiyu Kagera Mwanza +Geita Mara Manyara	1,045           2031           126           474           137           312           252           330           2,643           55           134           85           451           51           303           43           99           336           184           618           242           21	1,317 2032 138 513 147 342 273 360 2,862 61 141 94 463 318 57 340 48 109 440 202 672 265 22	1,520           2033         150           556         158           374         296           393         3,098           67         149           105         476           347         63           382         53           121         490           223         731           290         24	1,754           2034         2           164         601           171         410           321         429           3,354         74           74         158           117         490           379         71           428         59           133         545           545         245           796         318           25         25	1,996           2035         21           180         651           184         449           349         470           3,631         82           168         130           506         130           449         506           415         79           480         65           147         607           270         868           349         27	3,231 036 194 704 199 483 376 508 3,945 90 178 143 518 448 85 529 73 159 660 297 936 375 29	3,469           2037         200           208         201           762         215           521         406           549         4           4,287         4           98         191           157         532           483         93           583         83           172         718           328         1,011           404         30	3,731           38         203           222         2           825         3           562         4           438         4           595         6           567         5,1           108         2           547         5           522         1           547         1           522         1           100         644           94         1           186         2           362         362           091         1,1           435         32	4,020           9         204(           238         2           393         5           5250         2           506         6           4773         5           544         6           557         5,4           119         1           220         22           563         5           564         6           109         1           710         7           107         1           201         2           351         2           469         5           34         5	4,340           2010/1           56         2           66         0           70         -0           533         1           10         2           98         3           991         5           31         1           37         50           08         3           80         -2           09         3           18         4           83         0           22         -2           17         6           25         2           43         2           05         9           36         3	4,700           5         2015/20           .6         22.5           .8         30.2           .1         24.4           .4         24.8           .0         21.9           .3         32.6           .5         19.4           .1         49.2           .4         16.3           .1         30.1           .3         36.7           .0         24.1           .3         36.7           .6         49.4           .6         49.4           .6         16.3           .3         41.2           .3         26.1           .3         21.1	5,066 2020/25 6.3 7.7 4.4 6.8 8.3 15.0 8.0 10.0 3.8 20.8 1.0 8.8 1.0 9.8 11.9 7.8 14.7 9.8 7.4 4.6 4.6 11.0	5,467 2025/30 8.7 8.1 7.2 9.1 8.4 8.5 8.3 9.5 4.1 10.7 11.0 11.8 10.0 9.8 7 11.0 11.8 10.6 9.3 8.3 8.3 8.7 5.8	5,905 2030/35 9.2 8.2 7.7 9.4 8.5 9.2 8.3 10.2 5.6 11.2 2.8 9.2 11.5 12.1 10.7 10.4 11.2 10.7 10.4 11.2 10.0 8.8 9.5 6.3	6,386 2035/40 7.3 8.2 8.0 7.8 7.9 8.2 8.6 9.9 7.1 9.9 2.8 8.0 8.3 10.3 13.4 8.1 8.8 10.4 8.0 7.7 6.1	6,913 2015/40 10.7 12.2 10.1 11.4 10.9 14.3 10.4 16.8 7.3 16.3 15.0 12.4 12.5 16.0 16.2 17.0 16.5 16.5 12.0 11.5 9.5
1 2 3 4 5 6 7 8 8 9 10 11 12 13 13 14 15 5 16 17 18 19 20 20 21	Initial       Dodoma       Arusha       Kilimanjaro       Tanga       Morogoro       Pwani       Dar es Salaam       Lindi       Mtwara       Ruvuma       Iringa +Njombe       Mbeya       Singida       Tabora       Rukwa +Katavi       Kigoma       Shinyanga+ Simiyu       Kagera       Mwanza +Geita       Mara       Mainland total	1,045           2031           126           474           137           312           252           330           2,643           55           134           85           451           291           51           303           43           99           396           184           618           242           21           7,249	1,317 2032 138 513 147 342 273 360 2,862 61 141 94 463 318 57 340 48 109 440 202 672 265 22 7,868	1,520           2033         150           556         158           374         296           393         3,098           67         149           105         476           347         63           382         53           121         490           223         731           290         24           8,546         6	1,754           2034         2           164         2           164         2           171         410           321         429           3,354         74           158         117           490         379           71         428           59         133           545         245           796         318           255         9,289	1,996           1,095         21           180         5           184         449           349         349           470         3,631           82         168           130         506           415         79           480         65           147         607           270         868           349         27           10,03         1	3,231 036 194 704 199 483 376 508 3,945 90 178 143 518 448 85 529 73 159 660 297 936 375 29 0,931	3,469           2037         200           208         201           762         215           521         406           549         4           98         191           157         532           483         93           93         583           83         172           718         328           1,011         1           404         30           11,830         12	3,731           38         203           222         2           825         1           562         0           438         0           595         6           657         5,6           108         204           204         2           522         1           547         2           522         1           100         644           94         1           186         2           362         0           091         1,           435         32           810         13,0	4,020           9         204(           238         2           993         9           506         6           644         6           557         54           119         1           220         2           566         6           107         2           563         5           564         6           109         1           201         2           351         5           400         4           179         1,2           469         5           34         372	4,340           2010/1           56         2           66         0           70            73         1           37         50           88        2           098         3           37         50           08         3           80        2           099         3           18         4           83         0           22        2           17         6           25         2           24         3         1           36         3         3	4,700           5         2015/20           .6         22.5           .8         30.2           .1         24.4           .4         24.8           .0         21.9           .3         32.6           .5         19.4           .1         49.2           .4         16.3           .1         30.1           .3         36.7           .8         39.4           .6         49.4           .6         49.4           .6         49.4           .6         16.3           .3         24.1           .3         36.7           .8         39.4           .6         16.3           .3         24.1           .3         32.6.1           .2         25.9	5,066 2020/25 6.3 7.7 4.4 6.8 8.3 15.0 8.0 10.0 3.88 20.8 1.0 8.8 1.0 9.8 11.9 7.8 14.7 9.8 14.7 9.8 14.7 9.8 14.7 9.8 14.7 9.8 14.7 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	5,467           2025/30           8.7           8.87           9.1           8.4           8.5           8.3           9.5           4.1           10.7           1.9           8.7           11.0           11.8           10.0           9.8           10.6           9.3           8.3           8.7           13.8           10.6           9.3           8.3           8.7           5.8           8.1	5,905 2030/35 9.2 8.2 7.7 9.4 8.5 9.2 8.3 10.2 5.6 11.2 2.8 9.2 11.5 12.1 10.7 10.4 11.2 10.7 10.4 11.2 10.0 8.8 9.5 5.5 12.1 10.7 10.4 11.5 10.7 10.4 10.5 10.	6,386 2035/40 7.3 8.2 8.0 7.8 7.9 8.2 8.6 9.9 7.1 9.9 2.8 8.0 8.3 10.3 13.4 8.1 8.8 10.4 8.0 7.7 6.1 8.3	6,913 2015/40 10.7 12.2 10.1 11.4 10.9 14.3 10.4 16.8 7.3 15.0 12.4 12.5 16.0 16.2 17.0 10.9 16.5 12.0 11.5 9.5 11.5
1 2 3 4 5 6 7 8 9 10 11 12 2 13 14 15 16 17 18 19 9 20 20 21	Jodama       Arusha       Arusha       Kilimanjaro       Tanga       Morogoro       Pwani       Dar es Salaam       Lindi       Mtwara       Ruvuma       Iringa +Njombe       Mbeya       Singida       Tabora       Rukwa +Katavi       Kigoma       Shinyanga+ Simiyu       Kagera       Mwanza +Geita       Mara       Mainland total       Zanzibar	1,045           2031           126           474           137           312           252           330           2,643           55           134           85           451           291           51           303           43           99           396           184           618           242           21           7,249           240	1,317           2032           138           513           147           342           273           360           2,862           61           141           94           463           318           57           340           48           109           440           202           672           265           22           7,868           251	1,520           2033         150           150         556           158         374           296         393           3,098         67           149         105           476         347           63         382           53         121           490         223           731         290           24         8,546           264         264	1,754           2034         2           164         2           161         171           410         321           3,354         2           3,354         74           158         117           490         379           71         428           59         133           545         245           796         318           25         9,289           276         276	1,996           180         21           180         651           651         184           449         349           470         3,631           82         168           130         506           415         79           480         65           147         607           270         868           349         27           10,103         1           288         1	3,231 036 194 704 199 483 376 508 3,945 90 178 143 518 448 85 529 73 159 660 297 936 375 29 0,931 298	3,469           2037         20.           208         20.           762         21.5           521         406           549         4.           4,287         4           98         191           157         532           483         93           583         83           172         718           328         1,011           11,830         12           310         2310	3,731           38         203           222         2           825         6           232         2           562         0           438         5           595         0           657         5,1           108         204           204         2           522         100           644         94           94         186           782         32           091         1,1,           435         32           810         13,8	4,020           9         204(           238         2           393         2           506         6           4/73         5           544         6           557         5,4           119         1           220         2           263         5           564         66           109         1           710         7           201         20           351         5           469         5           34         6           372         15,0           332         3	4,340           2010/1           256         2           66         C           70         -C           73         1           98         3           91         5           37         5C           08         3           380         -2           09         3           18         4           833         C           22         -2           23         1         2           17         C         2           26         2         2           27         1         2           05         2         2           36         3         2           37         12         3         3           30         5         3         3           30         5         3         3           30         5         4         2         0	4,700           5         2015/20           .6         22.5           .8         30.2           .1         24.4           .4         24.8           .0         21.9           .3         32.6           .5         19.4           .1         49.2           .1         30.1           .3         30.1           .3         36.7           .6         49.4           .6         149.4           .6         149.4           .6         149.4           .6         149.4           .6         149.4           .6         149.4           .6         16.3           .3         26.1           .3         26.1           .3         26.1           .3         26.1           .3         26.1           .4         26.5           .2         25.9           .3         14.2	5,066 2020/25 6.3 7.7 4.4 6.8 8.3 15.0 8.0 10.0 0 3.8 20.8 1.0 0 8.8 8.4 11.0 9.8 14.7 9.8 14.7 9.8 14.7 9.8 7.4 4.6 7.8 14.9 7.8 14.9 7.8 14.9 7.8 14.9 7.8 14.9 7.8 7.7 7.7 7.7 7.7 7.7 7.7 7.7	5,467           2025/30           8.7           9.1           7.2           9.1           8.4           8.5           8.3           9.5           4.1           10.7           1.9           8.7           11.0           11.8           10.0           9.8           10.6           9.3           8.3           8.7           5.8           8.1           6.0	5,905 2030/35 9.2 8.2 7.7 9.4 8.5 9.2 5.6 11.2 2.8 9.2 11.5 12.1 10.7 10.4 11.2 10.7 10.4 10.4 11.2 10.7 10.4 11.2 10.7 10.4 11.2 10.7 10.4 11.2 10.7 10.4 11.2 10.4 11.2 10.4 11.2 10.7 10.4 11.2 10.7 10.4 11.2 10.7 10.4 11.2 10.7 10.4 11.2 10.7 10.4 11.2 10.5 10.4 10.5 10.4 10.4 10.4 10.4 10.4 10.5 10.4 10.4 10.4 10.4 10.5 10.4 10.4 10.4 10.5 10.4 10.4 10.5 10.4 10.4 10.5 10.4 10.4 10.5 10.4 10.4 10.5 10.4 10.4 10.4 10.4 10.4 10.5 10.4	6,386 2035/40 7.3 8.2 8.0 7.8 7.9 8.2 8.6 9.9 7.1 9.9 2.8 8.0 8.3 10.3 13.4 8.3 10.3 13.4 8.1 8.8 10.4 8.0 7.7 6.1 8.3 3.5	6,913 2015/40 10.7 12.2 10.1 11.4 10.9 14.3 10.4 16.8 7.3 16.3 15.0 12.4 12.5 16.0 16.2 17.0 10.9 16.5 12.0 11.5 9.5 7.4

Source: Study results of Task Force Team

#### CHAPTER THREE

#### 3 GENERATION

Generation plan presents an assessment of generation sequencing that meet demand for the forecast period. A number of generation technologies have been evaluated to attain the recommended plans for development of power sector in the country. In identifying new power projects, the plan evaluate new power generation technologies, including a review of capital investment, project lead time, fuel costs and their availability, both locally and imported. In addition, confirmatory studies such as environmental assessment and project financing arrangement are key elements of the projects preparations and signals on the possibility of success for the identified projects. The generation plan considers the following power sources namely hydro, gas, coal, wind, geothermal and solar among others.

# 3.1 Existing Generation Plants

#### 3.1.1 Hydro power plants

Existing hydro power plants are consisted of three reservoir type and eight run-of-river type plants as shown in Table 3-1(a) and (b).

# 3.1.2 Thermal power plants

The interconnected grid system is composed of several power plants, among those seven are gas fired plants, two are Heavy Fuel Oil (HFO) plants, two are Biomass plants, and one is Industrial Diesel Oil. Thermal power plants on average have an economic life span of twenty (20) years however; the life span can be extended by proper maintenance and interim replacement of major parts. Characteristics of the existing thermal power plants are shown in Table 3-2.

					Н	ydro Power Pla	ant		
	Ite	em	Hale	Nyumba Ya Mungu	New Pangani Falls	Kidatu	Mtera	Uwemba	Kihansi
	Ow	ner				TANESCO			
	R	iver Basin		Pangani			Ru	fiji	
		District	Korogwe	Mwanga	Muheza	Kilombero	Kilolo	Njombe	Kilombero
	Location	Region	Tanga	Kilimanjaro	Tanga	Morogoro	Iringa	Njombe	Iringa
	Power 0	Generation Type	Run-off-river	Reservoir	Run-off-river	Reservoir	Reservoir	Run-off-river	Run-off-river
tt sristic	Insta	allation Year	1964	1968	1995	1975 (2 units) 1980 (2 units)	1988	1991	1999 (1 unit) 2000 (2 units)
Plan racte	Installed	Capacity (MW)	21	8	68	204	80	0.843	180
Cha	Nun	ber of Units	2	2	2	4	2	3	3
	Plant D	Discharge (m <sup>3</sup> /s)	45.00	42.50	45.00	140.00	96.00	N/A	23.76
	Gro	ss Head (m)	70.00	27.00	170.00	175.00	101.00	N/A	852.75
	Annual Energ	gy Generation (GWh)	36.11	21.53	137.20	558.34	166.68	2.30	793.49
	Plan	t Factor (%)	20	31	23	31	24	31	50
	Dam	Туре	Concrete gravity	Rock fill	Concrete gravity	Rock fill	Concrete buttress	N/A	Concrete gravity
	(Main)	Height (m)	33.5	42	9	40	45	N/A	25
		Crest Length (m)	137	121	116.6	350	260	N/A	200
	D	Туре	Rock fill	Rock fill	Earth fill	-	-	N/A	-
	Dam (Auxiliary)	Height (m)	7.77	N/A	9	-	-	N/A	-
		Crest Length (m)	246.9	N/A	315	-	-	N/A	-
		Full Water Level (masl)	342.44	688.91	177.50	450.00	698.50	N/A	1,146.00
	Reservoir	Low Water Level (masl)	342.44	679.15	176.00	433.00	690.00	N/A	1,141.00
		Active Storage (10 <sup>6</sup> m <sup>3</sup> )	0	600	0.8	125	3,200	N/A	1
		Туре	Tunnel	-	Tunnel	Tunnel	Tunnel	N/A	Tunnel
	Headrace	Length (m)	2,050	-	1,050	9,600	70	N/A	2,250
		Diameter (m)	2.0 - 4.6	-	6.0 - 12.0	6.0 - 12.0	6.0	N/A	6.0 - 12.0
ity sristic		Туре	Tunnel	N/A	Tunnel	Tunnel	Tunnel	N/A	Tunnel
acili racte	Penstock	Length (m)	3.6	400	3	140	92	N/A	185
F Cha		Diameter (m)	1.8	2.69 - 3.85	2.4	4.7	3.2	N/A	1.1 - 2.0
		Туре	Underground	Surface	Underground	Underground	Underground	Surface	Underground
	Powerhouse	Width (m)	12	15	12.5	N/A	14	7.8	N/A
	1 o n ernoube	Depth (m)	30	43	40	N/A	48	13.6	N/A
		Height (m)	24	19	29	N/A	32	6.7	N/A
		Туре	Tunnel	N/A	Tunnel	Tunnel	Tunnel	N/A	Tunnel
	Tailrace	Length (km)	N/A	N/A	1,200	1,000	10,323	N/A	2,740
		Diameter (m)	1.0 - 2.0	N/A	1.0 - 2.0	1.0 - 2.0	6.5 - 8.4	N/A	5.3
	Turbine	Туре	Vertical Francis	Vertical Francis	Vertical Francis	Vertical Francis	Vertical Francis	N/A	Pelton
		Rated Output (MW/unit)	10.625	4.25	24	52.3 & 52.4	50	N/A	60
	Concerte	Туре	Synchronous 3 Phase	Synchronous 3 Phase	Synchronous 3 Phase	Synchronous 3 Phase	Synchronous 3 Phase	N/A	Synchronous 3 Phase
	Generator	Rated Output (MVA/unit)	12.5	4.7	40	60	45	N/A	71.5
1		Rated Voltage (kV)	11	11	11	10.5	22	N/A	22

# Table 3-1 (a): Existing Hydro Plant Characteristics (Owned by TANESCO)

Note: Annual energy generation and plant factor are actual record in 2013.

New Pangani Falls and Kihansi hydro power plants are considered and operated as a run-off-river type, although these plants have ponds (small reservoirs). Hale hydro power plant has no active storage capacity of reservoir due to full sedimentation.

Source: TANESCO and PSMP2012 Update

Item						Hydro Pow	er Plant			
	1	tem	Mwenga	Mapembasi	EA Power	Darakuta	Yovi	Tulila	Ikondo	Mbangamao
						SPI	þ			
	0	wner	Mwenga Hydro Ltd.	Mapembasi Hydro Power Co., Ltd.	EA Power Ltd.	N/A	N/A	N/A	N/A	N/A
	]	River Basin	Rı	ıfiji	Lake Nyasa	N/A	Rufiji	Rufiji	Rufiji	N/A
	Location	District	Mufindi	Njombe	Tukuyu	Magugu	Kisanga	N/A	N/A	N/A
	Location	Region	Iringa	Njombe	Mbeya	Manyara	Morogoro	Songea	N/A	Mbinga
	Power	Generation Type	Run-of-river	Run-of-river	Run-of-river	Run-of-river	Run-of-river	Run-of-river	Run-of-river	Run-of-river
nt eristic	Ins	tallation Year	2012	2019 (expected)	2019 (expected)	2015	2016	2015	2015	2014
Pla1 aract	Installe	d Capacity (MW)	4	10	10	0.46	0.96	5	0.6	0.5
Ch	Nu	mber of Units	1	3	2	N/A	1	2	3	1
	Plant 1	Discharge (m <sup>3</sup> /s)	8.00	30.00	N/A	N/A	N/A	N/A	N/A	N/A
	Gro Annual Ener	oss Head (m)	62.00	36.00	N/A	N/A	N/A	N/A	N/A	N/A
		rgy Generation (GWh)	17.10	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Pla	nt Factor (%)	49	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Туре	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Dam (Main)	Height (m)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Dam (Main)	Crest Length (m)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Туре	-	-	-	-	-	-	-	-
	Dam (Auriliana)	Height (m)	-	-	-	-	-	-	-	-
	(Auxiliary)	Crest Length (m)	-	-	-	-	-	-	-	-
		Full Water Level (masl)	1,127.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Reservoir	Low Water Level (masl)	1,126.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Active Storage $(10^6 \text{ m}^3)$	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Туре	N/A	Channel	N/A	N/A	N/A	N/A	N/A	N/A
	Headrace	Length (m)	N/A	900	N/A	N/A	N/A	N/A	N/A	N/A
		Diameter (m)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ic		Туре	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
lity terist	Penstock	Length (m)	340	168 - 185	340	340	N/A	N/A	N/A	N/A
Faci araci		Diameter (m)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ch		Туре	N/A	Surface	N/A	N/A	N/A	N/A	N/A	N/A
		Width (m)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Powerhouse	Depth (m)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Height (m)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Туре	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tailrace	Length (km)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Diameter (m)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Turbine	Туре	Francis	Horizontal Francis	Horizontal Francis	N/A	N/A	N/A	N/A	N/A
		Rated Output (MW/unit)	N/A	3.238	5	N/A	N/A	N/A	N/A	N/A
		Туре	Synchronous 3 Phase	Synchronous 3 Phase	N/A	N/A	N/A	N/A	N/A	N/A
	Generator	Rated Output (MVA/unit)	N/A	4.2	N/A	N/A	N/A	N/A	N/A	N/A
		Rated Voltage (kV)	6.6	6.3	N/A	N/A	N/A	N/A	N/A	N/A

# Table 3-1 (b): Hydro Plant Characteristics (Owned by SPP, Extisging or ongoing)

Note: Annual energy generation and plant factor are actual record in 2013.

New Pangani Falls and Kihansi hydro power plants are considered and operated as a run-off-river type, although these plants have ponds (small reservoirs).

Hale hydro power plant has no active storage capacity of reservoir due to full sedimentation.

Source: TANESCO and PSMP2012 Update

Plant	Fuel	Units	Installed Capacity MW	Available Capacity MW	Station service %	Net Available Capacity MW	FOR %	Combined Outage Rate %	Maximum Plant Factor %	Available Energy GWh	Year Installed (Jan)	Nominal Service Life Years	Retirem ent Year (Dec)
IPP UNITS		<u> </u>			·   · · · · ·					+ +	ĺ	<u> </u>	<b> </b>
Songas 1	Gas	2	42.00	38.30	1.60	37.69	5	13	80	251	2004	20	2023
Songas 2	Gas	3	120.00	110.00	1.60	108.24	5	13	80	721	2005	20	2024
Songas 3	Gas	1	40.00	37.00	1.60	36.41	5	13	80	242	2006	20	2025
Tegeta IPTL	HFO	10	103.00	100.00	1.60	98.40	8	18	75	595	2002	20	2021
TPC	Biomass		17.00	17.00	1.60	16.73	5	13	50	70	2011	20	2030
TANWAT	Biomass		2.70	2.40	1.60	2.36	5	13	50	10	2010	20	2029
Subtotal			324.70	304.70	<u> </u>	299.83				1888			<u> </u>
TANESCO			'	1	'						1		
Ubungo I	Gas	12	102.00	100.00	1.60	98.40	5	13	80	655	2007	20	2026
Tegeta GT	Gas	5	45.00	43.00	1.60	42.31	5	13	80	282	2009	20	2028
Ubungo II	Gas	3	105.00	100.00	1.60	98.40	5	13	80	655	2012	20	2031
Zuzu D	IDO	1	7	5.00	1.60	4.92	8	18	75	31	1980	20	2019
Nyakato	HFO	10	63.00	63.00	1.60	61.99	8	18	75	375	2013	20	2032
Kinyerezi-I	Gas	4	150.00	150.00	1.60	147.60	5	13	80	1034	2015	20	2035
Subtotal			472.00	461.00	'	453.62				1998	1		
TOTAL			796.70	765.70	·  '	753.45				3886	ĺ		
Available energy (MW Small diesels assumed FOR = Forced Outage I	/h) = Available cap J to stay in service Rate	acity (MW) * to December	8.76*(100-F 2012 as res	<sup>-</sup> OR)*max pla erve	ant factor/	100							

 Table 3-2: Existing Thermal Power Plants

#### 3.1.3 Retirement of Existing Plant

In the scheduling of new generation, existing generating units were assumed to be retired at the end of their normal "economic" service life except for hydroelectric plants which were assumed to remain in service. Assumed retirement dates are shown in Table 3-3.

Plant name	Nominal Capacity MW	Normal service life – years	Installation year (January)	Retirement year (December)
HYDRO				
Mtera	80	50	1988	2038**
Kidatu	204	50	1975	2025**
Hale	21	50	1967	2017**
Kihansi	180	50	2000	2050**
Pangani Falls	68	50	1995	2045**
Nyumba Ya Mungu	8	50	1968	2018**
Mwenga	4	15*	2012	2027*
Uwemba	0.843	50	1991	2041
Yovi	0.95	15*	2016	2031
Tulila	5	20*	2015	2035
Ikondo	0.6(0.4)	20*	2015	2035
THERMAL				
Songas I (2 units)	40	20	2004	2024
Songas II (3 units)	120	20	2005	2025
Songas III (1 units)	40	20	2006	2026
Tegeta IPTL	100	25	2002	2022
Tegeta Gas Engine	45	20	2009	2029
Ubungo I	100	20	2007	2027
Ubungo II	105	20	2012	2032
Tanwat	2.7	20	2010	2029
Zuzu Diesel	7.44	20**	1980	2019
Nyakato	63	20	2013	To be operated as backup after 2021
Kinyerezi-I	150	20	2015	2035
TPC	17	20	2011	2030

 Table 3-3: Existing Plant Retirement Dates (Interconnected System)

Source: TANESCO and Team compilation

\*Contractual period

\*\* To be rehabilitated

# 3.2 Future Generation Options

# 3.2.1 Hydroelectric power

# 3.2.1.1 Hydrology and Hydro System Capability

The availability of reliable generation sequences at each candidate hydroelectric project is of major importance. It is important that updated hydrologic data is used for each PSMP update, and that the simulations reflect the optimum use of hydroelectric resources, taking into account the use of reservoirs in a mixed hydro-thermal system. In this Power System Master Plan Update, the energy generation of all new candidate hydroelectric projects, and existing plants, was re-estimated using revised and updated flow records. The re-estimate of generation values was made in two steps, updated hydrology and new generation simulations.

# 3.2.1.2 Hydrological Data Update

In PSMP, a generation expansion plan for 25 years will be compiled. Accordingly, for the hydro power generation capability used in generation planning tool (WASP<sup>1</sup>), it is desirable to use energy generation values or generating performance based on hydrological data over at least 25 years.

Concerning energy generation values, in the "Power System Master Plan 2009 Update (August 2009, SNC-LAVALIN International)", energy calculations for existing hydro power plants are conducted using flow records from 1995 to 2005. However, in consideration of the following points, it was decided not to use these values in PSMP2016 Update:

- a) The flow records used in energy calculations are monthly data and do not have high accuracy.
- b) The calculation results only show average annual energy generation over 11 years, but not monthly energy generation.
- c) There are only calculation results for 11 years, which is not a sufficiently long period.

Accordingly, in this study, monthly energy generation capability was calculated by means of the following expression using monthly power generation performance. Table 3-4 shows monthly energy generation capability.

#### Calculation for large and medium-scale power plants

 $E_{GCi} = E_{GRi} x (1 - Ru)$ 

Where, E<sub>GCi</sub>: Energy generation capability in "*i*" month (GWh)

- E<sub>GR/</sub>: Mean energy generation performance in "*i*" month (GWh) as shown in Table 3-4
- Ru: Station use rate

= Average at existing hydro power plants =  $0.79 (\%)^{\approx}1 (\%)$ 

<sup>&</sup>lt;sup>1</sup> Wien Automatic System Planning Package, a least cost generation planning software developed by International Atomic Energy Agency

#### Calculation for Small Power Project (SPP) hydro power plants

 $E_{GCi} = E_{PRi}$ 

Where, E<sub>GCi</sub>: Energy generation capability in "*i*" month (GWh)

EPR/: Mean purchased energy in "i" month (GWh) as shown in Table 3-4

Hydro Power Plant	Energy Generation Capability (GWh)												
Trydro Power Plant	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Hale	4.22	3.81	3.76	4.03	5.38	5.55	4.80	4.62	4.00	3.73	4.32	4.21	52.43
Nyumba Ya Mungu	2.43	2.34	2.37	2.32	2.26	2.15	2.23	2.25	2.29	2.15	2.28	2.04	27.11
Kidatu	78.04	73.70	81.47	79.90	75.87	68.37	69.21	71.43	73.16	73.58	71.94	76.20	892.87
Mtera	27.63	26.62	28.52	22.51	25.56	25.15	27.30	32.41	34.04	34.85	32.44	28.17	345.20
Uwemba	0.29	0.23	0.30	0.30	0.30	0.21	0.20	0.18	0.14	0.14	0.11	0.20	2.60
New Pangani Falls	21.46	16.09	18.46	23.59	30.30	25.34	20.74	20.05	16.90	19.11	19.85	19.17	251.06
Kihansi	56.02	54.72	66.51	89.30	89.65	69.48	58.04	50.67	38.93	38.18	34.42	47.98	693.90
Mwenga SPP	1.20	1.22	2.02	2.11	2.38	1.81	1.38	1.40	0.98	0.90	0.65	1.05	17.10

Table 3-4: Monthly Energy Generation Capability in Existing Hydro Power Plantsfrom 1971 to 2010

Source: TANESCO

#### 3.2.1.3 Hydropower Resources

Tanzania has comparatively abundant hydro power potential since its inland area has a high elevation above sea level, and there are precipitous rivers. Various studies on hydro power have been carried out over a long period of time, and hydro power potential in Tanzania is estimated as 38,000MW and about 190,000GWh/year<sup>2</sup>.

For large and medium-scale hydro power projects, twenty three (23) projects with a total installed capacity of 4,765MW are identified as power development options in previous studies as shown in Table 3-5. Four (4) planned projects out of those, i.e. Rumakali, Rusumo, Ruhudji and Malagarasi Stage III, were committed projects in the PSMP2012 Update. However, only the Rusumo Project is at the stage of implementation, and in the process of bidding for contractors as of December 2016.

The outline of development plans for planned large and medium-scale hydro power projects is shown in Table 3-5, 3-5(1-5).

<sup>&</sup>lt;sup>2</sup> Kihansi Hydro Power Development Project - Study Final Report (October 1990, JICA)

			Planned P	roject	Installed Capacity (MW)	Current Status of Studies (as of December 2016)	Rank
1		Implemen tation	Rusumo		80.0	- F/S was completed in 2012 - ESIA Certificate was issued by NEMC in 2014 - Under bidding of contractor	A
2			Kakono		87.0	- F/S and ESIA study were completed in Sep-2014 - ESIA was approved by NEMC	В
3			Malagarasi Stage III		44.7	<ul> <li>F/S was completed in Sep-2011</li> <li>ESIA Certificate was issued by NEMC in 2014</li> </ul>	В
4			Rumakali		222.0	F/C and FCIA study ware completed in May 1009	С
5			Ruhudji		358.0	- F/S and ESIA study were completed in May-1998	С
6			Steiglers Gorge	Phase 1	1,048.0	- Pre-F/S was completed in 2012 - ESIA study commenced in Dec-2014	С
7			5 5	Phase 2	1,048.0		С
8	ale		C	Manolo (Lower)	177.9	- F/S was completed in Apr-2014	В
9	m-sc		Songwe	Sofre (Middle)	158.9	- ESIA study of Lower was completed in 2015 - NEMC is reviewing ESIA study report	В
10	l mediu		Mpanga		160.0	<ul> <li>Pre-F/S was completed in Jun-2010</li> <li>ESIA Certificate was issued by NEMC in 2012</li> </ul>	С
12	e anc	ning	Masigira		118.0	- F/S was completed	С
13	Larg	Plar	Lower Kihansi Expansio	n	120.0	- Preliminary study was completed in Mar-1997	A
14			Upper Kihansi		47.0	<ul> <li>Pre-F/S was completed in Oct-1990</li> <li>ESIA study was conducted</li> </ul>	С
15			Kikonge		300.0	- Reconnaissance study was completed in Feb-2014	С
16			lringo	Ibosa	36.0	Dro E/Curas completed in May 2012	C
17			Ininga	Nginayo	52.0	- Pre-F/S was completed in May-2015	С
18				Ruaha	60.3		С
19				Mnyera	137.4		C
20			h dan yang	Kwanini	143.9	- Pre-F/S was completed in Jun-2012	С
21			winyera	Pumbwe	122.9	- ESIA study was completed in 2014 - NEMC reviewed ESIA study report	С
22				Taveta	83.9		С
23				Kisingo	119.8		С
			Total		4,765.1		

#### Table 3-5: Planned Hydro Power Projects

Note: MOU (Memorandum of Understanding), ESIA (Environmental and Social Impact Assessment), NEMC (National Environment Management Council), RUBADA (Rufiji Basin Development Authority), CRIDF (Climate Resilient Infrastructure Development Facility) Source: TANESCO, RUBADA, Ministry of Water and PSMP2012 Update Criteria for Ranking:

Rank	Description
^	F/S completed, ESIA approved,
А	Financing closed, Bidding commenced
В	F/S completed, ESIA approved
С	Other than A and B

#### Table 3-5(1): Outline of Large and Medium-Scale Hydro Power Projects

					Planned	Project		
	Ι	tem	Rusumo	Kakono	Malagarasi Stage III	Rumakali	Masigira	Kikonge
	]	River Basin	Lake V	Victoria	Lake		Lake Nyasa	
		River Name	Ka	gera	Malagarasi	Rumakali	Ruł	nuhu
	Location	District	Ngara	Karagwe, Kyerwa, Missenvi	N/A	Makete	N/A	Mbinga
.ic		Region	Kagera	Kagera	Kigoma	Njombe	Iringa	Ruvuma
unt terisi	Power	Generation Type	Reservoir	Run-off-river	Pondage	Reservoir	Pondage	Reservoir
Pla arac	Installe	ed Capacity (MW)	80	87	44.7	222	118	300
Ch	Nu	mber of Units	3	2	3	3	2	3
	Plant	Discharge (m <sup>3</sup> /s)	357.00	315.00	171.00	19.05	57.00	N/A
	Gr	ross Head (m)	N/A	32.00	33.45	1,294.50	238.00	140.00
	Annual Ene	rgy Generation (GWh)	507.00	573.00	186.80	1,320.00	664.00	1,268.00
	Pla	int Factor (%)	64	75	48	68	64	48
	P	Туре	Concrete gravity	Concrete gravity	Concrete gravity	Concrete gravity	Rock fill	Concrete faced rock fill
	(Main)	Height (m)	15.3	51	18	72	35	120
		Crest Length (m)	177	435	670	780	700	N/A
	Dam	Туре	-	Rock fill	-	Rock fill	-	-
	(Auxiliary)	Height (m)	-	15	-	N/A	-	-
		Crest Length (m)	-	1,160	-	90	-	-
		Full Water Level (masl)	1,325.00	1,190.00	841.50	2,055.00	938.00	660.00
	Reservoir	Low Water Level (masl)	1,322.00	1,190.00	838.50	2,025.00	937.00	620.00
		Active Storage $(10^6 \text{ m}^3)$	473.1	-	0.457	256	1.5	6,200
		Туре	Tunnel	-	Culvert	Tunnel	Tunnel	Tunnel
	Headrace	Length (m)	610	-	1,098 x 2	4,300	1,700	2,500
0		Diameter (m)	Width: 11.0 Height: 14.3	-	Width: 5.05 x 2 Height: 5.05 x 2	5.00	7.00	10.00
ility teristic		Туре	Tunnel	Embedded in dam body	Buried	Tunnel	Tunnel	Surface
Fac	Penstock	Length (m)	N/A	N/A	41.5 x 3	3,100	270	256 x 3
ç		Diameter (m)	5.40	N/A	4.00 x 3	2.40, 2.20	3.40	4.00 x 3
		Туре	Surface	Surface	Surface	Underground	Underground	Surface
	Powerhouse	Width (m)	35	30	19	14	N/A	20
		Length (m)	89	57	50	70	N/A	60
		Height (m)	53	17	38	23	N/A	N/A
		Туре	Open channel	-	Open channel	Tunnel	Tunnel	Open channel
	Tailrace	Length (km)	268	-	135	3,000	500	11
		Diameter (m)	Width: 45.0	- Vorti 1	Width: 40.0	6.90	7.00	N/A
	Turbine	Туре	Kaplan	Kaplan	Francis	Pelton	Francis	Francis
	1 ur Onic	Rated Output(MW/unit)	N/A	44.5	15.75	74	59	100
		Туре	N/A	Synchronous 3 Phase	Synchronous 3 Phase	N/A	N/A	N/A
	Generator	Rated Output(MVA/unit)	N/A	52	17.5	82	N/A	110
		Rated Voltage (kV)	12	10 - 12	6 - 10	13.8	N/A	N/A
	Data	Source	(1)	(2)	(3)	(4)	(5), (6)	(7)

Source: (1) Regional Rusumo Falls Hydroelectric and Multipurpose Project - Power Generation Plant Final Feasibility Study Phase:

Final Feasibility Design Interim Report Volume 1 (July 2011, SNC-LAVALIN International)

(2) Feasibility Study of Kakono Hydropower Project and Transmission Line - Draft Final Feasibility Report (September 2014, Norplan)
 (3) Malagarasi Stage III Project - Power Plant Feasibility Study Final Report (September 2011, ESB International Ltd.)

(4) Tanzania Power VI Project Feasibility Studies for Rumakali Hydropower Project - Final Report (May 1998, SwedPower and Norconsult)

(4) Tanzania Power VI Project Feasibility Studies for Rumakali Hydropower Project - Final Report (May 1998, SwedPower and Norconsult)
(5) Tanzania Power VI Project Feasibility Studies for Hydropower Project - Interim Report No.2 Final Volume 1(March 1997, SwedPower and Norconsult)
(6) Power System Master Plan 2009 Update (August 2009, SNC-LAVALIN International)
(7) Ruhuhu Valley Multi-Purpose Scheme - Dams and Hydropower Report February 2014, Climate Resilient Infrastructure Development Facility)
(8) Detailed Design and Investment Preparation Project for the Songwe River Basin Development Programme - Update of the 2003 Feasibility Studies for Ruhudji Hydropower Project - Final Report (May 1998, SwedPower and Norconsult)
(9) Tanzania Power VI Project Feasibility Studies for Ruhudji Hydropower Project - Final Report (May 1998, SwedPower and Norconsult)
(10) Kihansi Hydro Power Development Project Study Final Report (October 1990, JICA)
(11) Mnyera River - Implantation of Hydroelectric Developments - Technical Preliminary Feasibility Studies (June 2012, Queiroz Galvao)
(12) Mnane Hydropower Project Project Froject Project Foruce June 2 (June 2 (June

(12) Mpanga Hydropower Project - Project Proposal (June 2010, Sinohydro Corporation Ltd)

(13) Preliminary Feasibility Study on Iringa Hydropower Projects - Final Report (May 2013, K-water)
 (14) Steiglers Gorge Hydropower Project Report and Proposal of Development (2012, Odebrecht)

#### Table 3-5(2): Outline of Large and Medium-Scale Hydro Power Projects

					Planned	l Project		
	Ι	tem	Songwe (Up	Bipugu per)	Songw (Mid	e Sofre ldle)	Songwe (Lo	Manolo wer)
	]	River Basin			Lake	Nyasa		
		River Name			Son	gwe		
	Location	District	Ile	eje	Ile	eje	Пе	eje
lic		Region	Mb	eya	Mb	eya	Mb	eya
nt erist	Power	Generation Type	Reservoir	Run-off-river	Reservoir	Run-off-river	Reservoir	Run-off-river
Pla aract	Installe	ed Capacity (MW)	28.2	1.2	155.7	3.2	172.8	5.1
Ch	Nu	mber of Units	3	2	3	2	3	3
	Plant	Discharge (m <sup>3</sup> /s)	50.10	2.60	60.00	4.00	70.00	6.00
	Gr	oss Head (m)	75.00	62.00	315.00	106.00	293.50	108.00
	Annual Ene	rgy Generation (GWh)	100.00	5.00	572.00	15.00	671.00	15.00
	Pla	unt Factor (%)	40	48	42	54	44	34
		Type	Concret	e gravity	Concret	e gravity	Concret	e gravity
	Dam (Main)	Height (m)	7	5	1	15	1	15
	(Main)	Crest Length (m)	2:	31	4	57	4	60
		Type		-			Eart	h fill
	Dam	Height (m)		-		-	2	23
	(Auxiliary)	Crest Length (m)					2	23
		Full Water Level (masl)	1.24	0.00	1 140 00		82(	) 00
	Reservoir	Low Water Level (masl)	1,24	0.00	1,14	0.00	79(	) 00
	Reservoir	Low water Level (mast) A stime Sterror $(10^6 \text{ m}^3)$	1,22	6.0	1,10	8.6	23	77
		Active Storage (10 m)	10	0.0	Tunnal	0.0	Tunnal	1.1
		Type	-	-	2 700	-	1 uniter	-
	Headrace	Length (m)	-	-	3,780	-	90	-
tic		Diameter (m)	-	-	4.50	-	N/A	-
cility acteris		Туре	Tunnel	Embedded in dam body	Tunnel	Embedded in dam body	Tunnel	Embedded in dam body
Fa	Penstock	Length (m)	210	N/A	330	N/A	270	N/A
0		Diameter (m)	4.50	1.10	3.50 - 4.20	1.30	3.70	1.60
		Туре	Underground	Embedded in dam	Underground	Embedded in dam	Underground	Embedded in dam
	Powerhouse	Width (m)	18	N/A	20	N/A	20	N/A
		Length (m)	71	N/A	67	N/A	67	N/A
		Height (m)	32	N/A	35	N/A	35	N/A
		Туре	Tunnel	N/A	Tunnel	N/A	Tunnel	N/A
	Tailrace	Length (km)	70	N/A	1,220	N/A	5,217	N/A
		Diameter (m)	5.00	N/A	5.60	N/A	6.00	N/A
	Turbina	Туре	Vertical Francis	Horizontal Francis	Vertical Francis	Horizontal Francis	Vertical Francis	Horizontal Francis
	Turbine	Rated Output(MW/unit)	9.5	0.6	52.8	1.6	58.5	1.7
		Type	Synchronous	Synchronous	Synchronous	Synchronous	Synchronous	Synchronous
	Generator	туре	3 Phase	3 Phase	3 Phase	3 Phase	3 Phase	3 Phase
	Generator	Rated Output(MVA/unit)	12	0.75	65	2	72	2.1
<u> </u>		Rated Voltage (kV)	10.5	0.4	10.5	3.3	10.5	3.3
1	Data	Source	(3	5)	(8	5)	(	8)

Source: (1) Regional Rusumo Falls Hydroelectric and Multipurpose Project - Power Generation Plant Final Feasibility Study Phases

Final Feasibility Design Interim Report Volume 1 (July 2011, SNC-LAVALIN International)
(2) Feasibility Study of Kakono Hydropower Project and Transmission Line - Draft Final Feasibility Report (September 2014, Norplan)
(3) Malagarasi Stage III Project - Power Plant Feasibility Study Final Report (September 2011, ESB International Ltd.)

(4) Tanzania Power VI Project Feasibility Studies for Rumakali Hydropower Project - Final Report (May 1998, SwedPower and Norconsult)
(5) Tanzania Power VI Project Feasibility Studies for Hydropower Project - Interim Report No.2 Final Volume 1(March 1997, SwedPower and Norconsult)
(6) Power System Master Plan 2009 Update (August 2009, SNC-LAVALIN International)

(6) Fower System Master Plan 2009 Optate (August 2009, SNC-LAVALIN International)
(7) Ruhuhu Valley Multi-Purpose Scheme - Dams and Hydropower Report 'February 2014, Climate Resilient Infrastructure Development Facility)
(8) Detailed Design and Investment Preparation Project for the Songwe River Basin Development Programme - Update of the 2003 Feasibility Study : Main Report Volume 1 (April 2014, Lahmeyer International GmbH and ACE Consulting Engineers)
(9) Tanzania Power VI Project Feasibility Studies for Ruhudji Hydropower Project - Final Report (May 1998, SwedPower and Norconsult)
(10) Kihansi Hydro Power Development Project Study Final Report (October 1990, JICA)

(11) Mnyera River - Implantation of Hydroelectric Developments - Technical Preliminary Feasibility Studies (June 2012, Queiroz Galvao)

(12) Mpanga Hydropower Project - Project Proposal (June 2010, Sinohydro Corporation Ltd)
 (13) Preliminary Feasibility Study on Iringa Hydropower Projects - Final Report (May 2013, K-water)

(14) Steiglers Gorge Hydropower Project Report and Proposal of Development (2012, Odebrecht)

			Planned Project								
	Ι	tem	Ruhudji	Lower Kihansi Expansion	Upper Kihansi	Mnyera - Ruaha	Mnyera - Mnyera	Mnyera - Kwanini			
	]	River Basin	Rufiji								
	River Name		Rhhudji Kihansi Mnyera								
	Location	District	N/A	N/A	N/A	N/A	N/A	N/A			
tic		Region	Iringa	Morogoro	Morogoro	Morogoro	Morogoro	Morogoro			
ant teris	Power	Generation Type	Reservoir	Reservoir	Reservoir	Reservoir	Run-off-river	Run-off-river			
Pla	Installe	ed Capacity (MW)	358	120	47	60.3	137.4	143.9			
Ċ	Nu	mber of Units	4	2	1	2	2	2			
	Plant	Discharge (m <sup>3</sup> /s)	54.40	16.60	25.70	67.00	103.20	105.00			
	Gt	ross Head (m)	765.00	853.50	221.50	110.00	155.00	160.00			
	Annual Ene	rgy Generation (GWh)	2,000.00	69.00	335.70	290.83	662.26	693.79			
	Pla	ant Factor (%)	64	7	82	55	55	55			
		Туре	Rock fill	Concrete	Rock fill	Concrete	Concrete	Concrete			
	Dam (Main)	Height (m)	70	24	95	N/A	N/A	N/A			
	(iviaiii)	Crest Length (m)	810	165	583	N/A	N/A	N/A			
	Dam (Auxiliary)	Type	Concrete			_	_	_			
		Height (m)	gravity 32								
		Crest Length (m)	200	-	-	-	-	-			
		Evil Water Lavel (most)	1 478 00	1 146 00	1 260 00	1.070.00	060.00	805.00			
	Pasarvoir	Full water Level (mast)	1,478.00	1,140.00	1,300.00	1,070.00	900.00	805.00			
	Reservoir	Low water Level (mast)	1,440.00	1,141.00	1,550.00	1,000.00	900.00	803.00			
		Active Storage (10° m°)	209.5	1.0	/5.1	287.84	-	-			
		Type			Tunnel		1 unnei	1 unnei			
	Headrace	Length (m)	7,300	3,384	653	3,140	5,080	2,770			
tic		Diameter (m)	6.70	6.20	3.30	6.80	8.20	N/A			
cility cteris	Penstock	Туре	Tunnel	Tunnel	Surface	Tunnel	Tunnel	Tunnel			
Fa		Length (m)	1,070	125	510	N/A	N/A	N/A			
0		Diameter (m)	3.20	1.80	1.85 - 3.30	4.80	7.40	N/A			
		Туре	Underground	Underground	Surface	Surface	Surface	Surface			
	Powerhouse	Width (m)	14	N/A	20	N/A	N/A	N/A			
		Length (m)	73	N/A	23	N/A	N/A	N/A			
		Height (m)	30	N/A 35 N/A		N/A	N/A	N/A			
		Туре	Tunnel	Tunnel	Tunnel	Open channel	Open channel	Open channel			
	Tailrace	Length (km)	3,100	1,500	641	N/A	N/A	N/A			
		Diameter (m)	7.70	6.60	4.00	N/A	N/A	N/A			
	Turbine	Туре	Pelton	Pelton	Francis	Vertical Francis	Vertical Francis	Vertical Francis			
		Rated Output(MW/unit)	91	N/A	48	31.09	70.83	74.18			
		Туре	N/A	N/A	Synchronous 3 Phase	Synchronous	Synchronous	Synchronous			
	Generator	Rated Output(MVA/unit)	N/A	N/A	53	33.50	76.34	79.95			
		Rated Voltage (kV)	13.8	N/A	11	N/A	N/A	N/A			
Data Source			(9)	(5), (6)	(10)	(11)	(11)	(11)			

Source: (1) Regional Rusumo Falls Hydroelectric and Multipurpose Project - Power Generation Plant Final Feasibility Study Phase:

Final Feasibility Design Interim Report Volume 1 (July 2011, SNC-LAVALIN International)
(2) Feasibility Study of Kakono Hydropower Project and Transmission Line - Draft Final Feasibility Report (September 2014, Norplan)
(3) Malagarasi Stage III Project - Power Plant Feasibility Study Final Report (September 2011, ESB International Ltd.)

(4) Tanzania Power VI Project Feasibility Studies for Rumakali Hydropower Project - Final Report (May 1998, SwedPower and Norconsult)

(5) Tanzania Power VI Project Feasibility Studies for Hydropower Project - Interim Report No.2 Final Volume 1(March 1997, SwedPower and Norconsult) (6) Power System Master Plan 2009 Update (August 2009, SNC-LAVALIN International)

(6) Fower System Master Pian 2009 Optate (August 2009, SNC-LA VALIN International)
(7) Ruhuhu Valley Multi-Purpose Scheme - Dams and Hydropower Report 'February 2014, Climate Resilient Infrastructure Development Facility)
(8) Detailed Design and Investment Preparation Project for the Songwe River Basin Development Programme - Update of the 2003 Feasibility Study : Main Report Volume 1 (April 2014, Lahmeyer International GmbH and ACE Consulting Engineers)
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(10) Kihansi Hydro Power Development Project Study Final Report (October 1990, JICA)

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(12) Mpanga Hydropower Project - Project Proposal (June 2010, Sinohydro Corporation Ltd)
 (13) Preliminary Feasibility Study on Iringa Hydropower Projects - Final Report (May 2013, K-water)

(14) Steiglers Gorge Hydropower Project Report and Proposal of Development (2012, Odebrecht)

		Planned Project								
	Ι	tem	Mnyera - Pumbwe	Mnyera - Taveta	Mnyera - Kisingo	Mpanga	Iringa - Ibosa	Iringa - Nginayo		
	]	River Basin	Rufiji							
		River Name		Mnyera	Little Ruaha					
	Location	District	N/A	N/A	N/A	N/A	Iringa	Iringa		
tic		Region	Morogoro	Morogoro	Morogoro	Morogoro	Iringa	Iringa		
nt eristi	Power	Generation Type	Run-off-river	Run-off-river	Run-off-river	Reservoir	Run-off-river	Run-off-river		
Pla	Installe	ed Capacity (MW)	122.9	83.9	119.8	160	36	52		
Ċ	Nu	mber of Units	2	2	2	2	2	2		
	Plant	Discharge (m <sup>3</sup> /s)	111.00	133.40	134.00	51.56	27.85	30.47		
	Gr	oss Head (m)	130.00	75.00	105.00	370.00	150.60	195.90		
	Annual Ene	rgy Generation (GWh)	592.18	403.84	577.28	796.00	186.09	262.75		
	Pla	unt Factor (%)	55	55	55	57	59	58		
		Type	Concrete	Concrete	Concrete	Concrete faced	Concrete	Concrete		
	Dam	Height (m)	gravity	gravity	gravity	rock fill	gravity	gravity		
	(Main)	Creat Langth (m)	N/A	N/A	N/A	250	50	50		
		Clest Length (III)	N/A	IN/A	IN/A	230	30	30		
	Dam (Auxiliary)	Туре	-	-	-	-	-	-		
		Height (m)	-	-	-	-	-	-		
		Crest Length (m)	-	-	-	-	-	-		
	Reservoir	Full Water Level (masl)	645.00	490.00	415.00	730.00	1,212.00	977.00		
		Low Water Level (masl)	645.00	490.00	415.00	710.00	1,212.00	977.00		
		Active Storage (10 <sup>6</sup> m <sup>3</sup> )	-	-	-	46.4	-	-		
	Headrace	Туре	Tunnel	Tunnel	Tunnel	Tunnel	Tunnel	Tunnel		
		Length (m)	4,340	2,010	3,750	N/A	1,515	1,518		
tic		Diameter (m)	8.40	N/A	N/A	5.00	4.00	4.00		
cility acteris	Penstock	Туре	Tunnel	Tunnel	Tunnel	Tunnel	Tunnel	Tunnel		
Fa		Length (m)	N/A	N/A	N/A	N/A	1,054	1,105		
0		Diameter (m)	5.20	N/A	N/A	5.00	4.00	4.00		
		Туре	Surface	Surface	Surface	Underground	Surface	Surface		
	Powerhouse	Width (m)	N/A	N/A	N/A	19	N/A	N/A		
		Length (m)	N/A	N/A	N/A	73	N/A	N/A		
		Height (m)	N/A	N/A	N/A	50	N/A	N/A		
	<b>T</b> 11	Туре	Open channel	Open channel	Open channel	Tunnel	N/A	N/A		
	Tailrace	Length (km)	N/A	N/A	N/A	N/A	N/A	N/A		
		Diameter (m)	IN/A	IN/A	IN/A	IN/A	IN/A	IN/A		
	Turbine	Туре	Vertical Francis	Vertical Francis	Vertical Francis	Francis	Francis	Francis		
		Rated Output(MW/unit)	63.36	43.25	61.76	81.6	N/A	N/A		
		Туре	Synchronous	Synchronous	Synchronous	N/A	3 Phase	3 Phase		
	Generator	Rated Output(MVA/unit)	68.28	46.62	66.56	N/A	21.16	30.60		
		Rated Voltage (kV)	N/A	N/A	N/A	N/A	12	12		
Data Source		(11)	(11)	(11)	(12)	(13)	(13)			

Source: (1) Regional Rusumo Falls Hydroelectric and Multipurpose Project - Power Generation Plant Final Feasibility Study Phase:

Final Feasibility Design Interim Report Volume 1 (July 2011, SNC-LAVALIN International)
(2) Feasibility Study of Kakono Hydropower Project and Transmission Line - Draft Final Feasibility Report (September 2014, Norplan)
(3) Malagarasi Stage III Project - Power Plant Feasibility Study Final Report (September 2011, ESB International Ltd.)

(4) Tanzania Power VI Project Feasibility Studies for Rumakali Hydropower Project - Final Report (May 1998, SwedPower and Norconsult)

(4) Tanzania Power VI Project Feasibility Studies for Rumakali Hydropower Project - Intai Report (May 1998, SwedPower and Norconsult)
(5) Tanzania Power VI Project Feasibility Studies for Hydropower Project - Interim Report No.2 Final Volume 1 (March 1997, SwedPower and Norconsult)
(6) Power System Master Plan 2009 Update (August 2009, SNC-LAVALIN International)
(7) Ruhuhu Valley Multi-Purpose Scheme - Dams and Hydropower Report February 2014, Climate Resilient Infrastructure Development Facility)
(8) Detailed Design and Investment Preparation Project for the Songwe River Basin Development Programme - Update of the 2003 Feasibility Study : Main Report Volume 1 (April 2014, Lahmeyer International GmbH and ACE Consulting Engineers)
(9) Tanzania Power VI Project Feasibility Studies for Ruhudji Hydropower Project - Final Report (May 1998, SwedPower and Norconsult)
(10) Kihansi Hydro Power Development Project Study Final Report (October 1990, JICA)

(11) Mnyera River - Implantation of Hydroelectric Developments - Technical Preliminary Feasibility Studies (June 2012, Queiroz Galvao)

(12) Mpanga Hydropower Project - Project Proposal (June 2010, Sinohydro Corporation Ltd)
 (13) Preliminary Feasibility Study on Iringa Hydropower Projects - Final Report (May 2013, K-water)

(14) Steiglers Gorge Hydropower Project Report and Proposal of Development (2012, Odebrecht)

#### Table 3-5(5): Outline of Large and Medium-Scale Hydro Power Projects

			Planned Project			
	Ι	tem	Steiglers	Steiglers		
			Gorge Phase 1	Gorge Phase 2		
	]	River Basin	Rufiji			
		River Name	Ru	Rufiji		
		District	N	/A		
0	Location	Region	Pw	ani		
ut sristi	Power	Generation Type	Rese	rvoir		
Plar racte	Installe	ed Canacity (MW)	1 048	1 048		
Cha	Nu	mber of Units	4	N/A		
	Plant	Discharge (m <sup>3</sup> /s)	N/A	N/A		
	Gr	ross Head (m)	118 50	N/A		
	Annual Ene	ray Generation (GWh)	4 558 67	N/A		
	Dle	ant Factor (%)	4,358.07	N/A		
	110		50	1V/A		
	Dam	Туре	Concrete fa	ced rock fill		
	(Main)	Height (m)	12	26		
		Crest Length (m)	7(	00		
	Dem	Туре	Rock fill & Earth fill			
	(Auxiliary)	Height (m)	25 & 10			
		Crest Length (m)	2,200 & 16,700			
		Full Water Level (masl)	186	5.50		
	Reservoir	Low Water Level (masl)	163	.00		
		Active Storage (10 <sup>6</sup> m <sup>3</sup> )	20,820			
		Туре	Tunnel	Tunnel		
	Headrace	Length (m)	N/A	N/A		
		Diameter (m)	9.00 x 4	N/A		
y istic		Туре	Tunnel	Tunnel		
acilit acter	Penstock	Length (m)	150.00 x 4	N/A		
Fa Char		Diameter (m)	9.00 x 4	N/A		
-		Туре	Underground	Underground		
	Powerhouse	Width (m)	22	N/A		
	romerniouse	Length (m)	151	N/A		
		Height (m)	51	N/A		
		Туре	Tunnel	Tunnel		
	Tailrace	Length (km)	692, 784	N/A		
		Diameter (m)	14.00 x 2	N/A		
	Turbine	Туре	Vertical Francis N/A			
		Rated Output(MW/unit)	267.40	N/A		
		Туре	Synchronous	N/A		
	Generator	Rated Output(MVA/unit)	291.20	N/A		
		Rated Voltage (kV)	13.8	N/A		
	Data	Source	(14)			

 Source:
 (1) Regional Rusumo Falls Hydroelectric and Multipurpose Project - Power Generation Plant Final Feasibility Study Phase: Final Feasibility Design Interim Report Volume 1 (July 2011, SNC-LAVALIN International)

 (2) Feasibility Study of Kakono Hydropower Project and Transmission Line - Draft Final Feasibility Report (September 2014, Norplan)

(3) Malagarasi Stage III Project - Power Plant Feasibility Study Final Report (September 2011, ESB International Ltd.)
 (4) Tanzania Power VI Project Feasibility Studies for Rumakali Hydropower Project - Final Report (May 1998, SwedPower and Norconsult)

(5) Tanzania Power VI Project Feasibility Studies for Hydropower Project - Interim Report No.2 Final Volume 1(March 1997, SwedPower and Norconsult)

(5) Tanzania Power VI Project Feasibility Studies for Hydropower Project - Interim Report No.2 Final Volume 1(March 1997, SwedPower and Nore (6) Power System Master Plan 2009 Update (August 2009, SNC-LAVALIN International)
(7) Ruhuhu Valley Multi-Purpose Scheme - Dams and Hydropower Report (February 2014, Climate Resilient Infrastructure Development Facility)
(8) Detailed Design and Investment Preparation Project for the Songwe River Basin Development Programme - Update of the 2003 Feasibility Study: Main Report Volume 1 (April 2014, Lahneyer International GmbH and ACE Consulting Engineers)
(9) Tanzania Power VI Project Feasibility Studies for Ruhudji Hydropower Project - Final Report (May 1998, SwedPower and Norconsult)
(10) Kihansi Hydro Power Development Project Study Final Report (October 1990, JICA)
(11) Mnyera River - Implantation of Hydroelectric Developments - Technical Preliminary Feasibility Studies (June 2012, Queiroz Galvao)
(12) Mpanga Hydropower Project - Project Proposal (June 2010, Sinohydro Corporation Ltd)
(13) Preliminary Feasibility Study on Iringa Hydropower Projects - Final Report (May 2013, K-water)
(14) Steiglers Gorge Hydropower Project Report and Proposal of Development (2012, Odebrecht)

# 3.2.2 Thermal power resources

## 3.2.2.1 Committed and planned thermal projects

Table 3-6 shows the thermal power generation development candidates under planning and /or ongoing.

Туре	Plant	Capacity MW	Remarks	Rank
Gas	Kinyerezi I Extension	185	Simple cycle gas turbine	Α
	Kinyerezi II	240	Combined cycle gas turbine	A
	Kinyerezi III	600	Simple and combined cycle gas turbine	С
	Kinyerezi IV	330	Combined cycle gas turbine	С
	Somanga Fungu (IPP)	320	Combined cycle gas turbine	В
	Somanga (TANESCO)	240	Combined cycle gas turbine	D
	Somanga (PPP)	300	Combined cycle gas turbine	С
	Bagamoyo (IPP)	200	Combined cycle gas turbine	D
	Mtwara (Gas engine, TANESCO)	18	Grid connection of existing gas engine	А
	Mtwara (TANESCO)	300	Combined cycle gas turbine	D
Coal	Mchuchuma I-IV	600	150MW x 4units, Subcritical	С
i i	Kiwira-I	200	Subcritical	С
	Kiwira-II	200	Subcritical	С
	Ngaka-I	200	Subcritical	D
	Ngaka-II	200	Subcritical	D

 Table 3-6: Power development candidates (Thermal power)

Source: TANESCO

Note: Criteria for Ranking

Rank	Description of Ranking			
А	Financing Closed or Construction started			
В	PPA (BOT/EPC) contract signed			
С	F/S, pre-F/S completed			
D	F/S, pre-F/S not completed			

# 3.2.2.2 Variable thermal options

Model plants for variable thermal options were set concerning promising availability of primary energies such as natural gas and coal, construction cost and O&M cost components to be input for the power development planning software (WASP: Wien Automatic System Planning Package) were examined.

Concerning the WASP input specifications, reference was made to PSMP 2012, the EAC Regional Power System Master Plan and Grid Code Study (EAC Regional PSMP) implemented by SNC-Lavalin in 2011, and the EIA's Annual Energy Outlook 2014 (EIA-AEO2014).

# 3.2.2.2.1 Coal-fired thermal power stations

#### a) Subcritical pressure coal-fired thermal power stations

In southern Tanzania, it is planned to construct Kiwira I&II power station, Mchuchuma I~IV power station, and Ngaka I&II power station. Since facility capacity is currently planned to be

50~100 MW and the plant heat rate at project locations is 9,243~9,730 [kJ/kWh] in PSMP 2012, it is thought that subcritical pressure (Sub-C) power generation is being considered. Moreover, because Tanzania has no past record of introducing coal-fired thermal power stations, examination was first carried out on the main specifications for subcritical pressure coal-fired thermal power stations.

#### b) Super Critical pressure coal-fired thermal power stations

In Super Critical (SC) pressure facilities, it is known that the main steam pressure exceeds the critical pressure of water (22.064MPa) and that the main steam temperature exceeds the critical temperature of water (374°C) but is no higher than 566°C (1,000°F). In other countries such as Japan, USA, Germany, Russia, Republic of Korea and China this technology has contributed to higher generating efficiency since 1980s.

#### c) Ultra-supercritical pressure coal-fired thermal power stations

In ultra-supercritical (USC) pressure facilities, it is known that the main steam pressure exceeds the critical pressure of water (22.064MPa) and that the main steam temperature exceeds 593°C (1,100°F), which is higher than the critical temperature of water (374°C). In other countries such as Japan, Germany, Russia, Republic of Korea and China this technology was first introduced in the late 1990s and developments are now moving more in the direction of high temperature rather than high pressure. The top performance facilities now have main steam pressure of around 25MPa and main steam temperature of 610~620°C. In Tanzania, ultra-supercritical pressure facilities have not yet been introduced, however, because such facilities have better thermal efficiency than supercritical facilities and can make a contribution to reducing coal consumption and mitigating environmental loads, it is recommended that ample consideration also be given to the introduction of ultra-supercritical pressure facilities.

#### d) Advanced subcritical pressure coal-fired thermal power stations

In advanced subcritical (Advanced Sub-C) pressure facilities, generating efficiency on a par with that of ultra-supercritical pressure facilities can be obtained in small- to medium-capacity plants of 150-350 MW through increasing the steam temperature to 600°C. Usually, drum boilers are used in sub-critical facilities, however, higher temperatures have been made possible through adopting once-through boilers that are used in super critical (ultra super critical) facilities.

Since it is difficult to effectively raise efficiency by applying supercritical pressure to small- to medium-capacity plants, this type of facility is effective for developing nations, where transmission systems are too fragile to introduce supercritical pressure (500 MW or more in single units).

#### e) Differences between subcritical pressure boiler and Supercritical pressure boiler

A super critical pressure boiler is a boiler that operates at pressure higher than the critical

pressure of the liquid (in this case water). In the case of water, a special state known as the critical point is adopted at critical pressure of 22.064MPa (218.3 atmospheric pressure) and critical temperature of 374.2°C.

When liquid water is heated at pressure below the critical pressure (i.e. sub-critical pressure), part of the water becomes steam (gas) containing air bubbles, and liquid and gas coexist. Meanwhile, at pressure higher than critical pressure (i.e. super critical pressure), there is no such co-existence of liquid and gas, but rather when heat is applied to the water (liquid), it instantaneously changes to steam (gas) at the critical temperature of 374.2°C. In other words, there is no "air bubble state inside water: coexistent field."

In terms of boiler structure, whereas a sub-critical pressure boiler requires a drum for separating steam, a super critical pressure boiler is a once-through boiler.

Figure 3-1: Differences between subcritical pressure boiler (Drum boiler) and Supercritical pressure boiler (once-through boiler)



#### 3.2.2.2.2 Gas-fired thermal power stations

#### a) Aero-derivative gas turbine thermal power stations

Aero-derivative gas turbines are characterized by small size, light weight and compactness, they quickly reach full load operation after activation, and they can respond to rapid starting and stopping. Also, they can be used for simple cycle operations, and it is easy to expand to combined cycle from simple cycle operation, and retrofit units. In Tanzania, there are SGT-800 gas turbines made by Siemens at Ubungo II gas-fired thermal power station and LM6000PF gas turbines made by GE at Kinyerezi I gas-fired thermal power station. Out of these, at Kinyerezi I gas-fired thermal power station, plans are being considered for combined operation in the future, however, it is first intended to introduce simple cycle gas turbines, but later to add waste heat recovery steam generator boilers and steam turbines and conduct

combined operation according to the power demand and supply situation in Tanzania.

# b) Heavy Duty gas turbine thermal power stations

Vigorous efforts are being made to improve the efficiency of power generating facilities and develop energy saving technologies and so on with a view to realizing more effective use of energy resources. In combined cycle facilities, since major improvements can be anticipated in overall plant efficiency thanks to higher temperature and performance of primary gas turbines, progress is being made in improving reliability and increasing the capacity and temperature of gas turbines. The latest heavy duty gas turbine (1,600°C J-class) possesses the highest thermal efficiency (61% or more) and power capacity (approximately 460 MW) in the world.

# 3.2.2.2.3 Selection of model units for variable candidates

Since the PSMP 2012 Update only indicates the maximum load and thermal efficiency (plant heat rate) at times of maximum load, it was decided to set the minimum load, and heat rate and operable scope at times of minimum load based on the specifications of gas turbines introduced to existing power sources. As specifications for candidate power sources for new development, out of aero-derivative gas turbines and heavy duty gas turbines, gas turbines (simple cycle and combined cycle) of varying capacity (small to large) were configured as the model units.

Similarly, concerning coal-fired model units, because the PSMP 2012 only indicates the maximum load and thermal efficiency (plant heat rate) at times of maximum load, typical power stations were configured as the model units. The coal-fired thermal power stations that are currently being implemented and formulated are based on the specifications of subcritical pressure coal-fired thermal power stations, however, the specifications of candidate power sources for new development are based on subcritical pressure coal-fired thermal power stations and ultra-supercritical coal-fired thermal power stations.

Concerning existing gas engine power stations, the minimum load, and heat rate and operable scope at times of minimum load were set based on gas engines introduced to existing power plants.

Concerning existing diesel power stations, because the equipment introduced to existing facilities is unknown, typical power stations were configured as the model units.

Moreover, when calculating the gas turbine heat rate, Thermoflow Co.'s GT Pro Master software was used based on the specifications of Gas Turbine World.

Table 3-7shows a list of model units for variable expansion candidates.

ID	Туре	Unit Name	Unit Capacity [MW]	Minimum Load Capacity [%]	Minimum Load Heat Rate [kJ/kWh]	Maximum Load Heat Rate [kJ/kWh]	Possible Operation Range [%]	Remarks
1-1	Simple Cycle GT	GE: LM6000PF	43.4	30	16765	9813	0-100	
1-2	Simple Cycle GT	GE: 6FA	71.4	30	19876	11551	0-100	
1-3	Simple Cycle GT	GE: 9E	118.2	30	17586	11908	0-100	
1-4	Simple Cycle GT	MHI: M701G	309.1	30	16623	10338	0-100	
2-1	Combined Cycle GT	GE: LM6000PF (1on1)	56.5	60	7948	7537	60-100	GT:43.2MW, ST:13.3MW
2-2	Combined Cycle GT	GE: 106FA (1on1)	111.2	60	7967	7421	60-100	GT:71.1MW, ST:40.2MW
2-3	Combined Cycle GT	GE: 109E (1on1)	183.6	60	8360	7670	60-100	GT:117.8MW, ST:65.8MW
2-4	Combined Cycle GT	MHI: M701G (1on1)	471.2	60	7199	6766	60-100	GT:307.3MW, ST:163.9MW
3-1	Coal	Typical Sub-C PS	156	35	10089	8853	30-100	
3-2	Coal	Typical USC PS	700	30	10013	8540	30-100	
3-3	Coal	Advanced Sub-C PS	300	35	10079	8581	30-100	
4-1	Gas Engine	Wartsila: W20V34SG	8.74	50	9441	8390	0-100	
5-1	Diesel Engine	Typical Diesel Plant	4.5	25	11103	8669	50-100	
5-2	Diesel Engine	Typical Diesel Plant	10	25	10201	8346	50-100	

Table 3-7: Model Unit for variable expansion candidates

Source: Suppliers and Gas Turbine World 2012 GTW Handbook (2012)

#### 3.2.3 Renewable energy and import

The table below shows the candidate of renewable energy and import projects which will be included in generation expansion plans.

Project	Earliest Com. Year	Capacity	Cost	Rank
Mbeya Geothermal	2025	100MW (2025) 200MW (2026)	(\$4,362/kW)*1	D
Singida Wind	2018	50MW	\$136M* <sup>2</sup> (\$2,720/kW)	С
	2019	75 (in 2019)- 200MW	(\$1,571/kW)* <sup>3</sup>	С
	2020	100MW	(\$1,571/kW)* <sup>3</sup>	С
Njombe Wind	2019	100MW	(\$1,571/kW)* <sup>3</sup>	D
Shinyanga/Simiyu Solar	2020	150MW	(\$1,200/kW)*3	D
Dodoma Solar	2019	50MW	(\$1,200/kW)* <sup>3</sup>	D
Import (Ethiopia)	2018 2020	200MW Max 400MW		A

# Table 3-8: Possible candidates for power generation expansion (Renewable energy and import)

Source: MEM, TANESCO and TGDC

\*1: US-EIA "Updated Capital Cost Estimates for Electricity Generation Plants" (Apr.2013)

\*2: Proposal from a developer

\*3: International Energy Agency/ Nuclear Energy Agency "Projected cost of generating electricity" (2015 Edition) Note: Criteria for Ranking

Rank	Description of Ranking
А	Financing Closed or Construction started
В	PPA (BOT/EPC) contract signed
С	F/S, pre-F/S completed
D	F/S, pre-F/S not completed

#### 3.2.4 Nuclear energy

The potential for uranium deposits in Tanzania was identified in a countrywide airborne geophysical survey in the 1970's. Further exploration between 1978 and 1982 resulted in the identification of surface mineralization and recognition of the potential for uranium deposits in Tanzania. Currently, there are about 20 companies engaged in exploration for uranium in Tanzania. Significant mineralization or deposits have been identified in the Dodoma area at Handa and Bahi North (Mantra Resources), in the Ruhuhu area near Lake Nyasa (Uranium Hunter, Atomic Minerals, and Western Metals). Nuclear generation could become an option, particularly when other indigenous resources are fully committed.

This technology has not been considered in this PSMP update because it is considered that nuclear generation could only be selected when:

- a) The Government has finalized the policies on uranium and nuclear generation.
- b) Human Capacity building on nuclear technology and other related matters.

It is considered that this resource would have been developed in Tanzania and available for

power generation by 2040s subject to further studies and familiarization with this technology.

# 3.3 Methodology and preconditions

# 3.3.1 Method for compiling the least cost power generation development plan

In order to examine the least cost power generation development plan combining various types of power generation and development patterns, WASP (Wien Automatic System Planning Package, Version -IV), which is a power generation development planning software developed by the International Atomic Energy Agency (IAEA), was used.

WASP-IV can select the optimum power source development plan that satisfies constraints such as supply reliability (LOLP), reserve capacity, fuel limitation, and restriction on the amount of environmental pollutant emissions, etc. for the next 30 years. The optimum power source development plan refers to the plan in which the general cost discounted according to current prices becomes the minimum. The following paragraphs give an outline of the WASP calculation model.

The combination of all power generation plants (power generation development plan) that satisfy constraints and are added to the power system is evaluated based on objective functions composed of the following items:

- i. Depreciable investment cost: Equipment and installation cost (I)
- ii. Residual value of investment cost (S)
- iii. Non-depreciable investment cost: Fuel store, replacement parts, etc. (L)
- iv. Fuel cost (F)
- v. Non-fuel operation and maintenance cost (M)
- vi. Non-supplied power cost (O)

The cost function evaluated in WASP is expressed by the following formula:

$$B_{j} = \sum_{t=1}^{T} [ \overline{I}_{j,t} - \overline{S}_{j,t} + \overline{L}_{j,t} + \overline{F}_{j,t} + \overline{M}_{j,t} + \overline{O}_{j,t} ]$$

Where,

- B<sub>j</sub> : Cost function of the power source development plan j
- t : Year of the power source development plan (1, 2, ..., T)
- T : Term of the power source development plan (all years)

The bars above each symbol indicate prices that have been discounted at discount rate i by the set time. The optimum power source development plan is the plan at which the cost function Bj in all development plan candidates j becomes the minimum.

Figure 3-2 shows the simplified flowchart of WASP-IV indicating the flow of information and data files between various WASP modules.



Source: WASP IV User's Manual

Module 1: Loadsy (Load System Description), processes information describing period peak loads and load duration curves for the power system over the study period.

Module 2, FIXSYS (Fixed System Description), processes information describing the existing generation system and any predetermined additions or retirements, as well as information on any constraints imposed by the user on environmental emissions, fuel availability or electricity generation by some plants.

Module 3, VARSYS (Variable System Description), processes information describing the various generating plants which are to be considered as candidates for expanding the generation system.

Module 4, CONGEN (Configuration Generator), calculates all possible year-to-year combinations of expansion candidate additions which satisfy certain input constraints and which in combination with the fixed system can satisfy the loads. CONGEN also calculates the basic economic loading order of the combined list of FIXSYS and VARSYS plants.

Module 5, MERSIM (Merge and Simulate), considers all configurations put forward by CONGEN and uses probabilistic simulation of system operation to calculate the associated production costs, energy-not-served and system reliability for each configuration. In the process, any limitations imposed on some groups of plants for their environmental emissions, fuel availability or electricity generation are also taken into account. The dispatching of plants is determined in such a way that plant availability, maintenance requirement, spinning reserve requirements and all the group-limitations are satisfied with minimum cost. MERSIM can also be used to simulate the system operation for the best solution provided by the current DYNPRO run and in this mode of operation is called REMERSIM.

Module 6, DYNPRO (Dynamic Programming Optimization), determines the optimum expansion plan based on previously derived operating costs along with input information on capital costs, energy-not-served cost and economic parameters and reliability criteria.

Module 7, REPROBAT (Report Writer of WASP in a Batched Environment), writes a report summarizing the total or partial results for the optimum or near optimum power system expansion plan and for fixed expansion schedules.

# 3.3.2 Examination conditions

# 3.3.2.1 Load Duration Curve

Figure 3-3 shows annual load duration curves in 2011, 2012 and 2013. Comparing hourly generation curves in the latest three years, 2013 seems to have less constraint in power supply than other two years. Therefore, load duration curve in 2013 will deemed as a typical load duration curve in Tanzania to be used for power generation planning.



Source: TANESCO

#### 3.3.2.2 Power demand forecast

In generation expansion planning, the base case of power demand forecast described in Chapter 2 of PSMP2016 Update is applied to meet the government target of achieving the generation capacity of at least 4,915MW by 2020. Table 3-9 shows the summary of the power demand forecast.

Cases		Demand items	Unit	2015	2020	2025	2030	2035	2040
Base	Peak demand	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 (Inc. Loss)	MW	0	685	677	677	677	677
		Total	MW	1,045	3,916	5,377	7,590	11,069	16,050
	Installed capacity	Domestic demand	MW	1,267	2,847	4,757	7,633	12,156	18,631
	(Peak*1.3)	Additional demand	MW	92	1,353	1,353	1,353	1,353	1,353
		Export (Inc. Loss)	MW	0	890	880	880	880	880
		Total	MW	1,359	5,091	6,991	9,867	14,389	20,865
High	Peak demand	Domestic demand	MW	974	2,256	4,017	7,381	13,508	23,724
		Additional demand	MW	71	1,041	1,041	1,041	1,041	1,041
		Export (Inc. Loss)	MW	0	685	677	677	677	677
		Total	MW	1,045	3,981	5,736	9,100	15,226	25,443
	Installed capacity	Domestic demand	MW	1,267	2,932	5,223	9,596	17,560	30,842
	(Peak*1.3)	Additional demand	MW	92	1,353	1,353	1,353	1,353	1,353
		Export (Inc. Loss)	MW	0	890	880	880	880	880
		Total	MW	1,359	5,176	7,456	11,829	19,794	33,075
Low	Peak demand	Domestic demand	MW	974	2,035	3,172	4,769	7,120	10,289
		Additional demand	MW	71	1,041	1,041	1,041	1,041	1,041
		Export (Inc. Loss)	MW	0	685	677	677	677	677
		Total	MW	1,045	3,760	4,891	6,487	8,838	12,007
	Installed capacity	Domestic demand	MW	1,267	2,645	4,124	6,199	9,256	13,376
	(Peak*1.3)	Additional demand	MW	92	1,353	1,353	1,353	1,353	1,353
		Export (Inc. Loss)	MW	0	890	880	880	880	880
		Total	MW	1,359	4,889	6,358	8,433	11,490	15,609

#### Table 3-9: Summary of power demand forecast

Source: MEM, TANESCO and Regional demand data survey

#### 3.3.2.3 Supply reliability standard

The LOLP (Loss Of Load Probability) is used as the indicator for evaluating the reliability of power supply, and the generation expansion plan which possesses the necessary reserve power for satisfying the target of LOLP is compiled. LOLP is widely applied as a standard of power supply reliability: NERC (North American Electric Reliability Corporation) adopts a LOLP of 1 day / 10 years, while PLN in Indonesia adopts 1 day / year, CEB (Ceylon Electricity Board) in Sri Lanka adopts 3 days/year and Kenya adopts 1 day/year. In PSMP 2012 Update, the target of LOLP is set at 5 days / year.

In view of the above, the PSMP2016 Update adopts LOLP of 5 days / year as the target reliability standard.

#### 3.3.2.4 Maximum allowable capacity of single unit power generator

In cases where generating equipment drops off the network due to accidents and so on, the frequency declines because power supply falls short of demand. The following formula is used to express the relationship between capacity drop and frequency drop.

$$\Delta F = -\frac{1}{K} \times \frac{\Delta P}{P} \times 100$$

Where,

 $\Delta F$  : System frequency fluctuation (Hz)

 $\Delta P$  : Output or load of the generator concerned (MW)

P : Total load of system (MW)

K : System constant (KG + KL) (%MW/0.1Hz)

KG : Frequency characteristics of the generator (%MW/0.1Hz)

KL : Frequency characteristics of the network (%MW/0.1Hz)

Single unit capacity of any new generator to be introduced to a grid should be so considered as not to cause any deviation from frequency operation standard even if it is shut down due to an unexpected break down. Target system frequency range in Tanzania is set as follows.

Normal condition	:	49.50Hz $\sim$ 50.50 Hz (50Hz $\pm$ 1%)
Emergency conditio	n :	48.75Hz~51.25 Hz (50Hz±2.5%)

In case system frequency fluctuates beyond emergency range described above, under frequency relay installed in 33kV distribution network will be activated and some feeders will be cut off to reduce demand. Currently, the largest single unit capacity in Tanzania is 60MW at Kihansi and 50MW at Kidatu hydro power stations. TANESCO has experienced system frequency drop up to 48.75Hz which is the lower limit of emergency range when a unit trip occurs at Kihansi or Kidatu during the night peak hours in rainy season. By using this situation system constant of Tanzanian power system is calculated as follows.

- a. Situation of single unit trip
  - $\Delta F$  : System frequency drop (Hz) = 50.0-48.75 = 1.25Hz
  - $\Delta P$  : Capacity of unit dropped (MW) = 50MW single unit of Kidatu
  - P : System load (MW) = 800MW
- b. Calculation of system constant

$$\Delta F = -\frac{1}{K} \times \frac{\Delta P}{P} \times 100$$
  
K = 5.0 %MW/Hz or K =0.5 %MW/0.1Hz

Assuming that allowable frequency drop is up to  $\Delta 1.25$  Hz, maximum single unit capacity which system frequency can be maintained within the operational limit even if the unit drops is calculated by the following equation using the system constant described above with base case demand forecast results. The results of calculation is shown in Figure 3-4.

$$\Delta P {=} {-} \frac{\Delta F {\times} K {\times} P}{100}$$





#### 3.3.2.5 Fuel cost

Table 3-10 shows the natural gas and coal cost used for economic calculation for generation expansion planning.

Туре	PSMP 2012 Update	Current Price	PSMP2016 Update
Natural gas	Ubungo: US\$ 0.64/mmBtu (US\$0.68/GJ) Additional gas : US\$3.01/mmBtu (US\$ 3.18/GJ) Mnazi Bay: US\$4.49/mmBtu (US\$ 4.74/GJ)	Ubungo: Protected Gas US\$ 0.6932/mmBtu (US\$ 0.7365/GJ) Additional Gas: US\$ 3.4494/mmBtu (US\$ 3.6650/GJ) Somanga: US\$ 0.6037/mmBtu (US\$ 0.6414/GJ) NNGIP: (Kinyerezi I, Symbion & Ubungo II) - US\$ 5.15/mmBtu (US\$ 5.4719/GJ) Mnazi Bay: US\$ 5.36/mmBtu (US\$ 5.6950/GJ)	US\$ 6.00/mmBtu
Coal	Ngaka: US\$2.37/mmBtu (US\$2.5/GJ) Mchuchuma: US\$ 2.46/mmBtu (US\$2.6/GJ or US\$55/ton)	-	US\$3.53/mmBtu (US\$70/ton)

Table	3-10:	Fuel	cost	assum	ption
IUNIO	0.10.	1 401	0000	accam	

Source: PSMP2012 Update, NDC and TPDC

#### 3.3.2.6 Outage rates

The plan assumes that there will be planned and forced outages at the generating plants. The Combined Outage Rates per year is a result of scheduled maintenance and forced outages. Table 3-11 below outlines the selected outage rates based on different technologies.

Generation type	Scheduled maintenance days per year	Forced outage in percent of time per year	Combined outage rate percent
Coal steam thermal	42	8	20
Gas turbine	28	5	13
Combined cycle gas turbine	21	5	11

Table 3-11: Selected Outage Rates for Different Technologies

Source: PSMP2012 Update and US-EIA "Updated Capital Cost Estimates for Electricity Generation Plants" (Apr.2013) Remarks: Maintenance period and forced outage rates of hydro and renewable energy (solar and wind) are relatively short and low compared to thermal power plants. Therefore, they are not considered in generation planning.

# 3.3.2.7 Economic plant lifetime

The following economic plant lifetimes were used in determining average unit generation costs for preliminary comparisons, and for determining retirement dates for existing and future plants in the development of generation plans.

Table 3-12: Plant service lives

Generation type	Economic plant lifetime – years*
Gas turbines	20
Combined cycle gas turbines	20
Coal steam plants	25
Hydroelectric plant	50
Geothermal	20
Solar PV	20
Wind	20

Source: PSMP 2012 Update and experience of electric utilities

\* Normally extended by major equipment replacement and maintenance

#### 3.3.2.8 Operation and maintenance cost

Unit generation costs include allowances for operation and maintenance, interim replacement, and insurance. For thermal plants, the operation and maintenance cost is separated into fixed and variable costs, while for hydroelectric plants, O&M cost is considered as fixed cost.

Plant type	Unit size MW	Fixed O&M US\$/kW-Month	Variable O&M US\$/MWh
Coal steam thermal	All	4.17	6.50
Gas turbine	All	0.83	5.00
Combined cycle gas turbine	All	1.67	4.00
Hydroelectric-SPP	All	37.72	-
(Run of river type)			
Hydroelectric	All	2.60	-
(Dam type)			
Geothermal (Binary)	50	100.00	-
Solar PV	All	24.69	-
Wind	All	39.55	-

Table 3-13: Selected operation and maintenance costs

Source: PSMP2012 Update and US-EIA "Updated Capital Cost Estimates for Electricity Generation Plants" (Apr.2013)

#### 3.3.2.9 Development cost

Capital costs for all candidate power plants are based on benchmarking of generic plants around the world, original capital costs from the PSMP2012 Update, and proposed developers' prices. These costs were then escalated from original sources to obtain costs on a common basis. Construction for both hydro, thermal and renewable are summarized in Table 3-14, Table 3-15 and Table 3-16, respectively.

		Installed	Annual	Plant	Construction Cost (2014 Price)		Average Generation
River Basin	Planned Projects Capac (MW	Capacity (MW)	Generation (GWh)	Factor (%)	Amount (Million USD)	Unit Rate (USD/kW)	Cost (US cent/kWh)
Laka Victria	Rusumo	80.0	456.33	58	150.32	1,670	3.94
Lake vicula	Kakono	87.0	573.00	75	383.88	4,412	7.23
Lake Tanganyika	Malagarasi Stage III	44.7	168.12	43	165.20	3,696	10.74
	Rumakali	222.0	1,188.01	61	559.87	2,522	5.34
	Masigira	118.0	597.62	58	261.20	2,214	5.02
Laka Nyasa	Kikonge	300.0	1,141.20	43	670.68	2,236	6.75
Lake Nyasa	Songwe Manolo(Lower)	177.9	617.46	40	469.18	2,637	8.56
	Songwe Sofre (Middle)	158.9	528.38	38	468.28	2,947	9.88
	Songwe Bipugu (Upper)	29.4	94.56	37	200.57	6,822	22.36
	Ruhudji	358.0	1,799.73	57	666.02	1,860	4.35
	Mnyera - Ruaha	60.3	290.83	55	255.08	4,230	9.49
	Mnyera - Mnyera	137.4	662.26	55	274.07	1,995	4.82
	Mnyera - Kwanini	143.9	693.79	55	164.12	1,141	3.03
	Mnyera - Pumbwe	122.9	592.18	55	219.15	1,783	4.38
	Mnyera - Taveta	83.9	403.84	55	205.75	2,452	5.79
Rufiji	Mnyera - Kisingo	119.8	577.28	55	313.53	2,617	6.13
	Mpanga	160.0	796.00	57	420.23	2,626	5.95
	Lower Kihansi Expansion	120.0	62.10	6	220.75	1,840	41.88
	Upper Kihansi	47.0	213.35	52	519.89	11,061	25.26
	Iringa - Ibosa	36.0	186.09	59	123.06	3,418	7.27
	Iringa - Nginayo	52.0	262.75	58	125.46	2,413	5.43
	Steiglers Gorge Phase 1	1,048.0	4,558.67	50	2,455.99	2,344	6.15

Table 3-14: Construction costs for hydro projects

Note:

The construction cost does not include the interest during construction and transmission line and substation costs. Steiglers Gorge Phase 2 Project is excluded because annual energy generation is not calculated in previous study report.

Туре	Name	Capacity (MW)	Heat Rate (kcal/kWh)	Construction Cost (\$/kW)	Construction period
Simple cycle	SGT1	70	2,759 (31.2%)	900	1 year
gas turbine	SGT2	120	2,845 (30.2%)	900	1 year
	SGT3	300	2,470 (34.8%)	900	1 year
Combined cvcle	CGT1	110	1,773 (48.5%)	1,200	2 years
Cycle	CGT2	185	1,832 (46.9%)	900	2 years
	CGT3	470	1,616 (53.2%)	900	2 years
Coal	SBCL Conventional sub-critical	150	2,115 (40.7%)	2,000	3 years
	ASBC Advanced sub-critical	300	2,050 (42.0%)	2,000	3 years
	USCL Ultra super critical	700	2,040 (42.2%)	2,000	3 years

Table 3-15: Construction costs for thermal projects

Source: US-EIA "Updated Capital Cost Estimates for Electricity Generation Plants" (Apr.2013), Gas Turbine Worldwide Handbook and PSMP2012 Update

Table 3-16	Construction	costs for	renewable	proj	ects
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Туре	Name	Capacity (MW)	Construction Cost (\$/kW)	Construction period
Geothermal	GEO	50	4,362*1	2 years
Solar PV, ground mounted	PV	100	1,200*2	1 year
Onshore wind	WIND	100	1,571* <sup>2</sup>	1 year

Source: \*1 US-EIA "Updated Capital Cost Estimates for Electricity Generation Plants" (Apr.2013)

\*2 International Energy Agency/ Nuclear Energy Agency "Projected cost of generating electricity" (2015 Edition)

#### 3.4 Power development scenarios

#### 3.4.1 Scenarios considered

The potential generation capacity determined from each energy resources is a basis for setting the scenarios. Potential of natural gas and its allocation for various purposes are shown in Table 3-17, Fig. 3-5 and 3-6.

Energy potential and possible generation capacity is described as follows.

 a) Gas: Assuming that 20% of recoverable natural gas reserve (70% of 57.25Tcf=40.075Tcf) is allocated to power sector, 8.015 Tcf can be used for power generation. It can support around 8,000MW combined cycle power plants for 20 years.

- b) Coal: Combined coal reserve in Mchuchuma, Ngaka, Kiwira, Mbeya and Rukwa is around 870mil.ton as shown in Table 3-18. It can support 9,900MW coal fired power plants for 30 years.
- c) Hydro: Identified hydro potential with feasibility studies in Tanzania is approx.
   4,700MW. The capacity of existing hydro power is 567MW.
- d) If capacity of power development is calculated only from energy potential, generation mix will be Gas: 34%, Coal: 43% and Hydro: 23%. This is a basis of setting power development scenarios.

Six generation expansion scenarios which have different share of energy sources considering the energy potential described above are set as shown in Table 3-19.

		Proven-	Probable-
Cotomorry	Cao Fielde	Reserve	Resource
Category	Gas rielas	P90	P50
		P1	P1+P2
	Songosongo	0.88	2.5
Land/ Shallow Water	Mnazi-bay	0.262	5
	Mkuranga		0.2
	Nyuni	0.045	0.07
	Ruvuma		0.178
	Ruvu		2.17
	Sub-total	1.187	10.118
	Block 2		25.4
Deep Water	Block 1,3 & 4		21.73
	Sub-total		47.13
Total			57.25

Table 3-17: Natural gas reserve in Tanzania

Source: TPDC



Figure 3-5: Gas Consumption Outlook: Base Case (NGUMP)

Source: Natural Gas Utilization Master Plan



Figure 3-6: Gas Consumption Share: Base Case (NGUMP)

Source: Natural Gas Utilization Master Plan

	National Dev	elopment Corpo	STAMICO	Others	
Coal mine name	Mchuchuma	Katewaka	Ngaka	Kiwira - Ngoro - Kabulo - Maturi	- Mbeya *1 - Rukwa *2
Reserve	370mil.t	81.65mil.t	251mil.t	85mil.t	109mil.t *1 58mil.t *2
Production plan	3 mil.t/year	0.34 mil.t/year	3 mil.t/year	1.5mil.t/year	N/A
(for Generation)	(1.5 mil.t/y)	(For iron making)	(1.0mil.t/y)	(1.0mil.t/y)	N/A
(for Industry)	(1.5 mil.t/y)	3/	(2.0mil.t/y)	(0.5mil.t/y)	N/A
Power development	600MW (150MWx4)	-	400MW (200MWx2)	400MW	*1: 300MW *2: 600MW

#### Table 3-18: Coal reserves in Tanzania

Source: NDC and STAMICO

Convertion	Generation Mix					
Scenarios	Gas	Coal	Hydro	Renewable etc.		
Scenario-1	50%	25%	20%	5%		
Scenario-2	40%	35%	20%	5%		
Scenario-3	35%	40%	20%	5%		
Scenario-4	25%	50%	20%	5%		
Scenario-5	50%	35%	10%	5%		
Scenario-6	40%	30%	20%	10%		

#### Table 3-19: Power development scenarios

[Remarks] Renewable etc. includes solar, wind, biomass, geothermal and import

Generation expansion plans which correspond to six scenarios from Scenario-1 to 6 were analyzed by using WASP (Wien Automatic System Planning Package) software.

#### 3.4.2 Items considered in formulating generation expansion plans

#### 3.4.2.1 Generation mix

Generation mix was established to avoid dependence on single energy source and should be balanced to maintain the security of electricity supply.

# 3.4.2.2 Gas fired power

Availability of gas to power is the key for considering the share of gas fired power in generation mix. In NGUMP 2016, it is assumed that gas fired power accounts for 40% of energy generation by 2040 as a condition of estimating total gas demand.

## 3.4.2.3 Coal fired power

Financing for coal fired power plant is challenging because of the international pressure against coal fired power due to greenhouse gas emission. In addition, disposal of bottom and fly ash and gypsum (by-product of Flue Gas Desulfurizer) is also a constraint in developing coal fired power plant.

# 3.4.2.4 Hydro power

Seasonal variation of energy generated and vulnerability to climate change should be taken into consideration. Environmental impact, resettlement of people, and huge initial investment cost are also negative aspects of hydro power development. Still, hydro is the most economical source of power generation. Since hydro power is site specific, it is not possible to add "unknown" site to power development candidate. Therefore, maximum hydro capacity to be added will be limited to 4,700MW.

# 3.4.2.5 Geothermal

The challenges in developing geothermal resource are high upfront investment costs; long lead time from conception to production of electricity; capital intensive and high exploration cost and risk, inadequate capital resource to undertake necessary studies; remote location and limited infrastructures. Therefore, geothermal power plant included in the generation expansion plan is limited to the projects which have high possibility of development potential.

# 3.4.2.6 Other renewable energy

Generation cost of renewable energy, i.e. solar and wind, has dramatically dropped recently. In case of utility scale solar project, levellized generation cost is in the range<sup>3</sup> of US\$54/MWh (United States) to US\$181/MWh (Japan) at a 3% discount rate. However, generation output from solar and wind is intermittent and not stable. Moreover, daily load pattern in Tanzania is still "lighting peak" type, therefore, solar cannot be utilized during peak hours unless storage device is equipped<sup>4</sup>. In order to achieve reliable and stable power supply, development of conventional generation plants must be accompanied with the development of renewable energy plants to supplement and backup the fluctuation of renewable energy generation. Considering intermittent output and low utilization factor and of solar (10-15%) and wind (20-30%), contribution of such renewable energy generation to total energy generated is limited.

<sup>&</sup>lt;sup>3</sup> International Energy Agency/ Nuclear Energy Agency "Projected cost of generating electricity" (2015 Edition)

<sup>&</sup>lt;sup>4</sup> The largest storage device was commissioned in Japan in March 2016. It is consisted of NaS battery and power conditioning system with the output of 50MW and storage capacity of 300MWh. Procurement and installation cost for the storage system is approximately US\$170 million.

# 3.5 Generation Plan Results

## 3.5.1 Optimum Generation Expansion Scenario

Optimum solutions obtained from WASP for each scenario are shown in Table 3-20. Scenario-2 is the most recommended through the evaluation of scenarios from the view point of total generation cost for 25years (from 2016 to 2040) which includes capital cost, operation and maintenance cost and fuel cost, energy balance and environmental aspect.

Scenarios	Features	Cost* (million\$)	Cost	Energy Balance	Environ ment	Order
Scenario-1	Gas:50%, Coal:25%, Hydro:20% Renewable and others:5%	58,664	3	3	2	3
Scenario-2	Gas:40%, Coal:35%, Hydro:20% Renewable and others:5%	57,462	2	1	3	1
Scenario-3	Gas:35%, Coal:40%, Hydro:20% Renewable and others:5%	57,098	2	1	4	2
Scenario-4	Gas:25%, Coal:50%, Hydro:20% Renewable and others:5%	56,368	1	3	5	5
Scenario-5	Gas:50%, Coal:35%, Hydro:10% Renewable and others:5%	58,576	3	5	4	6
Scenario-6	Gas:40%, Coal:30%, Hydro:20% Renewable and others:10%	72,049	5	1	1	4

Table 3-20: Re	esults of scen	ario comparison
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[Remarks] Ranking order: 1 (best) to 5 (worst)

\*Cost= Cumulative value of the following cost from 2015 to 2040 Investment Cost – Salvage Value +Fuel Cost+ O&M Cost

The following figures describe energy generated and capacity developed in six scenarios with the share of different type of fuel.


#### Figure 3-7: Energy generated

# Figure 3-8: Share of energy generated



## Figure 3-9: Generation capacity





# Figure 3-10: Share of generation capacity

#### 3.5.2 Observations

## 3.5.2.1 Natural gas demand and supply balance

Until deep water gas is developed, shallow water gas such as Songo Songo, Nyuni/Kiliwani, Mnazi Bay are the only source of natural gas for gas fired power plants. After the completion of a gas pipeline from Mtwara to Kinyerezi, constraint of pipeline capacity to deliver gas to power plants is relieved. Still, production capacity will be a bottleneck to deliver sufficient gas to power plants. Fig. 3-11 compares the capability of gas supply and demand by power for six scenarios. With accelerated production from shallow water gas fields, no serious shortage of gas to power will be anticipated as shown in Fig. 3-11.



Figure 3-11: Natural gas demand and supply for power sector

## 3.5.2.2 Carbon dioxide emission

Fig. 3-12 shows the CO<sub>2</sub> emission from six power development scenarios. Scenario-4 which has the largest share of coal fired power plants emits more CO<sub>2</sub> than others. Compared with the lowest emission trend of Scenario-6, Scenario-6 generates 29% less CO<sub>2</sub> than Scenario-4 in 2040.





#### 3.5.2.3 Optimal power development plan

The detailed results of Scenario-2 which was analyzed by WASP is shown in Table 3-21. Power development plan of Scenario-2 which includes the location and name of ongoing/planned projects is shown in Table 3-22.

	Fixed expansion					Variable expansion									LOLP%
	•		Sim	ole cvcle	GT	Con	nbined c	vcle		Coal		GeoTh	Hvdro		
Year	Plant	MW	SGT1	SGT2	SGT3	CGT1	CGT2	CGT3	SBCL	ASBC	USCL	GEO1	DAM		Target
			70MW	120MW	310MW	110MW	185MW	470MW	150MW	300MW	700MW	50MW	Site Name	(MW)	=1.37%
2015	Kinverezi-I	150				310									0.365
2016						110									0.657
	Kinyerezi-II	240													
2017	Kinverezi-I (Extension)	185													1.018
	Singida Wind (50MW)	50													
2010	Import from Ethiopia (1st stage)	200				660	370		150						4 007
2018	Singida Wind (75MW)	75													1.227
	Rusmo (Hydro)	30							300						
2010	Lower Kihansi Expansion	120													0 704
2019	Makambako Wind (100MW)	100													0.704
	Dodoma solar (50MW)	50													
	Singida Wind (75MW) Extension	75				110	185		450						
2020	Singida Wind (100MW)	100													1.320
	Kishapu-Shinyanga Solar	150													
2021	Singida Wind (75MW) Extension	50				110			150						1.176
2022	Import from Ethiopia( 2nd stage)	200				110									0.978
2023										600					0.215
2024										300			Malagarasi Stg-III	44.7	0.447
2025						220						100			1.203
2026										300		100	Iringa-Ibosa	36	1.342
					-								Iringa-Nginayo	52	
2027						220				300			Kakono	87	1.211
2028										600			Mnyera - Ruaha	60	0.699
													Songwe Manolo	88	
2029										300			Mnyera - Mnyera	137	1.227
										-			Minyera - Kwanini	144	
2030								940					Mnyera - Pumbwe	123	0.308
								0.40					Mnyera - Taveta	84	
2031								940					ivinyera - Kisingo	120	0.143
													Nipanga	160	
2032													Kunuaji	300	0.374
2022								040					Rumakali	110	0 122
2033								940		600			Kumakali	222	0.132
2034	Generation capacity in 204	0		1						000			Songwo Sofro	300	0 165
2004	Gas 10.253 M	iw	45.4%										Linner Kihansi	47	0.100
2025	Coal 6,000 M	W	26.6%					040					Stigglors Corgo Ph 1	1 0/9	0.082
2033	Hydro 5,093 N	1W	22.5%			110		340		200			Steglers Golge Fil-1	1,040	0.002
2036	Renewable 850 M	1W	3.8%			110		470		300					0.157
2037	Import 400 W	100	1.8%			110		470		300			Stieglers Gorge Ph-2	1,048	0.129
2038	10tal 22,595 lv	100	100%		-			470		600					0.228
2039						110		470		600					0.385
2040								1410	150						0.583
Total a	ddition (Number of units)					22	3	15	8	16	0	4		19	
Total a	ddition (MW)	1,775				2,180	555	7,050	1,200	4,800	0	200		4,357	

Table 3-21: Least cost generation expansion plan by WASP (Scenario-2)

Scenario-2 Least Cost Generation Expansion Plan

Note: The table above is a result of WASP simulation. Future expansion projects which are not committed yet are deemed as "Variable Expansion Candidates". WASP will select the type, capacity and year of operation for variable expansion candidates to formulate the least cost expansion plan.

# Table 3-22: Optimal generation expansion plan (Scenario-2)

Statu	us Name of plant	Owner	Year of	Туре	Installed Capacity(MW)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Pe	ak demand at generator en	nd (MW)	operation		Capacity(WW)	1,072	1,350	1,557	1,796	2,045	4,007	4,250	4,516	4,808	5,134	5,498	5,875	6,288	6,734	7,227	7,765	8,356	9,000	9,708	10,481	11,325	12,183	13,116	14,130	15,231	16,426
Po	wer supply capacity (MW)					1,455	1,343	1,811	3,074	4,091	5,536	5,586	5,983	6,583	6,886	6,866	7,314	7,487	8,529	9,065	10,212	11,327	11,803	12,902	13,929	15,767	17,695	18,150	19,220	20,400	21,960
Ge	neration capacity without s	solar, wind and	import (N	AW)		1,455	1,343	1,761	2,749	3,616	4,736	4,736	4,933	5,533	5,836	5,816	6,264	6,437	7,479	8,015	9,162	10,277	10,753	11,852	12,879	14,717	16,645	17,100	18,170	19,350	20,910
Ad	Libungo 1	TANESCO	r (MW) 2007	GasEngine	102	102	-112	418 102	988 102	102	1,120	102	197	600 102	303	- 20 102	448 102	173 Retire	1,042	536	1,147	1,115	476	1,099	1,027	1,838	1,928	455	1,070	1,180	1,560
	Tegeta	TANESCO	2009	GasEngine	45	45	5 45	5 45	45	45	45	45	45	45	45	45	45	45	45	Retire											
-	Ubungo 2	TANESCO	2012	2 GT	105	105	5 105	5 105	105	105	105	105	105	105	105	105	105	105	105	105	105	Retire									
Ē	Zuzu Diesel	TANESCO	1980	DG	7	7	7 7	7	42	42	Retire	42	42	42	Potiro																
۴L	Songas 2	IPP	2004	GT	120	120	120	120	120	120	120	120	120	120	120	Retire															
- Bu	Songas 3	IPP	2006	GT	40	40	0 40	0 40	40	40	40	40	40	40	40	40	Retire														
cisti	Tegeta IPTL	IPP	2002	2 DG	103	103	3 103	3 103	103	103	103	103	Retire																		
Ш	Symbion Ubungo	TANESCO	2011		112	112	Retire	3 63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	Potiro							
	Mtwara	TANESCO	2013	GT	18	Iso	lated opera	ation	18	18	18	18	18	18	18	18	18	6	Retire	03	03	03	03	Reure							
	Kinyerezi I	TANESCO	2015	5 Gas-GT	150	150	150	) 150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	Retire					
ngoi	Kinyerezi I Extension	TANESCO	2017	Gas-GT	185			185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	Retire			
°	Somanga Fungu (Kilwa E)	IPP	2017	Gas-GT	240			240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	210	210	210	210
	Somanga Fungu (Kilwa E)	IPP	2019	ST add-on	110					110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
	Kinyerezi III(Ph1) 1-3	PPP	2018	Gas-GT	300				300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
	Kinyerezi III(Ph2) 1-2	PPP	2018	3 Gas-C/C	300				300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
ate	Mtwara (TANESCO)	TANESCO	2020	Gas-C/C	300					300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
did	Somanga (PPP)	PPP	2022	2 Gas-C/C	300								300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
Car	Somanga (TANESCO)	TANESCO	2020	Gas-C/C	240						240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240
a	Bagamoyo(Zinga)	IPP	2027	Gas-C/C	200													200	200	200	200	200	200	200	200	200	200	200	200	200	200
lern	Future CGT3(1-10)	1		Gas-CGT3	470 *		1														940	1,880	1,880	2,820	2,820	3,760	4,230	4,700	5,170	5,640	7,050
1 Le	Subtotal Gas					716	604	1,029	1,857	2,267	2,837	2,837	3,137	3,137	3,095	2,975	2,935	3,021	3,015	2,970	3,910	4,745	4,745	5,685	5,685	6,475	7,055	7,210	7,680	8,260	9,670
able	Mchuchuma-1			SBCL	150 *		-		150	450	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
Vari	Ngaka 1-2+3 Ngaka (Exp)1-7	+		ASUB	200 *		+							600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	1 200	600 1 350
1	Kiwira 1-2			SBCL	200 *	,					400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Kiwira (Exp)1-2			ASUB	300 *	r -													600	600	600	600	600	600	600	600	600	600	600	600	600
	Mchuchuma(Exp)1-6			ASUB	300 *										000	000	300	300	600	600	600	600	600	600	600	600	900	1,200	1,200	1,200	1,200
	Rukwa 1+Exp			ASUB	300 *	0	0	0	150	450	1 000	1 000	1 000	1 600	300	1 900	2 200	2 200	300	3 400	3 400	3 400	3 400	3 400	4 000	4 000	4 300	4 600	1,200 5 200	5 800	1,200 5 950
	Thermal ger	neration capa	city subto	otal (MW)		889	777	1,195	2,173	2,883	4,003	4,003	4,200	4,800	5,058	4,938	5,198	5,284	6,178	6,433	7,373	8,208	8,208	9,085	9,685	10,475	11,355	11,810	12,880	14,060	15,620
	Geothermal	TGDC		Geo	50 *											100	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
	Singida Wind			Wind	50			50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
e	Niombe Wind			Wind	100				75	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
vat	Dodoma solar			Solar	50					50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
ane	Singida Wind			Wind	75						75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
r w	Singida Wind Shinyanga/Simiyu Solar			Wind	100						100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	Singida Wind			Wind	50						150	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
	Renewable	(Wind and So	lar ) subto	otal (MW)				50	125	275	600	650	650	650	650	650	650	650	650	650	650	650	650	650	650	650	650	650	650	650	650
	Power Import from Ethio	ріа	1007	ZDam	Max. 400				200	200	200	200	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Nyumba Ya Mungu	TANESCO	1967	3 Dam	21	2	3 8	3 8	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21		21
- p	Kidatu	TANESCO	1975	5 Dam	204	204	1 204	1 204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204
1 6	Mtera	TANESCO	1988	3 Dam	80	80	80	0 80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
istin	Uwemba New Pangani Falls	TANESCO	1991	Dam Dam	0.843	0.843	3 0.843	3 0.843	0.843	0.843	0.843	0.843	0.843	0.843	0.843	0.843	0.843	0.843	0.843	0.843	0.843	0.843	0.843	0.843	0.843	0.843	0.843	0.843	0.843	0.843	0.843
Ш	Kihansi	TANESCO	2000	) Dam	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180
	Mwenga SPP	SPP	2012	2 Run of river	4	4	4 4	4 4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
φ.	Rusumo	TANESCO	2019	Dam	27					27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27
nne	EA Power SPP	SPP	2019	Run of river	120					120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
E -	Darakuta SPP	SPP	2015	5 Run of river	0.24	0.24	1 0.24	1 0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
	Mapembasi SPP	SPP	2019	Run of river	10				10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Malagarasi Stage-III Maanga	TANESCO	2024	i Dam	44.7										44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7
	Iringa-Nginayo		2026	6 Dam	52												52	52	52	52	52	52	52	52	52	52	52	52	52	52	52
	Iringa-Ibosa		2026	6 Dam	36												36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
s	Moyera-Ruaha		2028	3 Dam	60.3														60.3	60.3	60.3 122.9	60.3	60.3	60.3 122.9	60.3 122.9	60.3 122.9	60.3	60.3	60.3 122.9	122.0	60.3 122.0
date	Mnyera-Kwanini		2030	Dam	143.9															143.9	143.9	143.9	143.9	143.9	143.9	143.9	143.9	143.9	143.9	143.9	143.9
ndi D	Mnyera-Kisingo		2031	I Dam	119.8																	119.8	119.8	119.8	119.8	119.8	119.8	119.8	119.8	119.8	119.8
ပီ	Mnyera-Taveta		2030	) Dam	83.9															407.4	83.9	83.9	83.9	83.9	83.9	83.9	83.9	83.9	83.9	83.9	83.9
L P	Ninyera-Minyera		2029	Dam Dam	137.4														88.1	137.4	137.4	88.1	137.4	137.4	137.4	137.4	137.4	88.1	137.4	88.1	137.4
Ŧ	Kakono		2027	7 Dam	87													87	87	87	87	87	87	87	87	87	87	87	87	87	87
able	Songwe Sofre		2034	1 Dam	79.5																				79.5	79.5	79.5	79.5	79.5	79.5	79.5
'aris	Masigira		2032	2 Dam	118		-																118	118	118	118	118	118	118	118	118
1	Runudji Rumakali	TANESCO	2032	3 Dam	222																		300	222	222	222	222	222	222	222	222
	Kikonge		2034	1 Dam	300																				300	300	300	300	300	300	300
	Stieglers Gorge Ph-1		2035	Dam	1048		<u> </u>												<b>⊢</b> – ]					<b>⊢</b> – ]		1048	1048	1048	1048	1048	1048
	Upper Kihansi	+	2037	1 Dam	1048	1	1	<u> </u>																	47	47	1048	1048	1048	1048	1048
	1.11.	Hydro subt	otal		· · · · ·	566	566	566	576	733	733	733	733	733	778	778	866	953	1,101	1,382	1,589	1,869	2,345	2,567	2,994	4,042	5,090	5,090	5,090	5,090	5,090
	Total	generation ca	apacity (M	W)		1,455	1,343	1,811	3,074	4,091	5,536	5,586	5,983	6,583	6,886	6,866	7,314	7,487	8,529	9,065	10,212	11,327	11,803	12,902	13,929	15,767	17,695	18,150	19,220	20,400	21,960
Res	erve capacity (with rated hyd	n capacity)		-		383	-7	254	1,278	2,046	1,529	1,336	1,468	1,775	1,752	1,368	1,438	1,199	26 7%	1,839	2,447	2,971	2,803	3,194	3,448	30.2%	5,512	5,033	5,089	5,169	5,533
1.00		- suparity/	I	1	1	+ 33.07	- 1/0	0.0/0	1 1 /0	/0	55.Z/0	UI.7/0	JZ.J /0	00.070	UT. 1 /0	ET. 3 /0	LT.J /0	13.170	20.1 /0	LU.7 /0	31.3/0	. 00.070	91.1/0	32.370	JZ.J /0	JJ.2 /0	TU.2 /0	JU.7/0	50.070		33.170

Note: \* means installed capacity per unit

## **CHAPTER FOUR**

## 4 TRANSMISSION EXPANSION PLAN

## 4.1 Introduction

This section provides the update to the transmission plan based upon the load forecast and the generation expansion plan presented in the previous chapters. Practically, the overall logical planning process that was used for conceptual primary transmission system planning update does not differ much from the previous Power System Master Plan of 2009 and 2012 Update.

An assessment of major power flows was conducted across widely separated geographical areas over the planning period up to the year 2040 in order to plan for reinforcement and new transmission lines. The assessment was done by calculating the ranges of major interface flows for critical system conditions, at discrete intervals of five years throughout the study period for the generation plans. These ranges of major interface power flows between geographic subsystems are based on a generation planning sequence, grid station load forecast, ranges of load levels and known operating constraints. This information led to a conceptual update design of the transmission additions or changes where it appeared necessary. Likewise, the information will provide an early feedback of transmission costs associated with the least cost generation update option.

After the simulation of load flow using generation data as an input to transmission plan, the results provided detail information for transmission system expansion/additions. Simulations were carried by an interval of 5 years starting from year 2020 to 2040.

## 4.1.1 Objectives

The main objective of this process is to identify a definitive near to mid-term plan (to year 2025) and an indicative long-range plan (to year 2040) for the transmission system expansion update. More specifically, transmission expansion plan objectives are:

- a) Ensuring security of supply in the short term by coordinating electricity supply and demand;
- b) Ensuring security of supply in the medium and long term by developing the National Grid;
- c) Ensuring accessible transmission and distribution routes by means of good maintenance practices;
- d) Determining the location, capacity, and type of the required power transmission development and upgrades over the planning horizon 2040;
- e) Establishing the timing of the transmission upgrades across years 2020, 2025, 2030, 2035 and 2040; and
- f) Estimating the capital cost and investment plan associated with the transmission line development and system upgrades.

In the context of a master plan, the transmission expansion determines the system upgrades that will allow the planned generation to serve the forecasted load. Additionally, a corresponding investment plan is developed to estimate the cost of the transmission expansion plan associated to the generation and sub- transmission/distribution plans which provide the basic input to financial and economic analysis.

The transmission plan chooses the system additions that are most economical, while satisfying a pre-defined set of technical criteria. Such criteria composed a set of rules that measure the system performance and compare several scenarios on a common technical basis, ensure the adequate operation of the power system under both normal and emergency conditions, once the infrastructure has been built.

## 4.1.2 Existing Grid System

There are transmission and distribution lines of different voltage capacities all over the country. The transmission system is comprised of 647km of 400kV, 2,745 km of 220kV, 1,626 km of 132kV and 580 km of 66kV. 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 132kV and from Zambia through 66kV lines.

Simulation of the existing power system under peak load conditions revealed that the following portions of line, the Iringa – Dodoma – Singida 220kV line, the Chalinze – Hale – Arusha 132kV line and Ubungo – Kunduchi – Ras Kilomoni 132kV line and 132kV submarine cable from Ras Kilomoni (Mainland) to Ras Fumba (Zanzibar) had exceeded their thermal limits, therefore they could not transfer all the respective demanded power. This has resulted in the introduction of the 647km of 400kV Iringa – Shinyanga backbone project (in final stage of commissioning), 441 km of 400kV Dar es Salaam – Chalinze – Segera – Arusha and 64km of 220kV Segera – Tanga (are committed). While the reinforcement of 38 km of 132kV submarine cable from Ras Kilomoni to Zanzibar has been commissioned.

The proposed increase of power generation in Mbeya, Iringa and Dar es Salaam regions has necessitated the reinforcement of the 220kV lines to these areas so that power can be evacuated to the load centres. To this effect, 400kV lines of 336 km Chalinze – Dodoma and 292 km Iringa – Kisada – Mbeya are planned for construction just to mention the few as per Table 4-5, 4-6, 4-7, 4-8 and 4-9.

#### Figure 4-1: Existing Grid System



Source: TANESCO

# Table 4-1: Parameters of the Existing Transmission Line System

As of November 2016

						Cond	uctor				
Rated			Route	No. of	No. of		Aluminum	Year	Current	Full	Normal
Voltage	from	to	Length	Towore	Circuite	Code	Sectional	Commi-	Rating <sup>*1</sup>	Rating	Rating <sup>*2</sup>
(kV)			(km)	Towers	Circuits	Name	Area (mm <sup>2</sup> )	ssioned	(Amps)	(MVA)	(MVA)
									< I /		. ,
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	Mbeva	220	544	1	Bison	350	1085	679	250	207
220	Dodoma	Singida	210	528	1	Bison	350	1088	679	250	207
220	Singida	Shinyanga	200	532	1	Bison	350	1088	670	250	207
220	Siriyiua	Mwonzo	200	226	1	Bison	250	1900	670	259	207
220	Maragara	IVIWaliZa	140	330	1	Distin	550	1900	1 000	209	207
220	Norogoro	Kidalu	130	328	1	Bluejay	504	1993	1,092	410	333
220	Morogoro	Ubungo 2nd	179	4//	1	Biuejay	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	Mandizi	37		1	Wolf	150	1963	406	93	74
132	Mandizi	Chalinze	60	334	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	201	1	Wolf	150	1975	406	03	74
122	Libungo	Togota	102	64	1	Wolf	150	1090	406	02	74
122	Togoto	Zonzibar	29	04	1		150	1090	296		52
132	Visupgi	ZariziDar Arusho (Niiro)	30	- 200	1		95	1900	200	00	32
132	Kiyungi	Arusna (Njiro)	70	208	1	VV OII	150	1983	406	93	74
132	Iviwanza	Musoma	210	628	1	VVOIf	150	1989	406	93	74
132	Shinyanga	Tabora	203	587	1	VVOIf	150	1989	406	93	74
132	Musoma	Nyamongo	90	238	1	VVolt	150	1989	406	93	/4
132	Mtukula (Uganda)	Kyaka	30	85	1	liger	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	llala	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	Kiyunai	Arusha	78	625	1	Rabbit	50	1967	197	23	18
66	Nyumba Ya Mungu	Kiyunai	53	463	1	Rabbit	50	1968	197	23	18
66	Babati	Kondoa	85	251	1	Wolf	150	1999	406	46	37
66	Bahati	Mbulu	85	102	1	Wolf	150	1999	406	46	37
20	Mbulu	Karatu	65	170	1	Wolf	150	1000	406	40	37
200	Mhala (Zambia)	Sumbawanga	120	560	1	Wolf	150	2001	400	40	37
200	Runda	Kibara	60	200	1	Pabbit	50	2001	107	-+U 22	10
60		Molana	00	300	4		150	2007	19/	20	10
00	riyungi	IVIAKUYUI'II	34	172		V V OII	UCI	2012	400	40	3/

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

Note: \*1 Source: SURAL catalogue \*2; Normal Rating

=Full Rating x 80%

Source: TANESCO

## 4.1.3 Development of New Interconnectors

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. It is necessary to increase the exchange capacity with other countries, both to ensure access through power trading.

The results from the operational experience in recent years lead to necessary adjustments of the plans for establishing new interconnectors in the coming five-year period. The countries project portfolio for interconnectors comprising of six projects: The new 400kV interconnector to Kenya, currently undergoing implementation phase, is scheduled for entering into operation in 2019. The connection point in the Grid is Arusha. Tanzania is planning another connection to Zambia at 400kV which is currently under preparation phase, scheduled to enter into operation in 2020 and the connection point in the Grid is Mbeya. Uganda and Tanzania are planning for the 220kV Masaka (Uganda) - Kyaka (Tanzania) interconnector, it is scheduled for operation by 2020.

Tanzania is also planning a new connection to Mozambique with a voltage of 400kV; 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. Tanzania, Rwanda and Burundi are planning a 90MW hydro power plant project at Rusumo border, the project will enable the National grids of the three countries to be interconnected through 220kV transmission line. The last one involves Tanzania and Malawi, a total of 360MW 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 by 2020. By year 2040, the Grid network (400kV and 220kV lines are shown in blue and red respectively) will be as per Fig. 4-2, 4-3 and 4-4.



Figure 4-2: Generation and Transmission Plan – Year 2020







Figure 4-4: Generation and Transmission Plan – Year 2040

Source: Team compilation Recommendation: Higher voltage would be recommended for 400kV lines from Mtwara to Dar es Salaam to reduce the number of lines.

## 4.1.4 Drivers for grid development

#### 4.1.4.1 Security of supply is our top priority,

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. In 2010, the government initiated several projects such as 400kV transmission lines (backbone), 220kV South-West project (Makambako – Madaba – Songea), 400kV North – East project (Dar es Salaam – Segera – Arusha) and 400kV Chalinze - Dodoma project and the 400kV North-West Grid (Nyakanazi – Kigoma – Mpanda – Sumbawanga – Mbeya), 400kV Kinyerezi – Somanga Fungu – Lindi - Mtwara and 400kV Songea –Tunduru – Masasi – Lindi - Mtwara. These projects are aimed at ensuring the security of power supply in the country and the implementation status are described in 4.1.3.

#### 4.1.4.2 Renewable energy development

The government is determined to achieve its goals regarding new renewable generation in the most social economic efficient way. Several renewable energy projects are underway, such as solar, wind, small hydro and geothermal.

Since the potential for renewable in the country is abundant, it is important that all these

developments are balanced, so that new generation is harmonized and adjusted to the implemented grid development plans as well as changes in consumption patterns. This applies both nationally and regionally, that is why the plans for a reinforced main grid include both domestic implementation measures and interconnector capacity to other countries. An increase in the generation from renewable energy will further increase variations in the grid power system between years with low precipitation and years with high precipitation; this requires an increase in the exchange capacity between Tanzania and other countries, both to secure access to energy in dry years, and ability to export surplus power during wet years.

## 4.1.4.3 Reliable grid creates value

The government will facilitate value creation by securing the necessary transmission capacity domestically, delivering power to the growing number of newly established enterprises, as well as facilitating increased power exchange internationally. Generally, in the entire country, the load forecast show that there will be high growth of power demand mainly due to increase of industrial activities, economic growth and in addition to that, the gas and coal discoveries made in recent years, will lead to higher levels of energy consumption. It is anticipated that the next generation main grid will comprise stronger connections between all regions, and contribute to more uniform electricity prices across the country during normal situations. This will provide producers and consumers alike with improved predictability, and facilitate value creation all over Tanzania.

## 4.1.4.4 The future of Tanzania is electric

The government's policy is to attain electrification rate of more than 50 percent by 2020 and more than 75 percent by 2033. In addition to that, the expectation in the long term is that the transport sector will be extensively electrified and industrial sector will grow up, in order to be able to facilitate these objectives; sufficient grid capacity must be developed.

## 4.2 Transmission Planning Criteria

Planning methodologies and criteria used in the Power System Master Plan Update Studies of 2012 were reviewed as appropriate and generally the same have been used in this update study. The planning of the transmission grid considers the operation of a power system under two possible situations, which are Normal operating conditions (N-0) and Contingency operating conditions (N-1).

## 4.2.1 Operating conditions

## (i) Normal operating conditions (N-0)

The transmission infrastructure is entirely available (no equipment has been forced out of service).

#### (ii) Contingency operating conditions (N-1)

The main principal is that the main grid will be operated and scheduled based on the so called N-1 criterion. This means that under normal system conditions a fault in one single component (line or transformer) will have no influence on the general power supply. This criterion establishes security of supply as a stronger driving force in grid development. In this chapter, the study has set as target to rectify all known breaches of the planning criteria by 2040. The deadline has been predetermined to ensure that we also have the capacity to carry out investment projects related to additional priorities, therefore only outages of equipment rated at 220kV or above will be considered under the N-1 criteria. For each of these two operating conditions, the following criteria are applied to the analyses.

It should be noted that in most cases for this voltage class (220kV and above), the line thermal capability is not the main limiting factor for the amount of power transferred. Transfer limits are usually dictated by steady state stability, dynamic stability and voltage stability concerns.

## 4.2.2 System Voltage Criteria

The acceptable voltage range for operating the system based on factors such as equipment limitations and motor operation under normal and contingency conditions is as follows:

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

It is important to note that from an operational standpoint, healthy systems usually target a minimum voltage close to 1.0 per unit (pu) in the bulk system.

## 4.2.3 Equipment Thermal Loading Criteria

The transmission system shall be planned/designed to allow all transmission lines and equipment to operate within the following limits for the following defined conditions:

Condition	Thermal Loading Limit
Normal System Conditions	Defined Normal Load Capacity
System Design Contingencies of Long Duration (i.e. an	Defined Normal Load Capacity
outage involving the failure of a transformer)	Denneu Normai Luau Capacity
System Design Contingencies of Short Duration (i.e.	Defined Emergency Load Capacity (120% of
not involving a transformer)	normal rating for 10 hours per year)

## 4.3 Transmission and Substation Costs

## 4.3.1 Transmission voltage options

It is expected that the present 132kV and 220kV system voltage levels and the proposed 400kV line will be the main transmission technology of choice for the internal transmission expansion. Should a Direct Current (DC) voltage level be required, the range of 330kV to 500kV voltage standard used in other African countries and / or Alternative Current (AC) 700kV level are the next voltage above the 220kV voltage standard that will be considered in future. Series and shunt capacitors and static variance compensators (STATCOM) are used to improve the receiving end voltages on long and heavily loaded lines. These devices are still considered to delay or replace the need for new transmission lines where they appeared to be economical and practical.

## 4.3.2 Transmission Unit Costs

Transmission line and substation costs have been studied from TANESCO for recent planning studies and from actual transmission line projects in Tanzania. These costs are based on international competitive bidding. Table 4-2 lists the updated transmission line unit costs that were used in this update study. Unit costs for various substation components are summarized in Table 4-3. Costs for new switching substations include circuit breakers, disconnectors, switches, current and voltage transformers, relay buildings, structures and site preparation.

Rated	PSMP 20	)16 Update	Kenya (Reference)
Voltage (kV)	Single Circuit	Double Circuit	Double Circuit
400	300 - 400	380 - 850	480
220	190 - 340	220 - 450	240
132	170 - 200	200 - 320	180

## Table 4-2: Unit Cost of Transmission Lines

Unit Cost (1 000 USD/km)

Source: Task Force Team using results of TANESCO projects, and Final Report on Development of a Power Generation and Transmission Master Plan, Kenya 2015 – 2035, May 2016 (www.erc.go.ke)

Table 4-3: Unit Cost of Substation per Bay⁵

Substation Cost 1,000,000 USD/bay										
132kV	220kV	400kV <sup>6</sup>								
3.49	5.89	9.68								

Source: TANESCO data, and Final Report on The Project for Preparation of Electricity Development Plan for Sustainable Geothermal Energy Development in Rwanda, March 2015, JICA

<sup>&</sup>lt;sup>5</sup> One bay means the designated compartment where switchgear and buses are configured to interconnect a transmission line or a transformer. The costs include the switchgear, the buses, the structures, Control/Protection devices and site preparation. (Building is not included)

<sup>&</sup>lt;sup>6</sup> For 400 kV cost, it represents two connections for 1-1/2 arrangement.

## 4.4 Grid Station Load Forecast

The grid substation load forecast updates are shown in Table 4-4. Individual existing and future grid substations were modelled in the load flow simulations in particular intervals of periods so that the corresponding total updated load forecasts in all regions were used as one of the inputs.

	Substation Load Distribution along 2020/2025/2030/2035/2040										
AREA	BUS no	BUS Name	2020	2025	2030	2035	2040				
America	51211	Njiro	174.34	237.96	370.38	569.68	863.17				
Arusna	50716	Karatu	13.12	17.91	27.88	42.88	64.97				
	10311	Ubungo	641.04	435.85	502.98	499.40	522.61				
	12202	South DSM		290.56	335.32	665.87	1,393.63				
	12302	West DSM			335.32	665.87	1,045.22				
Dar es Salaam	12002	North DSM		290.56	335.32	665.87	1,393.63				
	12102	Sourth-east DSM		290.56	670.64	998.80	1,045.22				
	11803	FZ2	267.10	181.60	209.58	208.08	217.75				
	80212	Dodoma	45.60	58.17	93.41	150.45	218.63				
Dodoma	50816	Kondoa	5.64	7.19	11.55	18.60	27.02				
	60412	Iringa	155.63	22.82	38.80	65.38	96.06				
	40112	Mufindi	118.24	17.33	29.47	49.67	72.98				
Iringa(Niombe)	40115	Makambako	47.79	7.01	11.91	20.07	29.49				
	60212	Kihansi	8.31	1.22	2.07	3.49	5.13				
	40601	Mchuchuma	47.79	7.01	11.91	20.07	29.49				
	90602	Nvakanazi	12.23	23.11	38.04	63.59	106.39				
	90701	Rusomo	12.23	23.11	38.04	63.59	106.39				
Kagera	91002	Kvaka	12.23	23.11	38.04	63.59	106.39				
	91201	Kibeta	12.23	23.11	38.04	63.59	106.39				
Kigoma	90402	Kigoma	29.11	48.33	81.59	138.34	208 43				
Nigoma	50311	Kiyungi	45 79	53 25	79.69	119.58	179.22				
Kilimaniaro	51011	Same	3 32	3.86	5 77	8 66	12.99				
Kiimanjaro	50313	KIΔ	16 59	19.29	28.87	43.32	64 94				
	20201	Somanga	18.63	13.23	20.07	38 30	62.82				
Lindi	20201	Lindi	0.00	13.73	22.04	38.39	62.82				
	50116	Babati	0.00	11.70	15.05	20.00	20.60				
Manyara	50016	Mbulu	9.22	154	2 16	22.33	30.00				
	20201	Runda	10.10	20.20	2.10	50.04	90 17				
Mara	20201	Museme	22.42	20.29	61.60	104.49	157.79				
Iviara	20216	Nusoma	32.42	50.30	01.09	144.40	210 11				
Mhava	40212	Mhave	105.05	151.00	00.20	200.16	505 51				
MDeya	40212		70.95	151.20	242.03	390.10	262.01				
	80111	Iviorogoro Kidatu	70.84	99.04	100.03	243.30	303.40				
Morogoro	10411		21.48	30.03	47.47	/3.80	10.20				
	10411		24.22	44.00	69.84	111.76	169.30				
	80401	IVITIDWA	80.00	80.00	80.00	80.00	80.00				
Mtwara	20401	Mtwara	84.47	32.08	27.50	47.31	81.49				
	20501	Masasi			27.50	47.31	81.49				
Mwanza(Geita)	30112	Mwanza	111.57	144.83	237.85	386.97	590.15				
	30401	Geita	111.57	144.83	237.85	386.97	590.15				
	10611	Mlandizi	35.55	58.30	92.58	148.65	225.56				
Pwani	11402	Bagamoyo	75.55	98.30	132.58	188.65	265.56				
	20101	Mkuranga		17.33	27.51	44.17	67.03				
Rukwa(Katavi)	90301	Mpanda	6.99	10.45	17.79	30.68	58.76				
	90101	Sumbawanga	6.99	10.45	17.79	30.68	58.76				
Ruvuma	20701	Tunduru			34.73	61.20	100.00				
	20902	Songea	16.30	39.47	34.73	61.20	100.00				
Shinyanga	70312	Shinyanga	40.52	55.60	97.21	171.36	266.77				
(Simivu)	71010	Buzwagi	27.01	37.07	64.81	114.24	177.85				
(Ciniyu)	70112	Bulyanhulu	67.53	92.66	162.02	285.61	444.61				
Singida	80312	Singida	16.30	23.42	41.66	74.21	113.09				
Tanza	51111	Tanga	60.55	79.35	129.74	211.02	313.85				
i anga	51302	Segera	60.55	79.35	129.74	211.02	313.85				
<b>T</b> .	70401	Tabora	54.49	86.44	159.85	293.27	488.73				
labora	70201	Lusu	29.34	46.54	86.08	157.92	263.16				

Table 4-4: Grid Substation Load forecast

#### 4.5 Planned Transmission Line Projects

By TANESCO, the following transmission line projects are planned.

- i. 400kV Backbone Project (BTLP) 400kV: Iringa – Dodoma – Singida – Shinyanga
- ii. 400/220 kV Project
  - a. 400kV : Kinyerezi Chalinze Segera Arusha
  - b. 220kV : Kinyerezi Ubungo (Cut-in)
  - c. 220kV : Zinga Kibaha (Cut-in)
  - d. 220kV : Segera Tanga
- iii. 400kV ZTK Project
  - a. 400kV: Singida Arusha Isinya (Kenya)
  - b. 400kV: Iringa Kisada Mbeya Nakonde (Zambia)
- iv. 400kV Project 400 kV: Chalinze – Dodoma
- v. 220kV Project 220kV: Makambako – Madaba – Songea
- vi. 400kV Northeast Grid 400kV: Mbeya – Sumbawanga – Mpanda – Kigoma – Nyakanazi
- vii. 220kV Projects
  - a. 220kV: Rusumo Nyakanazi
  - b. 220kV: Geita Nyakanazi
  - c. 220kV: Rusumo Kyaka Masaka (Uganda)
- viii. 400kV Projects
  - a. 400kV: Kinyerezi Mkuranga Somanga Fungu
  - b. 400kV: Somanga Fungu Lindi Mtwara
  - c. 400kV: Mtwara Namialo (Mozambique)
- ix. 400kV Project 400kV: Songea – Tunduru – Masasi – Lindi
- x. 220kV Project
   220kV: Mbeya Kyela Karonga (Malawi)

#### 4.6 Transmission System Additions - Least Cost Expansion Plan

TANESCO planned the transmission projects as stated above. As a results of the analysis, PSMP2016 Update recommends the following additions of transmission system which satisfy transmission planning criteria.

#### 4.6.1 **Transmission lines additions**

Rated				Pouto			Conductor		Veerteke	Current		Normal
Voltage	from	to	Remarks	Length	No. of	Code	No. of	Aluminum	Com-	Rating <sup>*1</sup>	Full Rating	Rating <sup>*2</sup>
(k\/)	nom	10	rtemano	(km)	Circuit	Name	Cond. per	Sectional	missioned	(Amps)	(MVA)	(MVA)
(100	Dodomo	Singido	Poolkhono Drojoot	210	2	Plugiou	Phase	Area (mm2)	2016	1.002	2.026	2 4 2 4
400	Iringo	Dodomo	Backbone Project	210	2	Bluejay	2	564	2010	1,092	3,020	2,421
400	Singida	Shinvanga	Backhone Project	200	2	Blueiav	2	564	2010	1,092	3,020	2,421
220	Kinverezi	Uhungo-Pai	Jacobson	8	1	Blueiav	2	564	2016	1,002	832	666
220	Libungo-Pai	Kinverezi	Jacobson	8	1	Blueiav	2	564	2016	1,032	832	666
132	Kinverezi	F7-II	000000011	5	1	Wolf	1	150	2016	406	93	74
132	Morogoro	Mtibwa	MCC. F/S completed	88	1	Hawk	1	242	2016	659	151	121
220	Wind Project	Singida		10	1	Blueiav	2	564	2017	1.092	832	666
400	Kin-Som SwS1	Kin-Som SwS2		53	2	Bluejay	8	564	2018	1,092	12,105	9,684
400	Kin-Som SwS2	Kin-Som SwS3		53	2	Bluejay	8	564	2018	1,092	12,105	9,684
400	Kin-Som SwS3	Somanga Fungu P/S	210 MW	53	2	Bluejay	8	564	2018	1,092	12,105	9,684
400	Kinyerezi	Kin-Som SwS1		53	2	Bluejay	8	564	2018	1,092	12,105	9,684
400	Kisada	Iringa		106	2	Bluejay	8	564	2018	1,092	12,105	9,684
400	Kisada	Madaba		243	2	Bluejay	8	564	2018	1,092	12,105	9,684
400	Muchuchuma P/S	Madaba	Total 1,800 MW	15	2	Bluejay	4	564	2018	1,092	6,052	4,842
220	Geita	Nyakanazi		130	2	Bluejay	2	564	2018	1,092	1,664	1,332
220	Madaba	Songea		171	1	Bluejay	2	564	2018	1,092	832	666
220	Makambako	Madaba		162	1	Bluejay	2	564	2018	1,092	832	666
220	Nyakanazi	Rusumo Falls P/S	30 MW	97	1	Bluejay	4	564	2018	1,092	1,664	1,332
220	Rusumo Falls P/S	Kyaka	30 MW	150	1	Bluejay	4	564	2018	1,092	1,664	1,332
220	Shinyanga	Geita		240	2	Bluejay	4	564	2018	1,092	3,329	2,663
400	Arusha	Singida	un ta Kanua hardar	317	2	Bluejay	2	564	2019	1,092	3,026	2,421
400	Arusna	Isinya (Kenya)	up to Kenya border	114	2	Flint	<u></u>	3/5	2019	790	3,284	2,627
400	Linui Mtwore B/S	Somanga Fungu	400 MM	210	2	Bluejay	0	564	2019	1,092	12,105	9,004
220	Ivilwala F/S	Linui Niiro (Arucho oxisting)	400 10100	- 14	2	Bluejay	4	504	2019	1,092	2,002	4,042
220	Iringo		(36+52+120) MM/	120	2 1	Blueiay	4 2	564	2019	1,092	3,329	2,003
220	Solar I	Dodoma	50 MM	120	1	Bluejay	1	242	2019	1,092	416	333
132	Wind Project	Makambako	100 MW	10	1	Hawk	1	242	2019	659	151	121
400	Chalinze	Segera		175	1	Blueiav	4	564	2020	1.092	3.026	2.421
400	Chalinze	Dodoma		336	1	Blueiav	2	564	2020	1.092	1.513	1.210
400	Chalinze	Segera		175	1	Blueiav	4	564	2020	1.092	3.026	2.421
400	Kigoma	Mpanda		290	2	Bluejay	8	564	2020	1,092	12,105	9,684
400	Kinyerezi	Chalinze		138	2	Bluejay	4	564	2020	1,092	6,052	4,842
400	Kisada	Mbeya		186	2	Bluejay	8	564	2020	1,092	12,105	9,684
400	Kiwira P/S	Mbeya	400MW in 2020	110	2	Bluejay	8	564	2020	1,092	12,105	9,684
400	Mbea	Nakonde(Zambia)	up to Zambia border	93	2	Bluejay	2	564	2020	1,092	3,026	2,421
400	Mbe-Sum SwS	Sumbawanga		150	2	Bluejay	8	564	2020	1,092	12,105	9,684
400	Mbeya	Mbe-Sum SwS		150	2	Bluejay	8	564	2020	1,092	12,105	9,684
400	Mpanda	Mpa-Sum SwS		119	2	Bluejay	8	564	2020	1,092	12,105	9,684
400	Mpa-Sum SwS	Sumbawanga		119	2	Bluejay	8	564	2020	1,092	12,105	9,684
400	Mtwara	Namialo(Mozambique)	up to Mozambique border	51	2	Bluejay	2	564	2020	1,092	3,026	2,421
400	Nyakanazi	Kigoma		317	2	Bluejay	8	564	2020	1,092	12,105	9,684
400	Segera	Arusha		366	1	Bluejay	4	564	2020	1,092	3,026	2,421
400	Somanga Fungu P/S	Somanga P/S(PPP)	300MW	20	2	Bluejay	2	564	2020	1,092	3,026	2,421
220	Bagamoyo (Zinga)	Kibana-Pai		45	1	Bluejay	1	564	2020	1,092	416	333
220	Bunda Kihaha Dai	Musona		60	1	Bluejay	4	564	2020	1,092	1,664	1,332
220	Kibana-Pai Kibuorozi	Bagamoyo (Zinga)		45	1	Bluejay	1	564	2020	1,092	416	333
220	Kiriyerezi Kishapu Salar	Obungo Shinyanga		12	Z	Bluejay	1	202	2020	1,092	032	222
220	Kisriapu Solar	Shinyanga Masaka(Liganda)	150 IVIV	30	1	Bluejay	I	30Z 564	2020	1,092	410 922	<u> </u>
220	ryara Kvolo	Karonga(Malawi)	up to Malawi border	20	1	Bluejay	2	564	2020	1,092	832	666
220		Tahora		130	1	Blueiav	2	564	2020	1,092	832	666
220	Mheva	Kvela		106	1	Blueiay	2	564	2020	1,032	832	666
220	Musona	Nyamongo		90	1	Blueiav	4	564	2020	1.092	1.664	1.332
220	Mwanza	Bunda		150	1	Blueiav	4	564	2020	1.092	1.664	1.332
220	Segera	Tanga		76	2	Blueiav	2	564	2020	1.092	1.664	1.332
220	Shinyanga	Lusu		64	1	Bluejav	1	564	2020	1,092	416	333
132	Kinyerezi	FZ-II		5	2	Hawk	2	242	2020	659	603	482
132	Morogoro	Mtibwa		88	1	Hawk	1	242	2020	659	151	121
66	Babati	Mbulu		85	2	Wolf	2	150	2020	406	186	149
Note:	*1 Source: SURAL ca	talogue										

#### Table 4-5: Transmission System Additions from 2016 to 2020

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

1 able 4-0. ITalistilission system additions itom 2021 to 2023	Tab	ole 4-6:	Transmission	System	additions	from 202	1 to 202
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Rated				Route			Conductor	•	Year to be	Current		Normal
Voltage	from	to	Remarks	Length	No. of	Code	No. of	Aluminum	Com-	Rating <sup>*1</sup>	Full Rating	Rating <sup>*2</sup>
(kV)				(km)	Circuit	Name	Cond. per	Sectional	missioned	(Amps)	(IVIVA)	(MVA)
400	Kinvarazi	Marongo D/C	200 MM	70	0	Blueieu	Phase	Area (mm2)	2022	1.000	10.105	0.694
400	Kinyerezi	ivikurariya P/S	300 10100	70		ыцејау	0	504	2022	1,092	12,105	9,004
400	Madaba	Songea		171	2	Bluejay	2	564	2023	1,092	3,026	2,421
400	Masasi	Lindi		141	2	Bluejay	4	564	2023	1,092	6,052	4,842
400	Ngaka P/S	Songea	600MW in 2023	37	2	Bluejay	4	564	2023	1,092	6,052	4,842
400	Songea	Tunduru		230	2	Bluejay	4	564	2023	1,092	6,052	4,842
400	Tunduru	Masasi		194	2	Bluejay	4	564	2023	1,092	6,052	4,842
400	Sumbawanga	Rukwa P/S	300MW in 2024	46	2	Bluejay	8	564	2024	1,092	12,105	9,684
132	Malagarasi P/S(Stage III)	Kigoma	44.7 MW	74	1	Hawk	1	242	2024	659	151	121
400	Chalinze	Bagamoyo		102	2	Bluejay	8	564	2025	1,092	12,105	9,684
400	Shinyanga	Mwanza		140	2	Bluejay	8	564	2025	1,092	12,105	9,684
220	Bagamoyo	North DSM		40	2	Bluejay	4	564	2025	1,092	3,329	2,663
220	Geothermal 1	Mbeya	(2 x 50 MW) x2	35	1	Bluejay	1	564	2025	1,092	416	333
220	Kinyerezi	South DSM		25	2	Bluejay	4	564	2025	1,092	3,329	2,663
220	Mkuranga	South-east DSM		50	2	Bluejay	4	564	2025	1,092	3,329	2,663
220	South DSM	South-east DSM		30	2	Bluejay	2	564	2025	1,092	1,664	1,332
132	Kyaka	Kibeta/Bukoba		54	1	Hawk	2	242	2025	659	301	241
66	Mbulu	Karatu		65	2	Wolf	2	150	2025	406	186	149

Note:

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

#### Table 4-7: Transmission Additions from 2026 to 2030

Rated				Route			Conductor		Year to be	Current		Normal
Voltage	from	to	Remarks	Length	No. of Circuit	Code	No. of Cond. per	Aluminum	Com-	Rating <sup>*1</sup>	Full Rating (MVA)	Rating <sup>*2</sup>
(kV)				(km)		Name	Phase	Area (mm2)	missioned	(Amps)		(MVA)
220	Geothermal 1	Geothermal 2	2 x 50 MW	20	1	Bluejay	1	564	2026	1,092	416	333
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
220	lbosa P/S (Hydro)	Nginayo P/S (Hydro)	52MW	10	1	Bluejay	1	564	2026	1,092	416	333
220	Zinga P/S	Bagamoyo	200 MW	15	1	Bluejay	2	564	2027	1,092	832	666
132	Kakono P/S (Hydro)	Kyaka	87 MW	39	1	Hawk	1	242	2027	659	151	121
400	Mnyera S/S (new)	Kisada	(668.2+358) MW	180	2	Bluejay	4	564	2028	1,092	6,052	4,842
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
132	Songwe B S/S	Kyela	(79.5 + 88.1) MW	7	2	Hawk	1	242	2028	659	301	241
132	Songw e Manolo P/S (Hydro)	Songwe B S/S	88.1 MW	17	1	Hawk	1	242	2028	659	151	121
220	Kwanini P/S (Hydro)	Mnyera S/S-Ruaha2 T/L	T-branch	10	1	Bluejay	2	564	2029	1,092	832	666
220	Mnyera 2 P/S (Hydro)	Mnyera S/S-Ruaha2 T/L	T-branch	10	1	Bluejay	2	564	2029	1,092	832	666
400	Shinyanga	Tabora		200	2	Bluejay	8	564	2030	1,092	12,105	9,684
400	Somanga Fungu S/S	Future CGT3-1	4x470 MW	20	2	Bluejay	4	564	2030	1,092	6,052	4,842
400	Tab-Mpa SwS	Mpanda		150	2	Bluejay	8	564	2030	1,092	12,105	9,684
400	Tabora	Tab-Mpa SwS		150	2	Bluejay	8	564	2030	1,092	12,105	9,684
220	Bagamoyo	Mlandizi		40	2	Bluejay	1	564	2030	1,092	832	666
220	Kinyerezi	West DSM		20	2	Bluejay	4	564	2030	1,092	3,329	2,663
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
220	Pumbwe P/S (Hydro)	Mnyera S/S-Taveta3 T/L	T-branch	10	1	Bluejay	2	564	2030	1,092	832	666
220	West DSM	North DSM		20	2	Bluejay	2	564	2030	1,092	1,664	1,332
132	Njiro (Arusha existing)	Kiyungi	T-branch to KIA	77	2	Hawk	4	242	2030	659	1,205	964

Note:

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

## Table 4-8: Transmission Additions from 2031 to 2035

Rated Voltage (kV)	from	to	Remarks	Route Length (km)	No. of Circuit	Code Name	Conductor No. of Cond. per Phase	Aluminum Sectional Area (mm2)	Year to be Com- missioned	Current Rating <sup>*1</sup> (Amps)	Full Rating (MVA)	Normal Rating <sup>*2</sup> (MVA)
400	Mkuranga	Mku-Som SwS1		61	2	Bluejay	8	564	2031	1,092	12,105	9,684
400	Mku-Som SwS1	Mku-Som SwS2		61	2	Bluejay	8	564	2031	1,092	12,105	9,684
400	Mku-Som SwS2	Somanga Fungu S/S		61	2	Bluejay	8	564	2031	1,092	12,105	9,684
220	Mufindi	Mpanga P/S (Hydro)	160 MW	65	1	Bluejay	2	564	2031	1,092	832	666
220	Taveta 3 P/S (Hydro)	Kisingo P/S (Hydro)	119.8MW	15	1	Bluejay	2	564	2031	1,092	832	666
220	Masigira P/S (Hydro)	Madaba	118 MW	73	1	Bluejay	2	564	2032	1,092	832	666
400	Somanga Fungu S/S	Future CGT3-2	6x470 MW	20	2	Bluejay	4	564	2033	1,092	6,052	4,842
220	Mbeya	Rumakali P/S (Hydro)	222MW	104	1	Bluejay	2	564	2033	1,092	832	666
220	Mnyera S/S (new)	Ruhudji P/S (Hydro)	358 MW	88	1	Bluejay	2	564	2033	1,092	832	666
220	Kihansi P/S (Hydro)	Upper Kihansi P/S (Hydro)	47MW	10	1	Bluejay	1	564	2034	1,092	416	333
220	Kikonge P/S (Hydro)	Madaba	300 MW	49	1	Bluejay	2	564	2034	1,092	832	666
132	Songwe A S/S	Songwe B S/S		40	1	Hawk	1	242	2034	659	151	121
132	Songw e Sofre P/S (Hydro)	Songwe A S/S	79.5 MW	16	1	Hawk	1	242	2034	659	151	121
400	Chalinze	Segera		175	1	Bluejay	4	564	2035	1,092	3,026	2,421
400	Segera	Arusha		366	2	Bluejay	4	564	2035	1,092	6,052	4,842
400	Somanga Fungu S/S	Chalinze		284	2	Bluejay	8	564	2035	1,092	12,105	9,684
400	Stiegler's Gorge	Chalinze	2 x 1,048 MW	195	2	Bluejay	8	564	2035	1,092	12,105	9,684
220	Bulyanhulu	Shinyanga		130	2	Bluejay	4	564	2035	1,092	3,329	2,663
220	Bunda	Musona		60	1	Bluejay	4	564	2035	1,092	1,664	1,332
220	Kyaka	Masaka(Uganda)	up to Uganda border	30	1	Bluejay	2	564	2035	1,092	832	666
220	Musona	Nyamongo		90	1	Bluejay	4	564	2035	1,092	1,664	1,332
220	Mwanza	Bunda		150	1	Bluejay	4	564	2035	1,092	1,664	1,332
220	Nyakanazi	Rusumo Falls P/S		97	1	Bluejay	4	564	2035	1,092	1,664	1,332
220	Rusumo Falls P/S	Kyaka		150	1	Bluejay	4	564	2035	1,092	1,664	1,332
220	Shinyanga	Buswagi		108	2	Bluejay	4	564	2035	1,092	3,329	2,663
132	Kyaka	Kibeta/Bukoba		54	1	Hawk	2	242	2035	659	301	241
66	Babati	Kondoa		85	2	Wolf	2	150	2035	406	186	149

Note:

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

Rated							Conductor		Year to be	Current		Normal
Voltage (kV)	from	to	Remarks	Length (km)	No. of Circuit	Code Name	No. of Cond. per Phase	Aluminum Sectional Area (mm2)	Com- missioned	Rating <sup>*1</sup> (Amps)	Full Rating (MVA)	Rating <sup>*2</sup> (MVA)
400	Mtwara	Future CGT1 P/S	330MW	50	2	Bluejay	2	564	2036	1,092	3,026	2,421
400	Somanga Fungu	Future CGT3-3	5x470 MW	20	2	Bluejay	4	564	2038	1,092	6,052	4,842
220	Kinyerezi	West DSM		20	1	Bluejay	4	564	2040	1,092	1,664	1,332
220	Shinyanga	Mwanza		140	2	Bluejay	1	564	2040	1,092	832	666
220	Singida	Babati		150	2	Bluejay	1	564	2040	1,092	832	666
220	Singida	Shinyanga		200	2	Bluejay	1	564	2040	1,092	832	666
132	Chalinze	Morogoro		82	2	Hawk	1	242	2040	659	301	241
Note:	*1 Source: SURAL ca	atalogue										

Table 4-9: Transmission Additions from 2036 to 2040

\*2; Normal Rating=Full Rating x 80%

Recommendations: Higher voltage (ex. 700kV) would be recommended for the 400kV transmission lines from Mtwara to Dar es Salaam to reduce the number of lines.

			•	
Voltage	Conductor	Name	Size (mm²)	*Normal Rating (MVA)
400kV	ACSR	Bluejay	565	605
220kV	ACSR	Bluejay	565	333
		Bison	350	207
		Pheasant	644	362
		Rail	483	303
132kV	ACSR	Wolf	150	74
		Hawk	241	121
		Tiger	130	66
	XLPE	—	300/400	143
		—	95	52
66kV	ACSR	Wolf	150	37
		Rabbit	50	18

#### Table 4-10: Transmission line assumed parameters

[Remarks] \*: 80% of current rating

## 4.6.2 Reactive compensation

It was assumed that each 400kV line would be compensated by two line-connected reactors located at the two line ends. The magnitude of each reactor was taken as 35% of the full line charging value, which is equivalent to a total of 70% compensation. These line-connected reactors would be switched on and off based on the system operation requirements. However, for line switching (or energization), these reactors must be switched on to avoid high voltages at the open line ends (Ferranti Effect). These factors are to be the subject of a detailed dynamic study performed at design stage.

## 4.6.3 Substation Additions

Lists of substation additions from 2016 to 2040 are shown in Table 4-11 up to 4-15 below. Configuration of substation equipment, abbreviations in the tables are provided at the bottom of the tables.

Table 4-11: Substation Additions from 2016 to 2020	
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Substation	Voltage	Equipment	Year	Q'ty	Remarks
Arusha	400	1-1/2 CB: 2 cct	2019	2	
		1-1/2 CB: 1 cct		2	
		Tr (375)		2	
		SR-F (70)		2	for Singida
		SR-F (25)		2	for Ishinya
		1-1/2 CB: 1 cct	2020	2	
		SR-F (95)		1	for Segera
		STATCOM (50)		1	
	220	DB-F	2019	2	Connection to existing bus
		DB-Tr		2	New 220 kV bus
		Tr (250)		2	
		DB-BC		1	
		DB-Tr	2020	2	
		Tr (200)		2	
	132 SB-Tr		2020	2	Existing 132 kV bus
Bagamoyo	220	DB-F	2020	2	
		DB-Tr	-	2	
		Tr (90)		2	220/33 kV Transformers
		DB-BC		1	
Bunda	220	DB-F	2020	2	
		DB-Tr		1	
		Tr (100)		1	
		DB-BC		1	
Musoma	220	DB-F	2020	2	
		DB-Tr		1	
		Tr (100)		1	
		DB-BC		1	
Nyamongo	220	DB-F	2020	2	
		DB-Tr		1	
		Tr (100)		1	
		DB-BC		1	

Symbols	Explanatior
1-1/2 CB: 2 cct:	One and Half Bus system with 2 circuits
1-1/2 CB: 1 cct:	One and Half Bus system with 1 circuit
DB-F:	Double Bus system - Feeder bay
DB-Tr:	Double Bus system - Transformer bay
DB-BC:	Double Bus system - Bus Coupler bay
SB-F:	Single Bus system - Feeder bay
SB-Tr:	Single Bus system - Transformer bay
400 kV Tr (xxx):	400/220 kV Transformer (xxx MVA)
220 kV Tr (xxx):	220/132 kV Transformer (xxx MVA)
SR (xxx):	Shunt Reactor (xxx Mvar)
SR-F (xxx):	Shunt Reactor for Feeder (xxx Mvar)
STATCOM (xxx):	Static Var Compensator (xxx Mvar)
SwS:	Switching Station between Substations

Substation	Voltage	Equipment	Year	Q'ty	Remarks	Substation
Chalinze	400	1-1/2 CB: 2 cct	2020	3		Kinyerezi
		1-1/2 CB: 1 cct		2		
		Tr (150)		2		
		SR-F (75)		1	for Dodoma	
		SR-F (45)		2	for Segera	
		SR-F (35)		3	for Kinyerezi	Ubungo
		STATCOM (50)		1		
	220	DB-Tr	2020	3		
		Tr (90)		1		
		DB-BC		1		Kin-Som
	132	SB-F	2020	2	Connection between existing bus	SwS-1
		DB-Tr		1	-	
		DB-BC		1		
Dodoma	400	DB-F	2016	5		
		SR-F (50)		4	for Singida & Iringa	Kin One
		SR-F (75)		1	for Chalinze	Kin-Som
		DB-Tr		3		5w5-2
		Tr (250)		2		
		DB-BC		1		
		STATCOM (50)		1		
	220	DB-Tr	2016	2		
		DB-F	2019	1	Dodoma Solar	Kin-Som
Geita	220	DB-F	2018	4		SwS-3
		DB-BC		1		0100
Iringa	400	DB-F	2016	2		
		SR-F (50)		2	for Dodoma	
		DB-Tr		2		
		Tr (250)		2		
		DB-BC		1		Kisada
		DB-F	2018	2		Noudu
		SR-F (50)		2	for Kisada	
		DB-Tr		1		
		STATCOM (50)		1		
	220	DB-Tr	2016	2		
		DB-F	2019	1	Lower Kihansi (Hydro)	
Kigoma	400	DB-F	2020	4		Kyaka
		SR-F (100)		2	for Nyakanazi	
		SR-F (90)		2	for Mpanda	
		DB-Tr		2		
		Tr (125)		1		
		STATCOM (50)		1		
	220	DB-Tr	2020	2		Rusumo
		DB-BC		1		Kyela
Kinyerezi	400	1-1/2 CB: 2 cct	2018	2		
-		1-1/2 CB: 1 cct	1	5		
		Tr (500)	1	5		Lindi
		SR (50)		1		
		SR-F (15)		2	for Somanga Fungu	
		1-1/2 CB: 1 cct	2020	5		
		SR-F (35)		2	for Chalinze	
		STATCOM (50)		1		
						1

Equipment	Year	Q'ty	Remarks
DB-F	2017	1	for G-I Extension
DB-F	2018	1	for G-II
DB-F	2020	2	for Ubungo
DB-Tr		2	
Tr (200)		2	
DB-F	2020	2	
DB-Tr		3	
Tr (150)		3	
DB-Tr	2020	3	
DB-F	2018	4	SwS between Kinyerezi - Somanga Fungu
SR-F (15)		4	for Kinyerezi & Kin-Som SwS-2
DB-BC		1	
DB-Tr	2020	1	
STATCOM (50)		1	
DB-F	2018	4	SwS between Kinyerezi - Somanga Fungu
SR-F (15)		4	for Kin-Som SwS-1 & Kin-Som SwS-3
DB-BC		1	
DB-Tr	2020	1	
STATCOM (50)		1	
DB-F	2018	4	SwS between Kinyerezi - Somanga Fungu
SR-F (15)		4	for Kin-Som SwS-2 & Somanga Fungu
DB-BC		1	
DB-Tr	2020	1	
STATCOM (50)		1	
1-1/2 CB: 2 cct	2018	2	
1-1/2 CB: 1 cct		2	
SR-F (60)		2	for Mbeya
SR-F (75)		2	for Madaba
SR-F (50)		2	for Iringa
1-1/2 CB: 1 cct	2020	1	
STATCOM (50)		1	
DB-F	2018	1	
DB-Tr		1	
Tr (100)		1	
DB-BC		1	
DB-F	2020	1	for Uganda (Export)
SB-Tr	2018	1	
DB-F	2018	2	for Kyaka & Nyakanazi
DB-F	2020	1	for Mbeya
DB-F		1	for Malawi (Export)
DB-BC		1	
DB-F	2019	4	
SR-F (65)		2	for Somanga Fungu
SR-F (20)		2	for Mtwara
DB-Tr		1	
Tr (125)		1	
DB-BC		1	
DB-Tr	2020	1	

Voltage 

Substation	Voltage	Equipment	Year	Q'ty	Remarks	1	Substation	Voltage	Equipment	Year	Q'ty	Remarks	Substation	Voltage	ļ
Lindi	400	STATCOM (50)	2020	1			Mho Sum SwS	400		2020	4	SwS between Mbeya -	Singida	400	
	220	DB-Tr	2019	1			NDE-SUIT SWS	400	DD-F	2020	4	Sumbawanga			
		DB-BC		1					SR-F (35)		2	for Sumbawanga			
Madaba	400	DB-F	2018	4					SR-F (50)		2	for Mbeya			
		SR-F (75)		2	for Kisada				DB-BC		1				
		DB-Tr		1					DB-Tr		1				_
		Tr (125)		1					STATCOM (50)		1				_
		DB-BC		1			Mtwara	400	DB-F	2019	2			220	
		DB-Tr	2020	1					SR-F (20)		2	for Lindi			_
		STATCOM (50)		1					DB-Tr		2	Mtwara Gen. & 125 MVA		100	+
	220	DB-F	2018	2	for Makambako &					4		Tr	Somanga	132	+
	220	661	2010		Songea				Tr (125)	_	1		Fungu	400	
		DB-Tr	_	1					DB-BC		1		i anga		F
		DB-BC		1		_			DB-F	2020	2				
Mbeya	400	DB-F	2018	2		_			SR-F (10)	_	2	for Mozambique (Export)			
		SR-F (60)	_	2	for Kisada	_			DB-Tr	-	1				
		DB-Tr	-	1					STATCOM (50)		1				
		Tr (500)	-	1				220	DB-Tr	2019	2				
		DB-BC		1					DB-BC		1				
		DB-F	2020	6		_		132	SB-Ir	2019	1				
		SR-F (35)		2	for Kiwira (Coal)	_	Mwanza	220	DB-F	2020	1	for Bunda			
		SR-F (50)		2	for Sumbawanga via		Nh salaan aadi	400	DB-BC	0000	1				+
			_		SWS	_	Nyakanazi	400		2020	2	for Virono		220	-
	220	3R-F (20)	2019	1	TOT Zambia (Export)					-		IOF RIGOMA	Songoo	220	+
	220		2010	1		_					4		Songea	220	-
		DB-BC	2020	1	for kvela	-			SR (100)	-	1		Tabora	220	+
Makambako	220	SB-F	2018	1	for Madaba	-			STATCOM (50)		1				
Manarhbano	132	SB-F	2019	1	Wind Project	_			DB-BC	_	1				
Morogoro	220	DB-Tr	2020	2		_		220	DB-F	2018	3	for Geita (2) & Rusumo			
	_	Tr (150)		2				-	DB-BC		1		Lusu	220	
	132	DB-F	2016	1	for Mtibwa				DB-Tr	2020	2				
		DB-F	2020	1	Ditto		Segera	400	1-1/2 CB: 2 cct	2020	2				
Mtibwa	132	DB-F	2016	1	for Morogoro				1-1/2 CB: 1 cct		1				_
		DB-F	2020	1	Ditto				SR-F (45)		1	for Chalinze	langa	220	-
Mpanda	220	DB-Tr	2020	1					SR-F (95)		1	for Arusha			-
		DB-BC		1					Tr (150)		2				-
Sumbawanga	400	DB-F	2020	4					STATCOM (50)		1				
		SR-F (35)		2	for Mpanda via SwS			220	DB-F	2020	2	for Tanga (2)			
		SR-F (50)		2	for Mbeya via SwS				DB-Tr		2				
		DB-Tr		2					DB-BC		1				
		Tr (125)		1			Shinyanga	400	DB-F	2016	2				
		STATCOM (50)	_	1					SR-F (50)		2	for Singida			
		DB-BC		1					DB-Tr		2				
	220	DB-Tr	2020	1					Tr (315)		2				
		DB-BC		1					DB-BC		1				
Mpa-Sum SwS	400	DB-F	2020	4	SwS between Mpanda -				DB-Tr	2020	1				
					Sumbawanga	_			STATCOM (50)		1				
		SR-F (35)		4	for Mpanda &			220	DB-F	2018	2	for Geita			
			-		Sumbawanga	_			DB-BC		1				
		DB-BC	-			_			DB-F	2020	3	tor Lusu & Kishapu Solar			
			-	1		-	Singida	400	DB-F	2016	4				
		STATCOM (50)	1	1		1									

Equipment	Year	Q'ty	Remarks
SR-F (50)	2016	4	for Shinyanga & Dodoma
DB-BC		1	
DB-F	2019	2	
SR-F (70)		2	for Arusha
DB-Tr		3	
Tr (250)		2	
STATCOM (50)		1	
DB-F	2017	2	Singida Wind
DB-Tr	2020	4	
Tr (100)		2	
SB-Tr	2020	2	
1-1/2 CB: 2 cct	2018	2	Somanga Fungu I (210 MW)
SR-F (15)		2	for Kinyerezi
1-1/2 CB: 2 cct	2019	1	Somanga Fungu I (Add-on 110 MW)
1-1/2 CB: 1 cct		1	
SR-F (65)		2	for Lindi
Tr (125)		1	
1-1/2 CB: 2 cct	2020	1	Somanga Fungu (PPP 300 MW)
1-1/2 CB: 1 cct		1	
STATCOM (50)		1	
DB-Tr	2019	1	
DB-BC		1	
DB-F	2018	1	for Madaba
DB-BC		1	
DB-F	2020	1	
DB-Tr		1	
Tr (100)		1	
DB-BC		1	
DB-F	2020	1	
DB-Tr		1	
Tr (100)		1	
DB-BC		1	
DB-F	2020	2	for Segera
DB-Tr		2	
Tr (90)		1	
DB-BC		1	

#### Table 4-12: Substation Additions from 2021 to 2025

Substation	Voltage	Equipment	Year	Q'ty	Remarks
Arusha	220	DB-Tr	2023	1	
		Tr (200)		1	
	132	SB-Tr	2023	1	Existing 132 kV bus
Babati	220	DB-Tr	2025	1	
		Tr (150)		1	
Bagamoyo	400	DB-F	2025	2	
		SR-F (30)		2	for Chalinze
		DB-Tr		1	
		Tr (500)		1	
		DB-BC		1	
		DB-Tr	1	1	
		STATCOM (50)		1	
	220	DB-F	2025	2	
Chalinze	400	1-1/2 CB: 1 cct	2025	2	
		SR-F (30)		2	for Bagamovo
	220	DB-Tr	2025	1	
	_	Tr (90)		1	
	132	DB-Tr	2025	1	
Kigoma	400	DB-Tr	2025	1	
lagonia	100	SR (50)		1	
	220	DB-Tr	2024	1	
	220	Tr (55)	2024	1	for Malagalasi (Hydro)
	132	SB-F	2024	1	for Malagalasi (Hydro)
Kinverezi	400	1-1/2 CB: 1 cct	2024	2	Tor Malagalasi (Hydro)
Kinyerezi	400	SP_E (20)	2022	1	for Mkuranga
	220		2025	1	for South DSM
Kuaka	122		2025	1	for Kiboto/Pokobo
Kyaka Lindi	102		2025	1 2	for Moscoi
LINGI	400		2023	2	TOF IVIASASI
Madaha	400	SR-F (35)	20022	2	for Connec
IVIADADA	400		2023	2	for Songea
N 41	400	SR-F (40)	0005	2	
ivibeya	400	DB-Ir	2025	2	
		SR (50)	-	1	
		STATCOM (50)		1	
	220	DB-F	2025	1	Geothermal A
Geothermal A	220	DB-F	2025	1	for Mbeya
		DB-Tr	_	1	
		DB-BC		1	
Mkuranga	400	DB-F	2022	2	
		SR-F (20)	4	2	for Kinyerezi
		DB-BC		1	
		DB-Tr	2025	3	
		Tr (500)	4	2	
		STATCOM (50)		1	
	220	DB-Tr	2025	2	
		DB-BC		1	
		DB-F		2	for Southeast DSM
Mwanza	400	DB-F	2025	2	
		SR-F (45)		2	for Shinyanga
		DB-Tr		1	

Substation	Voltage	Equipment	Year	Q'ty	Remarks
Mwanza	400	Tr (500)	2025	2	
		DB-BC		1	
		DB-Tr		2	
		STATCOM (50)		1	
	220	DB-F	2025	2	Connection between existing bus
		DB-Tr		4	Ű.
		Tr (200)		2	
	132	SB-Tr	2025	2	
Shinyanga	400	DB-Tr	2022	1	
		Tr (1,000)		1	
		DB-F	2025	2	
		SR-F (45)		2	for Mwanza
	220	DB-Tr	2022	1	
Songea	400	DB-F	2023	6	
<u> </u>	_	SR-F (10)		2	Ngaka (Coal)
		SR-F (40)	1	2	for Madaba
		SR-F (60)	1	2	for Tunduru
		DB-Tr	1	1	
		Tr (125)		1	
		DB-BC	_	1	
		DB-Tr	2025	1	
		STATCOM (50)	2020	1	
	220	DB-Tr	2023	1	
Tunduru	400	DB-F	2023	4	
Tanadia		SR-E (60)	2020	2	for Songea
		SR-F (50)	-	2	for Masasi
		DB-Tr	-	1	
		Tr (125)	-	1	
			_	1	
			2025	1	
			2025	1	
	220		2022	1	
	220	DD-11 Tr (125)	2023	1	
			-	1	
Magazi	400		2022	1	
11192921	400		2023	4	for Tunduru
		SR-F (30)	1	2	for Lindi
		DR-F (33)	1	4	
			-	4	
		IF (125)	-	1	
			2025	1	
			2025	1	
	000		2000	1	
	220		2023	1	
		IF (125)	-	1	
	000	DR-RC	0007	1	fan Dawa
North DSM	220	DB-F	2025	2	tor Bagamoyo
		DB-Ir	-	1	
		Tr (400)	-	1	
		DB-BC		1	
	132	SB-Tr	2025	1	
			1		

Substation	Voltage	Equipment	Year	Q'ty	Remarks
South DSM	220	DB-F	2025	4	for Kinyerezi & Southeast DSM
		DB-Tr		1	
		Tr (400)		1	
		DB-BC		1	
	132	SB-Tr	2025	1	
Southeast DSM	220	DB-F	2025	4	for South DSM & Mkuranga
		DB-Tr		1	
		Tr (400)		1	
		DB-BC		1	
	132	SB-Tr	2025	1	

## Table 4-13: Substation Additions from 2026 to 2030

Substation	Voltage	Equipment	Year	Q'ty	Remarks
Arusha	400	1-1/2 CB: 1 cct	2030	1	
		Tr (250)		1	
	220	DB-Tr	2029	1	
		Tr (200)		1	
		DB-Tr	2030	1	
		Tr (250)		1	New 220 kV bus
	132	SB-Tr	2029	1	Existing 132 kV bus
		SB-Tr	2030	1	Existing 132 kV bus
Bagamoyo	400	DB-Tr	2029	1	
		Tr (500)		1	
	220	DB-F	2027	1	
		DB-F	2030	2	
Bunda	220	DB-Tr	2030	1	
		Tr (100)		1	
Musoma	220	DB-Tr	2028	1	
		Tr (100)		1	
Nyamongo	220	DB-Tr	2026	1	
, ,		Tr (100)		1	
				_	for Iringa, Lower
Ibosa	220	DB-F	2026	3	Kihansi & Nginayo
Kigoma	400	DB-Tr	2030	1	
C		Tr (125)		1	
Kinyerezi	220	DB-F	2030	2	for West DSM
Kisada	400	1-1/2 CB: 1 cct	2028	2	
		SR-F (45)		1	for Mnyera (Hydro)
Kyaka	220	DB-Tr	2030	1	
5		Tr (100)		1	
	132	SB-F	2027	1	for Kakono (Hvdro)
		SB-Tr	2030	1	
Kvela	220	DB-Tr	2028	1	
		Tr (200)		1	
	132	SB-Tr	2028	1	
		SB-F		2	for Songwe B S/S
Songwe B S/S	132	SB-F	2028	3	Manalo (Hvdro)
Lindi	400	DB-Tr	2030	1	
		Tr (125)		1	
	220	DB-Tr	2030	1	
Madaba	400	DB-Tr	2030	1	
madaba		Tr (125)	2000	1	
	220	DB-Tr	2030	1	
	220	DB-Tr	2000	1	
		Tr (500)	2020	1	
Mbeva	400	DR-Tr	2028	1	
Mocya	400	Tr (500)	2020	1	
	220	ד פח	2020	1	
Coatharras	220		2020	1	for Coathernel D
Geothermal A	220	DR-F	2026	1	Ior Geothermal B
IVIkuranga	400	DB-Ir	2030	1	
		Ir (500)		1	
	220	DB-Tr	2030	1	
Mlandizi	220	DB-F	2030	2	for Bagamoyo

Substation	Voltage	Equipment	Year	Q'ty	Remarks
Mlandizi	220	DB-Tr	2030	2	
		Tr (100)		2	
		DB-BC		1	
	132	SB-F	2030	1	
		SB-Tr		2	
		SB-Tr		1	
Mnyera	400	DB-F	2028	2	
		SR-F (45)		2	for Kisada
		DB-BC		1	
		DB-Tr		3	
		Tr (500)		2	
		STATCOM (50)		1	
	220	DB-F	2028	1	Ruaha 2 (Hvdro)
		DB-Tr		2	
		DB-BC		1	
		DB-F	2030	1	Taveta 3 (Hydro)
Morogoro	220	DB-Tr	2000	1	
Worogoro	220	Tr (150)	2000	1	
Moondo	400		2020	2	
ivipariua	400		2030	2	for Toboro via SwS
		SK-F (43)		2	SwS botwoon Moanda
Mpa-Tab SwS	400	DB-F	2030	4	- Tabora
		SR-F (45)	_	4	for Mpanda & Tabora
		DB-BC		1	
		DB-Tr		1	
		STATCOM (50)		1	
Mtwara	400	DB-Tr	2030	1	
		Tr (125)		1	
	220	DB-Tr	2030	2	
	132	SB-Tr	2030	1	
Segera	400	1-1/2 CB: 1 cct	2029	1	
		Tr (250)		1	
	220	DB-Tr	2029	1	
Shinyanga	400	DB-F	2030	2	
		SR-F (65)		2	for Tabora via SwS
Somanga Fungu	400	1-1/2 CB: 2 cct	2030	1	Future CGT3-1
5		1-1/2 CB: 1 cct		1	
		Tr (125)		1	
	220	DB-Tr	2030	1	
Tabora	400	DB-F	2030	4	
labola	100	SR-E (45)	2000	2	for Mnanda via SwS
		SR-F (65)	_	2	for Shinyanga
			_	2	Tor Orninyanga
		Tr (500)	_	2	
			-	∠ 1	
			-	4	
1	000		0000		
LUSU	220		2026	1	
	000	ir (100)	0000	1	
North DSM	220	DB-F	2030	2	tor West DSM
West DSM	220	DB-F	2030	4	tor North DSM & Kinyerezi
		DB-Tr		1	

Substation	Voltage	Equipment	Year	Q'ty	Remarks
West DSM	220	Tr (400)	2030	1	
		DB-BC		1	
	132	SB-Tr	2030	1	
Southeast DSM	220	DB-Tr	2030	1	
		Tr (400)		1	
	132	SB-Tr	2030	1	

#### Table 4-14: Substation Additions from 2031 to 2035

Substation	Voltage	Equipment	Year	Q'ty	Remarks
Arusha	400	1-1/2 CB: 1 cct	2032	1	
		Tr (250)		1	
		1-1/2 CB: 1 cct	2035	2	
		SR-F (95)		2	for Segera
	220	DB-Tr	2032	1	
		Tr (250)		1	New 220 kV bus
		SB-Tr		1	
		Tr (200)		1	
		SB-Tr	2035	1	
		Tr (200)		1	
	132	SB-Tr	2032	1	Existing 132 kV bus
		SB-Tr	2035	1	Ditto
Babati		DB-Tr	2035	1	
		Tr (150)		1	
Bunda	220	DB-F	2035	2	
Musoma	220	DB-F	2035	2	
Nyamongo	220	DB-Tr	2033	1	
		Tr (100)		1	
		DB-F	2035	1	
Chalinze	400	1-1/2 CB: 1 cct	2035	4	
		SR-F (45)		1	for Segera
		SR-F (90)		2	for Somanga Fungu
		SR-F (60)		2	for Stiegler's Gorge
	220	DB-Tr	2034	1	
		Tr (90)		1	
	132	DB-Tr	2034	1	
Kihansi	220	SB-F	2034	1	for Upper Kihansi (Hydro)
Kigoma	400	DB-Tr	2035	1	
		STATCOM (145)		1	
Kinyerezi	400	1-1/2 CB: 1 cct	2035	1	
		Tr (500)		1	
Kyaka	220	DB-F	2035	2	for Uganda (Export) & Rusumo
		SB-F	2035	1	for Kibeta/Bokoba
Rusumo	220	DB-F	2035	1	for Kyaka
Songwe B S/S		SB-F	2034	1	for Songwe A S/S
Songwe A S/S	132	SB-F	2034	2	Sofre (Hydro)
Madaba	220	DB-F	2032	1	Masigira (Hydro)
		DB-F	2034	1	Kikonge (Hydro)
Mbeya	220	DB-F	2033	1	Rumalkali (Hydro)
Mufindi	220	SB-F	2032	1	Mpanga (Hydro)
Mkuranga	400	DB-F	2031	2	
		SR-F (20)		2	for Somanga Fungu
		DB-Tr	2035	1	
		Tr (500)		1	
	220	DB-Tr	2035	1	
Mnyera	400	DB-Tr	2033	1	
Mnyera	400	Tr (500)	2033	1	
	220	DB-F	2033	1	Ruhudji (Hydro)
		DB-Tr		1	

Substation	Voltage	Equipment	Year	Q'ty	Remarks
Mpanda	400	DB-Tr	2035	1	
		Tr (125)		1	
	220	DB-Tr	2035	1	
Sumbawanga	400	DB-Tr	2035	1	
		Tr (125)		1	
	220	DB-Tr	2035	1	
Mtwara	220	DB-Tr	2035	1	
	132	SB-Tr	2035	1	
Mwanza	220	DB-Tr	2033	1	
		Tr (200)		1	
		DB-F	2035	1	for Bunda
	132	SB-Tr	2033	1	
Nyakanazi	400	DB-Tr	2034	1	
		Tr (250)		1	
		DB-Tr	2035	1	
		STATCOM (150)		1	
		STATCOM (55)		1	
	220	DB-Tr	2034	1	
Segera	400	1-1/2 CB: 2 cct	2035	1	
		1-1/2 CB: 1 cct		3	
		SR-F (95)		2	for Arusha
		SR-F (45)		2	for chalinze
		Tr (250)		1	
	220	DB-Tr	2035	1	
Shinyanga	400	DB-Tr	2035	1	
		Tr (1,000)		1	
	220	DB-Tr	2034	2	
		DB-F	2035	4	for Bulyanhulu & Buzwagi
		DB-Tr		1	
Bulyanhulu	220	SB-F	2035	2	for Shinyanga
Buzwagi	220	SB-F	2035	2	for Shinyanga
Somanga Fungu	400	1-1/2 CB: 1 cct	2031	2	
		SR-F (20)		2	for Mkuranga via SwS
		1-1/2 CB: 1 cct	2033	2	Future CGT3-2
		1-1/2 CB: 1 cct	2035	2	
		SR-F (90)		2	for Chalinze
Mku-Som SwS-1	400	DB-F	2031	4	SwS between Mkuranga - Somanga Fungu
		SR-F (20)		4	for Somanga Fungu & Mku-Som SwS-2
		DB-BC	1	1	
Mku-Som SwS-2	400	DB-F	2031	4	SwS between Mkuranga - Somanga Fungu
		SR-F (20)	-	4	for Kin-Som SwS-2 & Mkuranga
		DB-BC	1	1	
Tabora	220	DB-Tr	2033	1	
Tabora	220	Tr (100)	2033	1	
Lusu	220	DB-Tr	2033	1	
		Tr (100)	1	1	
Tanga	220	DB-Tr	2031	1	
		<u>Tr (100)</u>		1	
Tunduru	400	DB-Tr	2033	1	

Substation	Voltage	Equipment	Year	Q'ty	Remarks
Tunduru	400	Tr (125)	2033	1	
	220	DB-Tr	2033	1	
		Tr (100)		1	
Masasi	400	DB-Tr	2033	1	
		Tr (125)		1	
	220	DB-Tr	2033	1	
		Tr (100)		1	
North DSM	220	DB-Tr	2035	1	
		Tr (400)		1	
	132	SB-Tr	2035	1	
West DSM	220	DB-Tr	2035	1	
		Tr (400)		1	
	132	SB-Tr	2035	1	
South DSM	220	DB-Tr	2035	1	
		Tr (400)		1	
	132	SB-Tr	2035	1	
Southeast DSM	220	DB-Tr	2035	1	
		Tr (400)		1	
	132	SB-Tr	2035	1	

#### Table 4-15: Substation Additions from 2036 to 2040

Substation	Voltage	Equipment	Year	Q'ty	Remarks
Arusha	400	1-1/2 CB: 1 cct	2037	1	
		Tr (250)		1	
		1-1/2 CB: 2 cct	2040	1	
		1-1/2 CB: 1 cct		1	
		STATCOM (150)		2	
		STATCOM (70)		1	
	220	SB-Tr	2038	1	
		Tr (200)		1	
	132	DB-Tr	2037	1	
		Tr (250)		1	New 220 kV bus
		SB-Tr	2038	1	
		Tr (200)		1	
Bagamoyo	400	DB-F	2040	1	
		STATCOM (60)		1	
Musoma	220	DB-Tr	2036	1	
		Tr (100)		1	
Nyamongo	220	DB-Tr	2037	1	
		Tr (100)		1	
Chalinze	400	1-1/2 CB: 1 cct	2039	1	
		Tr (150)		1	
		1-1/2 CB: 2 cct	2040	2	
		STATCOM (150)		3	
		STATCOM (80)		1	
	220	DB-Tr	2039	1	
		Tr (150)		1	
		DB-Tr	2040	1	
		Tr (90)		1	
	132	DB-Tr	2040	1	
		SB-F		2	
Dodoma	400	DB-F	2040	1	
		SR-F (75)		1	for Chalinze
		DB-Tr		4	
		STATCOM (150)		3	
		STATCOM (25)		1	
Iringa	400	DB-Tr	2040	2	
0		STATCOM (100)		1	
		STATCOM (55)		1	
Kigoma	400	DB-Tr	2040	1	
3		STATCOM (55)		1	
Kinverezi	400	1-1/2 CB: 1 cct	2040	3	
·		Tr (500)		1	
		STATCOM (150)		1	
		STATCOM (105)		1	
	220	DB-F	2040	1	for West DSM
Kin-Som SwS-1	400	DB-Tr	2040	3	SwS between Kinterezi
			-		- Somanga Fungu
				2	
Kin-Som SwS-2	400	DB-Tr	2040	1	SwS between Kinterezi
			-		- Somanga Fungu
		STATCOM (110)		1	

Substation	Voltage	Equipment	Year	Q'ty	Remarks
Kin-Som SwS-3	400	DB-Tr	2040	3	SwS between Kinterezi - Somanga Fungu
		STATCOM (150)		2	
		STATCOM (35)		1	
Kisada	400	1-1/2 CB: 2 cct	2040	1	
		STATCOM (150)		1	
		STATCOM (140)		1	
Kyaka	220	DB-Tr	2037	1	
		Tr (100)		1	
	132	SB-Tr	2037	1	
Rusumo	222	DB-F	2040	1	for Nyakanazi
Mbeya	400	DB-Tr	2037	1	
		Tr (500)		1	
		DB-Tr	2040	2	
		STATCOM (150)	_	1	
		STATCOM (140)		1	
	220	DB-Tr	2037	1	
Mkuranga	400	DB-Tr	2040	3	
		STATCOM (150)		2	
		STATCOM (140)		1	
Mlandizi	220	DB-Tr	2040	1	
		Tr (100)		1	
Mpanda	400	DB-Tr	2040	2	
		STATCOM (150)		2	
Mpa-Tab SwS	400	DB-Tr	2040	1	SwS between Mpanda & Tabora
		STATCOM (130)		1	
Sumbawanga	400	DB-Tr	2040	2	
		STATCOM (150)		1	
		STATCOM (60)		1	
Mpa-Sum SwS	400	DB-Tr	2040	3	SwS between Mpanda - Sumbawanga
		STATCOM (150)		2	
		STATCOM (50)		1	
Mbe-Sum SwS	400	DB-Tr	2040	1	SwS between Mbeya - Sumbawanga
		STATCOM (50)		1	
Mtwara	400	DB-Tr	2036	2	Future CGT 1 (CC)
		DB-Tr	2040	1	
		STATCOM (30)		1	
Mwanza	400	DB-Tr	2040	1	
		STATCOM (55)		1	
	220	DB-Tr	2037	1	
		Tr (200)		1	
		DB-F	2040	1	for Shinyanga
	132	SB-Tr	2037	1	
Nyakanazi	400	DB-Tr	2039	1	
		Tr (250)		1	
		DB-Tr	2040	1	
		STATCOM (150)		1	
	220	DB-Tr	2039	1	
		DB-F	2040	1	for Rusumo
Segera	400	1-1/2 CB: 1 cct	2040	2	

Substation	Voltage	Equipment	Year	Q'ty	Remarks
Segera	400	STATCOM (150)	2040	1	
		STATCOM (65)		1	
Shinyanga	400	DB-Tr	2040	3	
		STATCOM (150)		2	
		STATCOM (135)		1	
	220	DB-Tr	2038	1	
		DB-F	2040	4	for Singida & Mwanza
Singida	400	DB-Tr	2040	1	
		STATCOM (140)		1	
	220	DB-F	2040	4	for Shinyanga & Babati
Somanga Fungu	400	1-1/2 CB: 1 cct	2038	2	Future CGT3-3
		1-1/2 CB: 1 cct	2040	1	
		STATCOM (90)		1	
Mku Som					SwS between
SwS-1	400	DB-Tr	2040	1	Mkuranga - Somanga Fungu
		STATCOM (140)		1	
Mku-Som SwS-2	400	DB-Tr	2040	3	SwS between Mkuranga - Somanga
		STATCOM (150)		2	
		STATCOM (80)		1	
Songea	400	DB-Tr	2036	1	
Oongea	-00	Tr (125)	2030	1	
	220	DB-Tr	2036	1	
Tabora	400	DB-Tr	2040	4	
labola	-100	Tr (500)	2040	1	
		STATCOM (150)		2	
		STATCOM (40)		1	
	220	DB-Tr	2037	1	
	220	Tr (100)	2007	1	
			2040	1	
โมรม	220	DB-Tr	2036	1	
2000	220	Tr (100)	2000	1	
			2040	1	
Tanga	220	DB-Tr	2036	1	
langa	220	Tr (100)	2000	1	
North DSM	220	DB-Tr	2040	2	
		Tr (400)	_	2	
	132	SB-Tr	2040	2	
West DSM	220	DB-F	2040	1	for Kinyerezi
		DB-Tr	1	1	
		Tr (400)	1	1	
	132	SB-Tr	2040	1	
South DSM	220	DB-Tr	2040	2	
		Tr (400)	1	2	
	132	SB-Tr	2040	2	

## 4.7 Load flow analysis

The proposed Tanzania's transmission system is based on the load forecast and the new power plants as presented in the previous sections. Five study years were considered:

- a) Y-2020 peak load case;
- b) Y-2025 peak load case;
- c) Y-2030 peak load case;
- d) Y-2035 peak load case; and
- e) Y-2040 peak load case.

Each case has been analyzed under both normal (N-0) and contingency (N-1) conditions. System reinforcements including transmission lines, transformers and reactive power compensations were defined as appropriate.

## 4.7.1 Year-2020 case

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 bulk system (220kV and above). Transmission line power flows are also below the line normal capacity (rating A).

Contingency analysis (N-1) for this case was performed and no voltage or overloading problems were encountered in the bulk system. Under contingency conditions the voltage check was based on the (0.9-1.1 pu) limits and the loading was based of the transmission line/transformer emergency capacity (rating B).

## 4.7.2 Year-2025 case

The major additions by year 2025 are divided into two categories. The first is the expansion of the 400kV network. It is composed of the Songea-Tunduru-Masasi-Lindi 400kV double-circuit lines, the Shinyanga-Mwanza 400kV double-circuit line, the Chalinze-Zinga 400kV double-circuit line and the Kinyerezi-Mkuranga 400kV double-circuit line. The second is the expansion of the network in Dar es Salaam area. It is composed of the Zinga-North Dar es Salaam 220kV double-circuit lines and the Kinyerezi-South Dar es Salaam-Southeast Dar es Salaam-Mkuranga 220kV double-circuit lines.

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 violations are recorded in the bulk system (220kV and above.). Transmission line power flows are also below the line normal capacity (rating A).

Contingency analysis (N-1) for this case was performed and no voltage or overloading problems were encountered in the bulk system. Under contingency conditions the voltage check was based on the (0.9-1.1 pu) limits and the loading was based of the transmission

line/transformer emergency capacity (rating B).

## 4.7.3 Year-2030 case

The major additions by year 2030 are divided into two categories. The first is the expansion of the 400kV network. It is composed of the Shinyanga-Tabora-Mpanda 400kV double-circuit lines. The second is the expansion of the network in Dar es Salaam area. It is composed of the Zinga-Mlandizi 220kV double-circuit line and the North Dar es Salaam-West Dar es Salaam-Kinyerezi 220kV double-circuit lines.

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 bulk system (220kV and above.). Transmission line power flows are also below the line normal capacity (rating A).

Contingency analysis (N-1) for this case was performed and no voltage or overloading problems were encountered in the bulk system. Under contingency conditions the voltage check was based on the (0.9-1.1 pu) limits and the loading was based of the transmission line/transformer emergency capacity (rating B).

## 4.7.4 Year-2035 case

The major additions by year 2035 divided into two categories. The first is the expansion of the 400kV network. It is composed of the Chalinze-Somanga Fungu 400kV double-circuit line, the Chalinze-Segera 400kV additional single-circuit line and the Segera-Arusha 400kV additional double-circuit line. The second is the enhancement of 220kV single-circuit lines to 220kV double-circuit lines. It is composed of the Nyakanazi-Rusumo-Kyaka-Masaka 220kV lines and the Mwanza-Bunda-Musoma-Nyamongo 220kV lines.

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 violations are recorded in the bulk system (220kV and above.). Transmission line power flows are also below the line normal capacity (rating A).

Contingency analysis (N-1) for this case was performed and no voltage or overloading problems were encountered in the bulk system. Under contingency conditions the voltage check was based on the (0.9-1.1 pu) limits and the loading was based of the transmission line/transformer emergency capacity (rating B).

## 4.7.5 Year-2040 case

This case represents the ultimate load flow case for the Tanzania's power system. Generally, the importance of such a case is to plan the system in the early years (e.g. in Y-2020, Y-2025, Y2030 and Y-2035) with an eye on the foreseen ultimate configuration.

Both the 400kV and 220kV networks were expanded as many power plants were considered. Since the generation is mostly concentrated in the South and coastal areas and there are substantial load centers at North, reactive power compensation played an important role in reaching satisfactory operating conditions for the system developed.

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 bulk system (220kV and above.). Transmission line power flows are also below the line normal capacity (rating A).

Contingency analysis (N-1) for this case was performed and no voltage or overloading problems were encountered in the bulk system. Under contingency conditions the voltage check was based on the (0.9-1.1 pu) limits and the loading was based of the transmission line/transformer emergency capacity (rating B).

## 4.8 Short circuit study

A Short circuit study was performed only on the bulk system (220kV and above) and results are given in Table 4-16.

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 and 220kV substations 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 and 40kA for 220kV level. Therefore, the year 2040 case with the overall 400/220kV transmission system does not experience any switchgear short circuit rating problems.

Bus				oh Short circuit (	Currents
No.	Name	kV	kA	in MVA	X/R Ratio
220kV Buses					
10312	Ubungo	220	26.32	10,031	2.5
10402	Chalinze	220	11.32	4,313	5.9
10601	Mlandizi	220	11.48	4,374	3.9
11402	Bagamoyo	220	23.89	9,102	3.1
11501	Zinga	220	13.52	5,152	5.6
11601	Kibaha	220	7.09	2,700	5.2
11602	Kibaha	220	12.54	4,779	4.1
11701	Ubungo	220	20.65	7,869	3.4
11702	Ubungo	220	25.14	9,579	2.7
11802	Kinyerezi	220	34.54	13,161	2.1
12001	North Dar es Salaam	220	21.37	8,143	2.2
12101	Southeast Dar es Sallam	220	17.07	6,504	2.4
12201	South Dar es Sallam	220	21.55	8,212	2.1

#### Table 4-16: Year 2040 short circuit results

	Bus	3-ph Short circuit Currents					
No.	Name	kV	kA	in MVA	X/R Ratio		
12301	West Dar es Salaam	220	26.53	10,109	2.2		
20402	Mkuranga	220	21.45	8,173	4.1		
20902	Songea	220	5.83	2,221	14.1		
30112	Mtwara	220	8.84	3,367	0.7		
30201	Bunda	220	4.14	1,577	1.2		
30301	Musoma	220	3.39	1,294	1.2		
30316	Nyamongo	220	2.66	1,013	1.4		
30401	Geita	220	5.77	2,198	1.2		
40112	Mufindi	220	5.03	1,918	4.1		
40115	Makanbako	220	5.29	2,016	4.8		
40212	Mbeya	220	15.57	5,933	4.9		
40214	Uyole	220	12.97	4,943	4.9		
40601	Madaba	220	13.57	5,169	18.3		
40701	Masigira	220	4.69	1,787	20.5		
40801	Kikonge	220	7.27	2,768	24.9		
41001	Rumakali	220	4.74	1,807	17.6		
41101	Geothermal	220	7.74	2,948	7.9		
41201	Mpanda	220	3.78	1,439	7.9		
41301	Ruhudji	220	6.30	2,401	33.5		
41401	Ruaha2	220	7.44	2,835	21.8		
41501	Kwanini	220	9.50	3,619	23.3		
41602	Mnyera2	220	14.10	5,374	23.7		
41701	Pumbwe	220	9.29	3,540	22.7		
41801	Tavera3	220	8.33	3,176	22.2		
41901	Kisingo	220	7.82	2,978	22.5		
42801	Kyala	220	3.77	1,436	6.7		
49101	Karonga	220	3.12	1,188	6.2		
50112	Babati	220	4.17	1,590	2.5		
51101	Tanga	220	5.47	2,083	3.3		
51212	Njiro	220	8.97	3,418	1.7		
51302	Segera	220	9.00	3,431	3.4		
51402	Arusha	220	9.02	3,437	1.7		
60112	Kidatu	220	7.16	2,728	5.3		
60212	Kihansi	220	7.17	2,732	12.1		
60312	Mtera	220	4.51	1,717	5.7		
60412	Iringa	220	13.42	5,112	5.7		
60501	Ibosa	220	4.19	1,596	13.2		
70112	Bulyanhulu	220	5.96	2,270	1.3		
70201	Lusu	220	5.55	2,113	1.5		
70312	Shinyanga	220	11.51	4,385	0.6		
70401	Tabora	220	8.74	3,329	1.1		
71010	Buswagi	220	5.44	2,075	1.8		
80112	Morogoro	220	7.46	2,843	3.1		
80212	Dodoma	220	6.99	2,663	3.5		
80312	Singida	220	8.35	3,183	1.9		
90402	Kigoma	220	4.62	1,760	2.6		
90602	Nyakanazi	220	6.42	2,445	1.5		
90701	Rusmo	220	4.57	1,742	1.9		
91001	Kyaka	220	3.15	1,199	2.0		
91301	Masaka	220	2.80	1,069	2.1		

	Bus		3-р	h Short circuit C	urrents
No.	Name	kV	kA	in MVA	X/R Ratio
400kV Buses					
10401	Chalinze	400	22.19	15,376	3.6
10701	Somanga Fungu-Kinyerezi SwS1	400	20.93	14,503	4.1
10801	Somanga Fungu-Kinyerezi SwS2	400	20.68	14,330	5.4
10901	Somanga Fungu-Kinyerezi SwS3	400	24.13	16,719	6.3
11401	Bagamoyo	400	15.00	10,395	4.0
11801	Kinyerezi	400	25.36	17,570	2.8
20101	Mkuranga	400	20.93	14,500	3.7
20201	Somanga Fungu	400	36.52	25,303	6.4
20205	Future CGT3-1	400	26.53	18,383	9.2
20206	Future CGT3-2	400	32.11	22,245	10.0
20207	Future CGT3-3	400	26.70	18,498	9.2
20301	Lindi	400	13.17	9,126	10.9
20401	Mtwara	400	10.14	7,023	11.4
20403	Future CGT1	400	7.97	5,520	13.8
20501	Masasi	400	7.57	5,243	12.0
20601	Stiegler's Gorge	400	17.10	11,847	14.0
20701	Tunduru	400	6.71	4,646	13.7
20801	Ngaka	400	12.56	8,701	27.4
20901	Songea	400	12.51	8,670	20.0
21001	Mozambique	400	7.13	4,937	10.1
21101	Somanga Fungu-Mkuranga SwS1	400	19.85	13,755	5.1
21102	Somanga Fungu-Mkuranga SwS2	400	23.03	15,953	6.3
30101	Mwanza	400	5.78	4,005	0.8
40210	Mbeya	400	13.78	9,544	4.4
40215	Kiwira	400	11.69	8,102	7.5
40602	Madaba	400	16.28	11,277	15.3
41601	Mnyera	400	7.92	5,488	16.7
42001	Nakonde	400	6.73	4,663	5.9
42101	Kisada	400	14.63	10,135	6.1
51301	Segera	400	9.44	6,538	3.2
51401	Arusha	400	6.16	4,269	1.9
51501	Isinya	400	4.01	2,779	2.9
60401	Iringa	400	10.24	7,095	5.3
70301	Shinyanga	400	6.91	4,790	0.6
70402	Tabora	400	6.33	4,386	0.9
70501	Mpanda-Tabora SwS	400	6.24	4,325	1.2
80201	Dodoma	400	7.02	4,862	2.9
80301	Singida	400	7.33	5,075	1.5
90101	Sumbawanga	400	8.80	6,098	2.7
90102	Sumbawanga-Mbeya SwS	400	9.77	6,767	3.8
90301	Mpanda	400	6.70	4,645	1.4
90401	Kigoma	400	4.57	3,166	1.6
90601	Nyakanazi	400	3.73	2,586	1.6
90801	Sumbawanga-Mpanda SwS	400	7.25	5,026	2.0
91501	Rukwa	400	8.35	5,785	3.2

#### 4.9 Transmission System Costs

The major 400kV and 220kV, transmission additions required for the above Least Cost Expansion Plan are illustrated in Figure 4-2, the costs of the transmission additions are listed in Table 4-17 up to 4-21 and those for substation additions are listed in Table 4-22 up to 4-26. The total transmission system costs in the Least Cost Expansion Plan from 2015 up to 2020 are US\$ 4,925 million and from 2021 up to 2025 are US\$1,279million while from 2026 up to 2040 are US\$ 4,027 million. Accounting to the total amount from 2015 up to 2040 will be US\$10,230million.

	Pated				Davida		N	Construction		Annı	and USD)			
No	Voltage	from	to	Pemarke	Length	No. of	Year to be Com-	Cost						
NO	(k\A	nom	10	Remarks	(km)	Circuit	missioned		2015	2016	2017	2018	2019	2020
	(KV)	<b>D</b> 1	0		. ,		0040	(1.03D)	00.000	00.000				
1	400	Dodoma	Singida	Backbone Project	210	2	2016	79,800 *	39,900	39,900	0	0	0	0
2	400	Iringa	Dodoma	Backbone Project	237	2	2016	90,060 *	45,030	45,030	0	0	0	0
3	400	Singida	Shinyanga	Backbone Project	200	Z	2016	76,000 ^	38,000	38,000	0	0	0	0
4	220	Kinyerezi	Ubungo-Pai	Completed	8	1	2016		0	0	0	0	0	0
5	220	Ubungo-Pai	Kinyerezi	Completed	8	1	2016		0	0	0	0	0	0
6	132	Kinyerezi	FZ-II	Completed	5	1	2016		0	0	0	0	0	0
7	132	Morogoro	Mtibwa	MCC, F/S completed	88	1	2016	14,960	7,480	7,480	0	0	0	0
8	220	Wind Project	Singida		10	1	2017	2,300	0	1,150	1,150	0	0	0
9	400	Kin-Som SwS1	Kin-Som SwS2		53	2	2018	45,050	0	0	22,525	22,525	0	0
10	400	Kin-Som SwS2	Kin-Som SwS3		53	2	2018	45,050	0	0	22,525	22,525	0	0
11	400	Kin-Som SwS3	Somanga Fungu P/S	210 MW	53	2	2018	45,050	0	0	22,525	22,525	0	0
12	400	Kinyerezi	Kin-Som SwS1		53	2	2018	23,850	0	0	11,925	11,925	0	0
13	400	Kisada	Iringa		106	2	2018	90,100	0	0	45,050	45,050	0	0
14	400	Kisada	Madaba		243	2	2018	206,550	0	0	103,275	103,275	0	0
15	400	Muchuchuma P/S	Madaba	Total 1,800 MW	15	2	2018	8,400	0	0	4,200	4,200	0	0
16	220	Geita	Nyakanazı		130	2	2018	41,600	0	0	20,800	20,800	0	0
17	220	Madaba	Songea		171	1	2018	39,330	0	0	19,665	19,665	0	0
18	220	Makambako	Madaba		162	1	2018	37,260	0	0	18,630	18,630	0	0
19	220	Nyakanazi	Rusumo Falls P/S	30 MW	97	1	2018	32,980	0	0	16,490	16,490	0	0
20	220	Rusumo Falls P/S	Kyaka	30 MW	150	1	2018	51,000	0	0	25,500	25,500	0	0
21	220	Shinyanga	Geita		240	2	2018	108,000	0	0	54,000	54,000	0	0
22	400	Arusha	Singida		317	2	2019	120,460	0	0	0	60,230	60,230	0
23	400	Arusha	Isinya (Kenya)	up to Kenya border	114	2	2019	51,300 *	0	0	0	25,650	25,650	0
24	400	Lindi	Somanga Fungu		216	2	2019	97,200	0	0	0	48,600	48,600	0
25	400	Mtwara P/S	Lindi	400 MW	74	2	2019	33,300	0	0	0	16,650	16,650	0
26	220	Arusha	Njiro (Arusha existing)		5	2	2019	104,020	0	0	0	52,010	52,010	0
27	220	Iringa	Low er Kihansi P/S (Hydro)	(36+52+120) MW	120	1	2019	27,600	0	0	0	13,800	13,800	0
28	220	Solar I	Dodoma	50 MW	10	1	2019	167,680	0	0	0	83,840	83,840	0
29	132	Wind Project	Makambako	100 MW	10	1	2019	6,650	0	0	0	3,325	3,325	0
30	400	Chalinze	Segera		175	1	2020	80,180 *	0	0	0	0	40,090	40,090
31	400	Chalinze	Dodoma		336	1	2020	100,800	0	0	0	0	50,400	50,400
32	400	Chalinze	Segera		175	1	2020	70,000	0	0	0	0	35,000	35,000
33	400	Kigoma	Mpanda		290	2	2020	246,500	0	0	0	0	123,250	123,250
34	400	Kinyerezi	Chalinze		138	2	2020	104,020 *	0	0	0	0	52,010	52,010
35	400	Kisada	Mbeya		186	2	2020	158,100	0	0	0	0	79,050	79,050
36	400	Kiwira P/S	Mbeya	400MW in 2020	110	2	2020	93,500	0	0	0	0	46,750	46,750
37	400	Mbea	Nakonde(Zambia)	up to Zambia border	93	2	2020	35,340	0	0	0	0	17,670	17,670
38	400	Mbe-Sum SwS	Sumbawanga		150	2	2020	127,500	0	0	0	0	63,750	63,750
39	400	Mbeya	Mbe-Sum SwS		150	2	2020	127,500	0	0	0	0	63,750	63,750
40	400	Mpanda	Mpa-Sum SwS		119	2	2020	101,150	0	0	0	0	50,575	50,575
41	400	Mpa-Sum SwS	Sumbawanga		119	2	2020	101,150	0	0	0	0	50,575	50,575
42	400	Mtwara	Namialo(Mozambique)	up to Mozambique border	51	2	2020	19,257	0	0	0	0	9,628	9,628
43	400	Nyakanazi	Kigoma		317	2	2020	269,450	0	0	0	0	134,725	134,725
44	400	Segera	Arusha		366	1	2020	167,680 *	0	0	0	0	83,840	83,840
45	400	Somanga Fungu P/S	Somanga P/S(PPP)	300MW	20	2	2020	7,600	0	0	0	0	3,800	3,800
46	220	Bagamoyo (Zinga)	Kibaha-Pai		45	1	2020	6,650 *	0	0	0	0	3,325	3,325
47	220	Bunda	Musona		60	1	2020	20,400	0	0	0	0	10,200	10,200
48	220	Kibaha-Pai	Bagamoyo (Zinga)		45	1	2020	6,650 *	0	0	0	0	3,325	3,325
49	220	Kinyerezi	Ubungo		12	2	2020	2,640	0	0	0	0	1,320	1,320
50	220	Kishapu Solar	Shinyanga	150 MW	10	1	2020	1,900	0	0	0	0	950	950
51	220	Kyaka	Masaka(Uganda)	up to Uganda border	30	1	2020	6,900	0	0	0	0	3,450	3,450
52	220	Kyela	Karonga(Malawi)	up to Malawi border	20	1	2020	4,600	0	0	0	0	2,300	2,300
53	220	Lusu	Tabora		139	1	2020	31,970	0	0	0	0	15,985	15,985
54	220	Mbeya	Kyela		106	1	2020	24,380	0	0	0	0	12,190	12,190
55	220	Musona	Nyamongo		90	1	2020	30,600	0	0	0	0	15,300	15,300
56	220	Mwanza	Bunda		150	1	2020	51,000	0	0	0	0	25,500	25,500
57	220	Segera	Tanga		76	2	2020	33,470 *	0	0	0	0	16,735	16,735
58	220	Shinyanga	Lusu		64	1	2020	12,160	0	0	0	0	6,080	6,080
59	132	Kinyerezi	FZ-II		5	2	2020	1,150	0	0	0	0	575	575
60	132	Morogoro	Mtibwa		88	1	2020	14,960	0	0	0	0	7,480	7,480
61	66	Babati	Mbulu		85	2	2020	12,750	0	0	0	0	6,375	6,375
								(Thousand USD)			37	17.457		
								<u>,</u>			0,1	,		

Table 4-17: Phased transmission lines cost estimates 2015-2020

Note: \* Should be replaced with the contract amount

	Rated				Route		Year to be Com- missioned	Construction Cost (T. USD)	Ar	nual Expe	nditure (Tho	ousand USE	))
No	Voltage (kV)	from	to	Remarks	Length (km)	No. of Circuit			2021	2022	2023	2024	2025
62	400	Kinyerezi	Mkuranga P/S	300 MW	70	2	2022	59,500	29,750	29,750	0	0	0
63	400	Madaba	Songea		171	2	2023	64,980	0	32,490	32,490	0	0
64	400	Masasi	Lindi		141	2	2023	78,960	0	39,480	39,480	0	0
65	400	Ngaka P/S	Songea	600MW in 2023	37	2	2023	20,720	0	10,360	10,360	0	0
66	400	Songea	Tunduru		230	2	2023	128,800	0	64,400	64,400	0	0
67	400	Tunduru	Masasi		194	2	2023	108,640	0	54,320	54,320	0	0
68	400	Sumbawanga	Rukwa P/S	300MW in 2024	46	2	2024	39,100	0	0	19,550	19,550	0
69	132	Malagarasi P/S(Stage III)	Kigoma	44.7 MW	74	1	2024	12,580	0	0	6,290	6,290	0
70	400	Chalinze	Bagamoyo		102	2	2025	86,700	0	0	0	43,350	43,350
71	400	Shinyanga	Mwanza		140	2	2025	119,000	0	0	0	59,500	59,500
72	220	Bagamoyo	North DSM		40	2	2025	18,000	0	0	0	9,000	9,000
73	220	Geothermal 1	Mbeya	(2 x 50 MW) x2	35	1	2025	6,650	0	0	0	3,325	3,325
74	220	Kinyerezi	South DSM		25	2	2025	11,250	0	0	0	5,625	5,625
75	220	Mkuranga	South-east DSM		50	2	2025	22,500	0	0	0	11,250	11,250
76	220	South DSM	South-east DSM		30	2	2025	9,600	0	0	0	4,800	4,800
77	132	Kyaka	Kibeta/Bukoba		54	1	2025	10,800	0	0	0	5,400	5,400
78	66	Mbulu	Karatu		65	2	2025	9,750	0	0	0	4,875	4,875
79	220	Geothermal 1	Geothermal 2	2 x 50 MW	20	1	2026	3,800	0	0	0	0	1,900
80	220	lbosa P/S (Hydro)	lringa-L. Kihansi T branch	(36+52+120) MW	20	2	2026	6,400	0	0	0	0	3,200
81	220	lbosa P/S (Hydro)	Nginayo P/S (Hydro)	52MW	10	1	2026	1,900	0	0	0	0	950
ſ								(Thousand USD)			813,580		

#### Table 4-18: Phased transmission lines cost estimates 2021-2025

#### Table 4-19: Phased transmission lines cost estimates 2026-2030

	Rated				Route		Year to be	Construction	Annual Expenditure (Thousand USD)				
No	Voltage	from	to	Remarks	Length	NO. Of Circuit	Com-	Cost	0000	0007	0000	0000	0000
	(kV)				(km)	Oncon	missioned	(T. USD)	2026	2027	2028	2029	2030
79	220	Geothermal 1	Geothermal 2	2 x 50 MW	20	1	2026	3,800	1,900	0	0	0	0
80	220	lbosa P/S (Hydro)	lringa-L. Kihansi T branch	(36+52+120) MW	20	2	2026	6,400	3,200	0	0	0	0
81	220	lbosa P/S (Hydro)	Nginayo P/S (Hydro)	52MW	10	1	2026	1,900	950	0	0	0	0
82	220	Zinga P/S	Bagamoyo	200 MW	15	1	2027	3,450	1,725	1,725	0	0	0
83	132	Kakono P/S (Hydro)	Kyaka	87 MW	39	1	2027	6,596	3,298	3,298	0	0	0
84	400	Mnyera S/S (new)	Kisada	(668.2+358) MW	180	2	2028	100,800	0	50,400	50,400	0	0
85	220	Ruaha 2 P/S (Hydro)	Mnyera S/S (new)	(60.3+137.4+143.9) MW	33	1	2028	7,590	0	3,795	3,795	0	0
86	132	Songwe B S/S	Kyela	(79.5 + 88.1) MW	7	2	2028	1,400	0	700	700	0	0
87	132	Songw e Manolo P/S (Hydro)	Songwe B S/S	88.1 MW	17	1	2028	2,890	0	1,445	1,445	0	0
88	220	Kwanini P/S (Hydro)	Mnyera S/S-Ruaha2 T/L	T-branch	10	1	2029	2,300	0	0	1,150	1,150	0
89	220	Mnyera 2 P/S (Hydro)	Mnyera S/S-Ruaha2 T/L	T-branch	10	1	2029	2,300	0	0	1,150	1,150	0
90	400	Shinyanga	Tabora		200	2	2030	170,000	0	0	0	85,000	85,000
91	400	Somanga Fungu S/S	Future CGT3-1	4x470 MW	20	2	2030	11,200	0	0	0	5,600	5,600
92	400	Tab-Mpa SwS	Mpanda		150	2	2030	127,500	0	0	0	63,750	63,750
93	400	Tabora	Tab-Mpa SwS		150	2	2030	127,500	0	0	0	63,750	63,750
94	220	Bagamoyo	Mlandizi		40	2	2030	8,800	0	0	0	4,400	4,400
95	220	Kinyerezi	West DSM		20	2	2030	9,000	0	0	0	4,500	4,500
96	220	Mnyera S/S (new)	Taveta 3 P/S (Hydro)	(119.8+83.9+122.9) MW	26	1	2030	5,980	0	0	0	2,990	2,990
97	220	Pumbwe P/S (Hydro)	Mnyera S/S-Taveta3 T/L	T-branch	10	1	2030	2,300	0	0	0	1,150	1,150
98	220	West DSM	North DSM		20	2	2030	6,400	0	0	0	3,200	3,200
99	132	Njiro (Arusha existing)	Kiyungi	T-branch to KIA	77	2	2030	24,640	0	0	0	12,320	12,320
100	400	Mkuranga	Mku-Som SwS1		61	2	2031	51,850	0	0	0	0	25,925
101	400	Mku-Som SwS1	Mku-Som SwS2		61	2	2031	51,850	0	0	0	0	25,925
102	400	Mku-Som SwS2	Somanga Fungu S/S		61	2	2031	51,850	0	0	0	0	25,925
103	220	Mufindi	Mpanga P/S (Hydro)	160 MW	65	1	2031	14,950	0	0	0	0	7,475
104	220	Taveta 3 P/S (Hydro)	Kisingo P/S (Hydro)	119.8MW	15	1	2031	3,450	0	0	0	0	1,725
(Thousand USD)											713,671		

#### Table 4-20: Phased transmission lines cost estimates 2031-2035

	Rated				Route	No. of	Year to be	Construction	A	Annual Expenditure (Thousand USD)			
No	Voltage (kV)	from	to	Remarks	Length (km)	Circuit	Com- missioned	Cost (T. USD)	2031	2032	2033	2034	2035
100	400	Mkuranga	Mku-Som SwS1		61	2	2031	51,850	25,925	0	0	0	0
101	400	Mku-Som SwS1	Mku-Som SwS2		61	2	2031	51,850	25,925	0	0	0	0
102	400	Mku-Som SwS2	Somanga Fungu S/S		61	2	2031	51,850	25,925	0	0	0	0
103	220	Mufindi	Mpanga P/S (Hydro)	160 MW	65	1	2031	14,950	7,475	0	0	0	0
104	220	Taveta 3 P/S (Hydro)	Kisingo P/S (Hydro)	119.8MW	15	1	2031	3,450	1,725	0	0	0	0
105	220	Masigira P/S (Hydro)	Madaba	118 MW	73	1	2032	16,790	8,395	8,395	0	0	0
106	400	Somanga Fungu S/S	Future CGT3-2	6x470 MW	20	2	2033	11,200	0	5,600	5,600	0	0
107	220	Mbeya	Rumakali P/S (Hydro)	222MW	104	1	2033	23,920	0	11,960	11,960	0	0
108	220	Mnyera S/S (new)	Ruhudji P/S (Hydro)	358 MW	88	1	2033	20,240	0	10,120	10,120	0	0
109	220	Kihansi P/S (Hydro)	Upper Kihansi P/S (Hydro)	47MW	10	1	2034	1,900	0	0	950	950	0
110	220	Kikonge P/S (Hydro)	Madaba	300 MW	49	1	2034	11,270	0	0	5,635	5,635	0
111	132	Songwe A S/S	Songwe B S/S		40	1	2034	6,800	0	0	3,400	3,400	0
112	132	Songw e Sofre P/S (Hydro)	Songwe A S/S	79.5 MW	16	1	2034	2,720	0	0	1,360	1,360	0
113	400	Chalinze	Segera		175	1	2035	70,000	0	0	0	35,000	35,000
114	400	Segera	Arusha		366	2	2035	204,960	0	0	0	102,480	102,480
115	400	Somanga Fungu S/S	Chalinze		284	2	2035	241,400	0	0	0	120,700	120,700
116	400	Stiegler's Gorge	Chalinze	2 x 1,048 MW	195	2	2035	165,750	0	0	0	82,875	82,875
117	220	Bulyanhulu	Shinyanga		130	2	2035	58,500	0	0	0	29,250	29,250
118	220	Bunda	Musona		60	1	2035	20,400	0	0	0	10,200	10,200
119	220	Kyaka	Masaka(Uganda)	up to Uganda border	30	1	2035	6,900	0	0	0	3,450	3,450
120	220	Musona	Nyamongo		90	1	2035	30,600	0	0	0	15,300	15,300
121	220	Mwanza	Bunda		150	1	2035	51,000	0	0	0	25,500	25,500
122	220	Nyakanazi	Rusumo Falls P/S		97	1	2035	32,980	0	0	0	16,490	16,490
123	220	Rusumo Falls P/S	Kyaka		150	1	2035	51,000	0	0	0	25,500	25,500
124	220	Shinyanga	Buswagi		108	2	2035	48,600	0	0	0	24,300	24,300
125	132	Kyaka	Kibeta/Bukoba		54	1	2035	10,800	0	0	0	5,400	5,400
126	66	Babati	Kondoa		85	2	2035	12,750	0	0	0	6,375	6,375
127	400	Mtwara	Future CGT1 P/S	330MW	50	2	2036	19,000	0	0	0	0	9,500
								(Thousand USD)			1,196,955		

#### Table 4-21: Phased transmission lines cost estimates 2036-2040

	Rated	from	to	Remarks	Route	No. of	Year to be	Construction	Annual Expenditure (Thousand USD)					
No V	Voltage (kV)				Length (km)	No. or Circuit	Com- missioned	Cost (T. USD)	2036	2037	2038	2039	2040	
127	400	Mtwara	Future CGT1 P/S	330MW	50	2	2036	19,000	9,500	0	0	0	0	
128	400	Somanga Fungu	Future CGT3-3	5x470 MW	20	2	2038	11,200	0	5,600	5,600	0	0	
129	220	Kinyerezi	West DSM		20	1	2040	6,800	0	0	0	3,400	3,400	
130	220	Shinyanga	Mwanza		140	2	2040	30,800	0	0	0	15,400	15,400	
131	220	Singida	Babati		150	2	2040	33,000	0	0	0	16,500	16,500	
132	220	Singida	Shinyanga		200	2	2040	44,000	0	0	0	22,000	22,000	
133	132	Chalinze	Morogoro		82	2	2040	16,400	0	0	0	8,200	8,200	
								(Thousand USD)			151,700			
No         Substation         Trace         Control         Trace         Dot for the second se			Now		Construction	Annual Expenditure (Thousand LISD)								
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Examine         Expansion         memore         (T_LOD)         2015         2016         2017         2018         2019         2020           2         Impa         N         2016         352.90.2         361.25         261.00         0 <td< td=""><td>No</td><td>Substation</td><td>or</td><td>Year to be Com-</td><td>Construction</td><td></td><td>7 111001</td><td></td><td>/ mousure</td><td>1000)</td><td></td></td<>	No	Substation	or	Year to be Com-	Construction		7 111001		/ mousure	1000)				
1         Dockma         E         2016         552/201         26.12/2         26.12/2         0         0         0         0           3         Morogono         E         2016         700*         356         356         0 <td></td> <td>Cubotation</td> <td>Expansion</td> <td>missioned</td> <td>(T. USD)</td> <td>2015</td> <td>2016</td> <td>2017</td> <td>2018</td> <td>2019</td> <td>2020</td>		Cubotation	Expansion	missioned	(T. USD)	2015	2016	2017	2018	2019	2020			
2         Imag         N         2016         39.170         19.885         0         0         0         0           4         Microgro         E         2016         700.1         350         350         0         0         0         0         0           4         Microgro         E         2016         700.1         350         350         0	1	Dodoma	Ē	2016	52.250 *	26.125	26.125	0	0	0	0			
S         Mecogon         E         2016         700         350         350         0         0         0         0         0           6         Shnyanga         E         2016         345,400         17,270         17,270         0	2	Iringa	N	2016	39,170 *	19,585	19,585	0	0	0	0			
4         Mutwa         E         2016         300         360         360         0         0         0         0         0           6         Singda         E         2016         20,510         17,227         1,225         10         0	3	Morogoro	E	2016	700 *	350	350	0	0	0	0			
s         Siniyanga         E         2016         34,540         71,270         17,270         17,270         0         0         0         0           7         Kinyenezi         N         2017         335         0         488         468         0 <td< td=""><td>4</td><td>Mtibwa</td><td>E</td><td>2016</td><td>700 *</td><td>350</td><td>350</td><td>0</td><td>0</td><td>0</td><td>0</td></td<>	4	Mtibwa	E	2016	700 *	350	350	0	0	0	0			
B         Dirigida         E         2010         2013         10.259         10.259         40.269         40.0         0         0           B         Geilss         N         2076         8.400         0         468         468         0	5	Shinyanga	E	2016	34,540 *	17,270	17,270	0	0	0	0			
b         Diversity         N         2017         363         0         463         463         0	6	Singida	E N	2016	20,510 *	10,255	10,255	0	0	0	0			
9         Geila         N         2018         8,400         0         1         4200	/ 8	Singida	F	2017	935	0	400	400	0	0	0			
10         Iringa         E         2018         14,500         0         0         7,250	9	Geita	N	2018	8.400	0	00+00	4.200	4.200	0	0			
11       Kin-Som Sw62       N       2018       24,810       0       0       12,405       12,405       0       0         13       Kin-Som Sw633       N       2018       24,810       0       0       12,405       14,46,473       46,473 </td <td>10</td> <td>Iringa</td> <td>E</td> <td>2018</td> <td>14,500</td> <td>0</td> <td>0</td> <td>7,250</td> <td>7,250</td> <td>0</td> <td>0</td>	10	Iringa	E	2018	14,500	0	0	7,250	7,250	0	0			
12       Kin-Som Sw832       N       2018       24,810       0       0       12,405       12,405       0       0         14       Kinyerezi       E       2018       22,845       0       0       46,473       0       0         15       Kisada       N       2018       27,510       0       0       13,755       13,755       0       0         16       Kiyaka       E       2018       9,930       0       0       4,465       0       0       0         17       Madaba       N       2018       9,335       0       0       14,648       0       0       0       0       14,648       0       0       0       14,648       0       0       0       14,648       0       0       0       14,648       0       0       0       14,648       0       0       0       0       14,648       0       0       0       14,854       0       0       0       14,854       0       0       0       14,854       0       0       0       13,845       0       0       0       14,854       0       0       14,854       0       0       14,854       0	11	Kin-Som SwS1	N	2018	24,810	0	0	12,405	12,405	0	0			
13       Kin-Som Sw53       N       2018       22,4810       0       0       12,405       0       0         15       Kiseda       N       2018       22,7510       0       0       13,755       0       0         16       Kisada       N       2018       23,300       0       0       14,4955       4,4955       0       0         17       Madaba       N       2018       25,330       0       0       12,665       0       0         19       Mbeya       E       2018       33,055       0       0       15,648       0       0         21       Rusumo       E       2018       2,570       0       0       1,285       0       0         22       Shinyanga       E       2018       3,210       0       0       6,605       0       0       0       2,285       0       0       0       2,285       0       0       0       2,285       0       0       0       2,285       0       0       0       1,285       0       0       0       2,285       0       0       0       1,285       0       0       0       1,2895       0	12	Kin-Som SwS2	N	2018	24,810	0	0	12,405	12,405	0	0			
Init         Anymetezi         E         2018         32,943         0         0         46,47,3         0         1           16         Kisada         E         2018         27,510         0         0         1,3755         13,755         0         0           16         Kiyaka         E         2018         25,330         0         0         4,465         0         0           19         Mekambako         E         2018         3355         0         0         468         0         0           20         Nyakanazi         N         2018         7,850         0         0         3,815         0         0           21         Rusimaga         E         2018         2,520         0         0         468         0         0         2,325         0         0         0         2,325         0         0         0         0         0         2,325         0	13	Kin-Som SwS3	N	2018	24,810	0	0	12,405	12,405	0	0			
10         Instate         Nature         Long         Long <thlong< th="">         Long         Long         &lt;</thlong<>	14	Kinyerezi	E N	2018	92,945	0	0	46,473	46,473	0	0			
1         Madaba         N         2018         25.300         0         12.666 <th< td=""><td>15</td><td>Kvaka</td><td>F</td><td>2018</td><td>9 930</td><td>0</td><td>0</td><td>4 965</td><td>4 965</td><td>0</td><td>0</td></th<>	15	Kvaka	F	2018	9 930	0	0	4 965	4 965	0	0			
18         Mekambako         E         2018         3935         0         0         468         468         0         0           20         Nyakanazi         N         2018         30.955         0         0         15.048         15.048         0         0           21         Rusumo         E         2018         2,570         0         0         14.285         14.285         0         0           23         Simyanga         E         2018         3,250         0         0         4.686         6.605         0         0           24         Somarga Fungu         N         2018         5,380         0         0         2.685         2.325         23.295         0         0         4.648         0         0         0         2.235         23.295         0         0         0         4.648         0         0         0         2.235         23.295         0         0         0         4.648         0         0         12.985         0         0         0         12.985         0         0         14.848         0         12.385         12.985         0         0         0         14.844.84         0	17	Madaba	N	2018	25.330	0	0	12.665	12.665	0	0			
19         Mbeya         E         2018         30,095         0         15,048         15,048         10         0           21         Rusumo         E         2018         2,570         0         0         1218         1,285         0         0           22         Shinyanga         E         2018         3955         0         0         486         448         0         0           23         Songapa         N         2018         13,210         0         0         6,605         0         0           24         Songapa         N         2019         46,590         0         0         0         23,235         23,295         0         0           25         Dodoma         E         2019         485         0         0         0         448         448         0         0         12,395         13,395         0         0         0         14,485         148         6,444         14,485         14,485         0         0         0         14,485         14,485         0         0         0         0         14,485         14,445         14,445         14,445         14,444         14,444         14,444	18	Makambako	E	2018	935	0	0	468	468	0	0			
20         Nyakanazi         N         2018         7,630         0         0         3,815         3,815         0         0           21         Rusumo         E         2018         9,35         0         0         1,285         1,225         0         0           22         Somange Fungu         N         2018         13,210         0         0         6,605         6,605         0         0           24         Sushinyanga         E         2019         46,590         0         0         0         2,225         22,225         22,225         22,225         22,225         22,225         22,225         22,225         22,225         22,225         22,225         22,225         22,225         0         0         0         4,488         468         0           25         Iudai         N         2019         25,900         0         0         0         14,88         14,48         14         4           25         Iudai         E         2019         15,440         0         0         0         13,848         14,44         4         4         4         4         4         4         8         4,448         4	19	Mbeya	E	2018	30,095	0	0	15,048	15,048	0	0			
21         Rusumo         E         2018         2,570         0         0         1,285         1,285         0         0           22         Shinyanga         E         2018         935         0         0         468         468         0         0           23         Sangea         N         2018         5,390         0         0         2685         2,265         0         0           24         Songea         N         2019         935         0         0         0         468         468         0           27         Inga         E         2019         335         0         0         0         468         468         0           28         Makambako         E         2019         700         0         0         0         12,995         12,995         0           33         Migida         E         2019         15,540         0         0         0         1,665         1,665         0         1,848         1,448         0         0         1,655         1,665         1,652         0         0         0         1,356         1,365         1,632         1,848         1,844	20	Nyakanazi	N	2018	7,630	0	0	3,815	3,815	0	0			
22         Shinyanga         E         2018         935         0         0         468         468         0         0           24         Sorngea         N         2018         15,210         0         0         6,605         6,605         0         0           24         Sorngea         N         2019         45,590         0         0         0         0         2255         22,225         22,225         22,225         22,225         22,225         22,225         22,225         22,225         22,225         22,225         22,225         22,225         22,225         22,225         22,225         22,225         0         0         0         468         468         0           22         Makambako         E         2019         70,200         0         0         0         1,665         1,665         0           33         Singida         E         2019         16,295         0         0         0         1,1665         1,6540           34         Arusha (Nijro)         E         2020         27,295         0         0         0         0         1,3649         13,644           34         Bayantyo         N <td>21</td> <td>Rusumo</td> <td>E</td> <td>2018</td> <td>2,570</td> <td>0</td> <td>0</td> <td>1,285</td> <td>1,285</td> <td>0</td> <td>0</td>	21	Rusumo	E	2018	2,570	0	0	1,285	1,285	0	0			
22         Solniargar Fungu         N         2018         1.3.2.10         0         0         0.003         0.003         0.003           28         Arusha (Njiro)         N         2018         5.336         0         0         0         2.3.295         2.3.295         0           28         Lindi         N         2019         9.355         0         0         0         468         468         0           28         Lindi         N         2019         7.00         0         0         0         1.2.995         1.0.0           29         Makambako         E         2019         7.00         0         0         0         1.665         1.1.65         1.1.65         1.1.65         1.1.65         1.1.65         1.1.65         1.1.65         1.1.65         1.1.65         1.1.65 <td>22</td> <td>Shinyanga</td> <td>E</td> <td>2018</td> <td>935</td> <td>0</td> <td>0</td> <td>468</td> <td>468</td> <td>0</td> <td>0</td>	22	Shinyanga	E	2018	935	0	0	468	468	0	0			
22         Oxige         N         2010         J.200         J.200 <thj.200< th=""> <thj.200< th=""> <thj.200< th=""></thj.200<></thj.200<></thj.200<>	23	Somanga Fungu		2018	13,210 5 300	0	0	0,000	0,000	0	0			
26         Dodoma         E         2019         935         0         0         0         148         548         1           27         Iringa         E         2019         935         0         0         0         488         468         0           28         Lindi         N         2019         700         0         0         0         12,985         1         0           29         Makambako         E         2019         700         0         0         0         11,665         1<	25	Arusha (Niiro)	N	2010	46.590 *	0	0	2,033	23.295	23.295	0			
Indi         E         2019         935         0         0         0         468         468         0           28         Lindi         N         2019         25.990         0         0         0         12.995         12.995         0           30         Mwara         E         2019         23.330         0         0         0         11.665         13.648         13.644         13.644         13.644         13.644         13.644         13.644         13.648         13.648         13.648         13.648         13.648         13.648         13.648         13.648         13.648         13.648         13.648         13.648         13.648         13.648	26	Dodoma	E	2019	935	0	0	0	468	468	0			
28         Lindi         N         2019         25,990         0         0         0         12,995         13,648         13,648         13,648         13,648         13,648         14,865         0         0         0         13,648         13,644         13,644         13,644         13,644         13,648         13,648         13,648         13,648         13,648         13,648         13,648         13,648         13,648         13,648         13,648         13,648         13,648         13,648         13,648         13,648         13,643         13,648         13,643         13,643         13,643         13,643         13,643         13,648         13,648         13,643         13,643         13,643         13,643         13,643         13,643         13,643         13,643         13,643         13,643         13,643         13,643         13,643         13,644         13,643         13,644         1	27	Iringa	E	2019	935	0	0	0	468	468	0			
29         Makambako         E         2019         700         0         0         350         360 <td>28</td> <td>Lindi</td> <td>N</td> <td>2019</td> <td>25,990</td> <td>0</td> <td>0</td> <td>0</td> <td>12,995</td> <td>12,995</td> <td>0</td>	28	Lindi	N	2019	25,990	0	0	0	12,995	12,995	0			
30         Nttwara         E         2019         23,330         0         0         0         0         11,665         11,660         11,660         11,600	29	Makambako	E	2019	700	0	0	0	350	350	0			
Singled         E         2019         15,340         0         0         0         1,770         1,770         1,770           32         Sommarga Fungu         E         2019         16,295         0         0         0         1,770         1,770         1,770           34         Babati         E         2020         27,295         0         0         0         0         13,648         13,644           34         Babati         E         2020         13,040         0         0         0         0         13,540         20.0         13,040         0         0         0         15,350         3,720         3,722         3,720         3,720         3,720         3,720         3,720         3,720         3,720         3,720         3,720         3,720	30	Mtwara		2019	23,330	0	0	0	11,665	11,665	0			
33         Avasha (Njiro)         E         2013         Avasha (Njiro)         E         2020         77.295         0         0         0         13.448         13.648           34         Babati         E         2020         7700         0         0         0         0         3.50           35         Bagamoyo         N         2020         13.940         0         0         0         0         5.350           37         Chalinze         N         2020         34.930 *         0         0         0         0         5.350         5.353           39         Kin-Som SwS1         E         2020         7.760         0         0         0         0         3.880         3.880           39         Kin-Som SwS3         N         2020         7.440         0         0         0         0         3.720         3.721         3.721         3.721         3.721         3.720         3.720         3.721         3.720         3.720         3.721         3.720         3.720         3.720         3.720         3.720         3.720         3.720         3.720         3.720         3.720         3.720         3.720         3.720         3.720	32	Somanga Eungu		2019	15,540	0	0	0	7,770 8 178	7,770 8 178	0			
34         Babati         E         2020         700         0         0         0         0         0         350         353           36         Bagamoyo         N         2020         13,040         0         0         0         6,520         6,520           37         Chalinze         N         2020         10,700         0         0         0         0         23,965         23,965           38         Kigoma         N         2020         7,760         0         0         0         0         3,860         3,860           39         Kin-Som SwS1         E         2020         7,740         0         0         0         0         3,3720         3,720<	33	Arusha (Niiro)	E	2013	27.295	0	0	0	0,140	13.648	13.648			
35         Bagamoyo         N         2020         13.040         0         0         0         6.520         6.522           36         Bunda         N         2020         10,700         0         0         0         0.5,350         5.350           37         Chalinze         N         2020         38,190         0         0         0         0.2,365         23,965           38         Kinoma         N         2020         7,760         0         0         0         3,880         3,880           40         Kin-Som SwS1         E         2020         7,440         0         0         0         3,720         3,721           41         Kin-Som SwS3         N         2020         7,440         0         0         0         1,8,160         18,160           43         Kisada         E         2020         7,900         0         0         0         3,3350         3,356           44         Kyaka         E         2020         7,440         0         0         0         3,320         5,356         5,356           50         Mbesum SwS         E         2020         27,120         0         0<	34	Babati	E	2020	700	0	0	0	0	350	350			
36         Bunda         N         2020         10,700         0         0         0         5,350         5,353           37         Chalinze         N         2020         47,930*         0         0         0         0         23,965         23,965           38         Kingoma         N         2020         38,180         0         0         0         0         19,095         19,095           39         Kin-Som SwS1         E         2020         7,740         0         0         0         3,720         3,724           41         Kin-Som SwS3         N         2020         7,440         0         0         0         3,720         3,724           42         Kinyerezi         E         2020         36,320*         0         0         0         0         3,430         3,434           43         Kisada         E         2020         7,440         0         0         0         0         3,430         3,434           44         Kyaka         E         2020         7,440         0         0         0         0         3,560         3,560         3,560         3,560         3,560         3,560	35	Bagamoyo	N	2020	13,040	0	0	0	0	6,520	6,520			
37       Chalinze       N       2020       47,930 *       0       0       0       0       23,965       23,965       23,965       13,099         38       Kin-Som SwS1       E       2020       38,190       0       0       0       0       0       19,095       19,095         39       Kin-Som SwS2       N       2020       7,740       0       0       0       0       3,880       3,880         40       Kin-Som SwS2       N       2020       7,440       0       0       0       0       3,720       3,720         41       Kin-Som SwS3       N       2020       7,440       0       0       0       0       3,850       3,950         42       Kinyaka       E       2020       7,900       0       0       0       0       4,843         45       Kyaka       E       2020       7,440       0       0       0       0       3,430       3,433         46       Lindi       E       2020       7,440       0       0       0       0       0       1,3,560       13,560       13,560       13,560       13,560       13,560       13,560       13,560	36	Bunda	N	2020	10,700	0	0	0	0	5,350	5,350			
38         Kigoma         N         2020         38,190         0         0         0         0         19,095         19,095           39         Kin-Som SwS1         E         2020         7,760         0         0         0         3,720         3,720           41         Kin-Som SwS3         N         2020         7,440         0         0         0         3,720         3,720           41         Kin-Som SwS3         N         2020         7,440         0         0         0         18,160         18,160           42         Kinyerezi         E         2020         36,320*         0         0         0         18,160         13,150         13,343         13,343         13,343         143         144         14,164         14,164         16,160         16,160         16,160         16,170 <td>37</td> <td>Chalinze</td> <td>N</td> <td>2020</td> <td>47,930 *</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>23,965</td> <td>23,965</td>	37	Chalinze	N	2020	47,930 *	0	0	0	0	23,965	23,965			
39         NH-Soft SWS1         E         2020         7,40         0         0         0         0         3,860         3,860           40         Kin-Som SwS2         N         2020         7,440         0         0         0         0         3,720         3,722           41         Kin-Som SwS3         N         2020         7,440         0         0         0         0         3,720         3,722           42         Kinyerezi         E         2020         36,320 *         0         0         0         0         3,950         3,956           44         Kyaka         E         2020         7,900         0         0         0         0         3,430         3,433           45         Kyela         N         2020         7,440         0         0         0         0         3,720         3,722           47         Lusu         E         2020         7,440         0         0         0         0         13,720         3,722           49         Mbe-Sum SwS         E         2020         27,825         0         0         0         0         10,413         10,413           51<	38	Kigoma		2020	38,190	0	0	0	0	19,095	19,095			
13       141       Kin-Som Sw23       N       2020       7,440       0       0       0       0       1720       3,721         42       Kinyerezi       E       2020       36,320*       0       0       0       0       1,816       18,160         43       Kisada       E       2020       7,900       0       0       0       0       1,816       1,816         44       Kyaka       E       2020       335       0       0       0       0       3,430       3,430         45       Kyela       N       2020       6,860       0       0       0       0       3,430       3,433         46       Lindi       E       2020       7,440       0       0       0       0       3,720       3,720       3,720         47       Lusu       E       2020       7,440       0       0       0       0       3,720       3,720       3,720         48       Madaba       E       2020       27,120       0       0       0       0       1,350       1,356         50       Mbeya       E       2020       20,285       0       0       0	39 40	Kin-Som SwS2		2020	7,760	0	0	0	0	3,000	3,000			
42         Kinyerezi         E         2020         36,320 *         0         0         0         18,160         18,160         18,160           43         Kisada         E         2020         7,900         0         0         0         0         3,950         3,950           44         Kyaka         E         2020         935         0         0         0         0         3,430           45         Kyela         N         2020         6,860         0         0         0         3,433           46         Lindi         E         2020         7,440         0         0         0         3,720         3,720           47         Lusu         E         2020         27,120         0         0         0         13,560           48         Madaba         E         2020         27,120         0         0         0         13,356           50         Mbe-Sum SwS         E         2020         27,120         0         0         0         0         13,451         13,451           51         Mbrogoro         E         2020         26,490         0         0         0         0	41	Kin-Som SwS3	N	2020	7,440	0	0	0	0	3.720	3.720			
43         Kisada         E         2020         7,900         0         0         0         0         3,950         3,950           44         Kyaka         E         2020         935         0         0         0         0         468         468           45         Kyela         N         2020         6,860         0         0         0         3,430         3,433           46         Lindi         E         2020         7,440         0         0         0         0         3,720         3,720           47         Lusu         E         2020         7,440         0         0         0         0         3,720         3,720           47         Husu         E         2020         27,120         0         0         0         13,560         13,560           50         Mbeya         E         2020         20,825         0         0         0         0         10,413         10,413           51         Morogoro         E         2020         12,190         0         0         0         0         17,758         17,758           53         Mpa-Sum SwS         N         2020	42	Kinyerezi	E	2020	36,320 *	0	0	0	0	18,160	18,160			
44         Kyaka         E         2020         935         0         0         0         468         464           45         Kyela         N         2020         6,860         0         0         0         3,430         3,430           46         Lindi         E         2020         7,440         0         0         0         3,720         3,721           47         Lusu         E         2020         7,440         0         0         0         0         3,720         3,721           49         Mbe-Sum SwS         E         2020         27,120         0         0         0         0         13,560         13,560           50         Mbeya         E         2020         20,825         0         0         0         0         10,413         10,413           51         Morogoro         E         2020         12,190         0         0         0         0         17,758         17,756           53         Mpa-Sum SwS         N         2020         26,490         0         0         0         0         350         355           54         Mtibawa         E         2020	43	Kisada	E	2020	7,900	0	0	0	0	3,950	3,950			
45         Kyela         N         2020         6,860         0         0         0         3,430         3,433           46         Lindi         E         2020         7,440         0         0         0         3,720         3,720           47         Lusu         E         2020         10,700         0         0         0         3,720         3,720           48         Madaba         E         2020         7,440         0         0         0         0         3,720         3,720           49         Mbe-Sum SwS         E         2020         27,120         0         0         0         13,560         13,566           50         Mbeya         E         2020         22,825         0         0         0         0         10,413         10,413           51         Morogoro         E         2020         35,515         0         0         0         0         17,758         17,758           53         Mpa-Sum SwS         N         2020         26,490         0         0         0         0         3,324           54         Mitiwa         E         2020         12,420         0 </td <td>44</td> <td>Kyaka</td> <td>E</td> <td>2020</td> <td>935</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>468</td> <td>468</td>	44	Kyaka	E	2020	935	0	0	0	0	468	468			
46       Lindi       E       2020       7,440       0       0       0       0       3,720       3,720         47       Lusu       E       2020       10,700       0       0       0       0       3,720       3,720         48       Madaba       E       2020       7,440       0       0       0       0       3,720       3,720         49       Mbe-Sum SwS       E       2020       27,120       0       0       0       0       13,560       13,560         50       Mbeya       E       2020       27,120       0       0       0       0       10,413       10,411         51       Morogoro       E       2020       12,190       0       0       0       0       10,413       10,413         52       Mpanda       N       2020       35,515       0       0       0       0       17,758       17,755         53       Mpa-Sum SwS       N       2020       26,490       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0	45	Kyela	N	2020	6,860	0	0	0	0	3,430	3,430			
47       List       2020       10,740       0       0       0       0       0       0,330       0,337       0,337         48       Madaba       E       2020       7,440       0       0       0       0       3,720       3,720         49       Mbe-Sum SwS       E       2020       27,120       0       0       0       0       3,720       3,720         49       Mbersum SwS       E       2020       27,120       0       0       0       0       1,3,60       13,560       13,560         50       Mberya       E       2020       12,190       0       0       0       0       10,413       10,411         51       Morogoro       E       2020       12,190       0       0       0       0       17,758       17,754         53       Mpa-Sum SwS       N       2020       26,490       0       0       0       0       13,245       13,244         54       Mtibwa       E       2020       700       0       0       0       0       6,210       6,210       6,210       6,210       6,210       6,210       6,210       6,210       6,210       6	40			2020	7,440	0	0	0	0	5 350	5 350			
49         Mbe-Sum SwS         E         2020         27,120         0         0         0         0         13,560         13,560           50         Mbeya         E         2020         20,825         0         0         0         0         10,413         10,413           51         Morogoro         E         2020         12,190         0         0         0         0         6,095         6,099           52         Mpanda         N         2020         35,515         0         0         0         0         17,758         17,756           53         Mpa-Sum SwS         N         2020         26,490         0         0         0         0         13,245         13,245           54         Mtbwa         E         2020         700         0         0         0         0         355         355           55         Mtwara         E         2020         10,700         0         0         0         0         2,695         2,695           56         Mwanza         E         2020         5,390         0         0         0         0         2,2945         2,2,945           59	48	Madaba	F	2020	7,440	0	0	0	0	3,330	3,720			
50         Mbeya         E         2020         20,825         0         0         0         10,413         10,413           51         Morogoro         E         2020         12,190         0         0         0         0         6,095         6,095           52         Mpanda         N         2020         35,515         0         0         0         0         17,758         17,755           53         Mpa-Sum SwS         N         2020         26,490         0         0         0         0         13,245         13,245           54         Mtibwa         E         2020         700         0         0         0         0         350         355           Mtwara         E         2020         12,420         0         0         0         0         2,530         355           Musoma         E         2020         10,700         0         0         0         0         2,695         2,699           57         Mwanza         E         2020         5,390         0         0         0         0         2,2945         2,944           59         Nyamongo         E         2020	49	Mbe-Sum SwS	E	2020	27,120	0	0	0	0	13,560	13,560			
51         Morogoro         E         2020         12,190         0         0         0         6,095         6,095           52         Mpanda         N         2020         35,515         0         0         0         0         17,758         17,758           53         Mpa-Sum SwS         N         2020         26,490         0         0         0         0         13,245         13,245           54         Mtibwa         E         2020         700         0         0         0         0         6,210         6,210           55         Mtwara         E         2020         12,420         0         0         0         0         6,210         6,210           56         Musoma         E         2020         10,700         0         0         0         0         0         2,695         2,699           57         Mwanza         E         2020         45,890         0         0         0         0         22,945         22,945         22,945         22,945         22,945         22,945         22,945         4,965         4,965         4,965         4,965         4,965         4,965         4,965         4	50	Mbeya	E	2020	20,825	0	0	0	0	10,413	10,413			
52         Mpanda         N         2020         35,515         0         0         0         0         17,758         17,758           53         Mpa-Sum SwS         N         2020         26,490         0         0         0         0         13,245         13,245           54         Mtibwa         E         2020         700         0         0         0         0         350         350           55         Mtwara         E         2020         12,420         0         0         0         0         6,210         6,210           56         Musoma         E         2020         10,700         0         0         0         0         5,350         5,535           57         Mwanza         E         2020         5,390         0         0         0         0         2,695         2,699           58         Nyakanazi         E         2020         45,890         0         0         0         0         2,2,945         22,945         22,945         22,945         4,965         4,965         4,965         4,965         4,965         4,965         60         Segera         N         2020         33,540	51	Morogoro	E	2020	12,190	0	0	0	0	6,095	6,095			
53         Mpa-Sum SwS         N         2020         26,490         0         0         0         0         13,245         14,00         0         0         0         0         14,070         16,770         16,770         16,770         16,770         16,770         16,770         16,770         16,770         16,770         16,770         16,770         16,770         16,770         16,780         16,780         16,780         16,780         16,780         16,780         16,780         16,780         16,780	52	Mpanda	N	2020	35,515	0	0	0	0	17,758	17,758			
54         MilbWa         E         2020         700         0         0         0         0         350         350         350           55         Mtwara         E         2020         12,420         0         0         0         0         6,210         6,210           56         Musoma         E         2020         10,700         0         0         0         0         2,695         2,695           57         Mwanza         E         2020         5,390         0         0         0         2,2,945         2,2,945           58         Nyakanazi         E         2020         34,230 *         0         0         0         0         4,965         4,965           60         Segera         N         2020         34,230 *         0         0         0         0         17,115         17,115           61         Shinyanga         E         2020         10,245         0         0         0         0         5,600         5,600         5,600         5,600         5,600         5,600         5,600         5,600         5,600         5,600         5,600         5,600         5,600         5,600         5,600<	53	Mpa-Sum SwS		2020	26,490	0	0	0	0	13,245	13,245			
So         Nikuana         E         2020         12,720         0         0         0         0,214         0         0         0         0         0,214         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0	55	Mtwara		2020	12 /20	0	0	0	0	6 210	6 210			
57         Mwanza         E         2020         5,330         0         0         0         2,695         4,965	56	Musoma	F	2020	10,700	0	0	0	0	5,350	5,350			
58         Nyakanazi         E         2020         45,890         0         0         0         0         22,945         22,945         22,945         22,945         22,945         22,945         22,945         22,945         22,945         22,945         22,945         4,965         5,600         5,600         5,600 </td <td>57</td> <td>Mwanza</td> <td>E</td> <td>2020</td> <td>5,390</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>2,695</td> <td>2,695</td>	57	Mwanza	E	2020	5,390	0	0	0	0	2,695	2,695			
59         Nyamongo         E         2020         9,930         0         0         0         0         4,965         4,965           60         Segera         N         2020         34,230 *         0         0         0         0         17,115         17,115           61         Shinyanga         E         2020         10,245         0         0         0         0         5,123         5,123           62         Singida         E         2020         33,540         0         0         0         0         16,770         16,770           63         Somanga Fungu         E         2020         11,200         0         0         0         0         5,600         5,600           64         Sumbawanga         N         2020         33,560         0         0         0         16,780         16,780           65         Tabora         E         2020         12,530         0         0         0         0         6,265         6,265           66         Tanga         E         2020         14,020         0         0         0         0         9,305         9,305           Thousan	58	Nyakanazi	E	2020	45,890	0	0	0	0	22,945	22,945			
60         Segera         N         2020         34,230 *         0         0         0         17,115         17,115           61         Shinyanga         E         2020         10,245         0         0         0         0         5,123         5,123           62         Singida         E         2020         33,540         0         0         0         0         16,770         16,770           63         Somanga Fungu         E         2020         11,200         0         0         0         0         5,600         5,600           64         Sumbawanga         N         2020         33,560         0         0         0         0         5,600         5,600           64         Sumbawanga         N         2020         33,560         0         0         0         0         6,265         6,265           65         Tabora         E         2020         12,530         0         0         0         0         7,010         7,010           67         Ubungo         E         2020         14,020         0         0         0         0         9,305         9,305         9,305	59	Nyamongo	E	2020	9,930	0	0	0	0	4,965	4,965			
b1         Sninyanga         E         2020         10,245         0         0         0         5,123	60	Segera	N -	2020	34,230 *	0	0	0	0	17,115	17,115			
b2         Singlua         E         2020         33,340         0         0         0         0         16,770	61	Shinyanga		2020	10,245	0	0	0	0	5,123	5,123			
64         Sumbawanga         N         2020         33,560         0         0         0         0         16,780         16,780           65         Tabora         E         2020         12,530         0         0         0         0         6,265         6,265           66         Tanga         E         2020         14,020         0         0         0         0         7,010         7,010           67         Ubungo         E         2020         18,610         0         0         0         9,305         9,305           (Thousand USD)         1         207.060	62	Somanda Eurodu		2020	33,540 11 200	0	0	0	0	5 600	5 600			
65         Tabora         E         2020         12,530         0         0         0         0         6,265 <t< td=""><td>64</td><td>Sumbawanda</td><td>N</td><td>2020</td><td>33.560</td><td>0</td><td>0</td><td>0</td><td>0</td><td>16.780</td><td>16.780</td></t<>	64	Sumbawanda	N	2020	33.560	0	0	0	0	16.780	16.780			
66         Tanga         E         2020         14,020         0         0         0         7,010         7,010           67         Ubungo         E         2020         18,610         0         0         0         9,305         9,305           (Thousand USD)	65	Tabora	E	2020	12,530	0	0	0	0	6,265	6,265			
67 Ubungo E 2020 18,610 0 0 0 9,305 9,305 (Thousand USD) 1 207 060	66	Tanga	E	2020	14,020	0	0	0	0	7,010	7,010			
(Thousand USD) 1 207 060	67	Ubungo	E	2020	18,610	0	0	0	0	9,305	9,305			
					(Thousand USD)			1 207	060					

#### Table 4-22: Phased substation cost estimates 2015-2020

Note: \*: Should be replaced with the contract amount

		New	Year to be	Construction	Ar	nual Exper	nditure (Tho	usand USE	))
No	Substation	or Expansion	Com- missioned	Cost (T. USD)	2021	2022	2023	2024	2025
68	Kinverezi	E	2022	6.820	3.410	3.410	0	0	0
69	Mkuranga	N	2022	13.930	6.965	6.965	0	0	0
70	Shinvanga	E	2022	28.975	14.488	14.488	0	0	0
71	Arusha (Niiro)	E	2023	7.045	, 0	3.523	3.523	0	0
72	Lindi	E	2023	6,630	0	3,315	3,315	0	0
73	Madaba	E	2023	6,840	0	3,420	3,420	0	0
74	Masasi	N	2023	25,990	0	12,995	12,995	0	0
75	Songea	E	2023	31,195	0	15,598	15,598	0	0
76	Tunduru	N	2023	27,370	0	13,685	13,685	0	0
77	Kigoma	E	2024	3,485	0	0	1,743	1,743	0
78	Sumbawanga	E	2024	5,790	0	0	2,895	2,895	0
79	Babati	E	2025	5,745	0	0	0	2,873	2,873
80	Bagamoyo	E	2025	36,680	0	0	0	18,340	18,340
81	Chalinze	E	2025	11,425	0	0	0	5,713	5,713
82	Geothermal A S/S	N	2025	6,305	0	0	0	3,153	3,153
83	Kigoma	E	2025	3,310	0	0	0	1,655	1,655
84	Kinyerezi	E	2025	1,870	0	0	0	935	935
85	Kyaka	E	2025	700	0	0	0	350	350
86	Masasi	E	2025	7,440	0	0	0	3,720	3,720
87	Mbeya	E	2025	11,685	0	0	0	5,843	5,843
88	Mkuranga	E	2025	42,580	0	0	0	21,290	21,290
89	Mpanda	N	2025	1,120	0	0	0	560	560
90	Mtwara	E	2025	10,820	0	0	0	5,410	5,410
91	Mwanza	E	2025	66,890	0	0	0	33,445	33,445
92	North DSM	N	2025	19,180	0	0	0	9,590	9,590
93	Nyakanazi	E	2025	1,430	0	0	0	715	715
94	Shinyanga	E	2025	7,050	0	0	0	3,525	3,525
95	Songea	E	2025	7,440	0	0	0	3,720	3,720
96	South DSM	N	2025	20,720	0	0	0	10,360	10,360
97	Southeast DSM	N	2025	20,720	0	0	0	10,360	10,360
98	Tunduru	E	2025	7,240	0	0	0	3,620	3,620
99	Geothermal A S/S	E	2026	935	0	0	0	0	468
100	lbosa	N	2026	3,375	0	0	0	0	1,688
101	Iringa	E	2026	935	0	0	0	0	468
102	Lusu	E	2026	4,445	0	0	0	0	2,223
103	Nyamongo	E	2026	4,445	0	0	0	0	2,223
104	Tabora	E	2026	7,045	0	0	0	0	3,523
				(Thousand USD)			10-010		
							465,010		

#### Table 4-23: Phased substation cost estimates 2021-2025

Table 4-24: Phased substation cost estimates 2026-203	0
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		New	Year to be	Construction	Ar	nual Exper	nditure (Tho	usand USE	))
No	Substation	or Expansion	Com- missioned	Cost (T. USD)	2026	2027	2028	2029	2030
99	Geothermal A S/S	F	2026	935	468	0	0	0	0
100	lbosa	N	2026	3.375	1.688	0	0	0	0
101	Iringa	E	2026	935	468	0	0	0	0
102	Lusu	Ē	2026	4.445	2.223	0	0	0	0
103	Nvamongo	E	2026	4,445	2.223	0	0	0	0
104	Tabora	E	2026	7.045	3.523	0	0	0	0
105	Bagamovo	E	2027	935	468	468	0	0	0
106	Kvaka	E	2027	700	350	350	0	0	0
107	Kisada	E	2028	7.870	0	3.935	3.935	0	0
108	Kvela	N	2028	8.445	0	4.223	4.223	0	0
109	Mbeva	E	2028	15.975	0	7.988	7.988	0	0
110	Mnvera	N	2028	52.400	0	26.200	26.200	0	0
111	Musoma	E	2028	4,445	0	2,223	2,223	0	0
112	Songwe Hydro B S/S	N	2028	4,560	0	2,280	2,280	0	0
113	Arusha (Njiro)	E	2029	7,045	0	0	3,523	3,523	0
114	Bagamovo	E	2029	16.665	0	0	8.333	8.333	0
115	Segera	E	2029	9.935	0	0	4.968	4.968	0
116	Arusha (Njiro)	E	2030	10,375	0	0	0	5,188	5,188
117	Bagamoyo	E	2030	2,090	0	0	0	1,045	1,045
118	Bunda	E	2030	4,445	0	0	0	2,223	2,223
119	Kigoma	E	2030	6.225	0	0	0	3.113	3.113
120	Kinyerezi	E	2030	1,870	0	0	0	935	935
121	Kyaka	E	2030	4,445	0	0	0	2,223	2,223
122	Lindi	E	2030	6,225	0	0	0	3,113	3,113
123	Madaba	E	2030	6,225	0	0	0	3,113	3,113
124	Mkuranga	E	2030	2,975	0	0	0	1,488	1,488
125	Mlandizi	E	2030	12,790	0	0	0	6,395	6,395
126	Mnyera	E	2030	935	0	0	0	468	468
127	Morogoro	E	2030	5,745	0	0	0	2,873	2,873
128	Mpanda	E	2030	7,050	0	0	0	3,525	3,525
129	Mpa-Tab SwS	E	2030	27,330	0	0	0	13,665	13,665
130	Mtwara	E	2030	10,670	0	0	0	5,335	5,335
131	North DSM	E	2030	1,870	0	0	0	935	935
132	Shinyanga	E	2030	7,890	0	0	0	3,945	3,945
133	Somanga Fungu	E	2030	14,065	0	0	0	7,033	7,033
134	Southeast DSM	E	2030	12,245	0	0	0	6,123	6,123
135	Tab-Mpa SwS	N	2030	27,330	0	0	0	13,665	13,665
136	Tabora	E	2030	57,250	0	0	0	28,625	28,625
137	West DSM	N	2030	20,720	0	0	0	10,360	10,360
138	Mkuranga	E	2031	6,420	0	0	0	0	3,210
139	Mku-Som SwS-1	N	2031	17,990	0	0	0	0	8,995
140	Mku-Som SwS-2	N	2031	17,990	0	0	0	0	8,995
141	Somanga Fungu	E	2031	6,820	0	0	0	0	3,410
142	Tanga	I E	2031	4,445	0	0	0	0	2,223
				(Thousand USD)			447 460		
							417,103		

No         Substation         or Expansion         Cost (T, USD)         203         203         203         203         203           138         Mutrangi         E         2031         (T, USD)         3.210         0         0         0         0         0           139         Mutrangi         E         2031         (T, 980)         8.985         0			New	Year to be	Construction	Ar	nual Exper	nditure (Tho	ousand USE	))
Expansion         reconst         (T. USD)         203         203         203         203         203         203         0	No	Substation	or	Com-	Cost	0004	0000	0000	0004	0005
138         Muranga         E         2031         6.420         3.210         0			Expansion	missioned	(T. USD)	2031	2032	2033	2034	2035
139       Mu-Som Sw5-1       N       2031       17.990       8.995       0       0       0       0         140       Mu-Som Sw5-2       N       2031       16,820       3,410       0       0       0       0         141       Somanga Fungu       E       2031       16,841       8,421       8,421       0       0       0       0         143       Arusha (Niro)       E       2032       16,841       8,421       8,421       0	138	Mkuranga	E	2031	6,420	3,210	0	0	0	0
140       Mu-Som SwS-2       N       2031       17,990       8,995       0       0       0       0       0         141       Somange Fungu       E       2031       4,445       2,223       0       0       0       0       0         143       Ausha (Niro)       E       2032       16,841       8,421       8,421       0	139	Mku-Som SwS-1	N	2031	17,990	8,995	0	0	0	0
141       Somanga Fungu       E       2031       6.420       3.410       0       0       0       0       0         142       Tanga       E       2031       6.4445       2.223       0       0       0       0         144       bosa       E       2032       16.841       8.421       8.421       0       0       0         145       Lusu       E       2032       4.445       2.223       0       0       0       0         146       Madaba       E       2032       9.35       4468       448       0       0       0       0         147       Mufindi       E       2033       6.225       0       3.113       3.113       0       0         148       Mesasi       E       2033       7.045       0       3.523       3.223       0       0       0         151       Mwanza       E       2033       4.445       0       2.223       0 <td>140</td> <td>Mku-Som SwS-2</td> <td>N</td> <td>2031</td> <td>17,990</td> <td>8,995</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td>	140	Mku-Som SwS-2	N	2031	17,990	8,995	0	0	0	0
144       Ianga       E       2031       4,445       2,223       0       0       0       0         144       Ausha (Njiro)       E       2032       16,841       8,421       0       0       0       0         144       Lusu       E       2032       935       468       466       0       0       0         146       Lusu       E       2032       935       468       468       0       0       0         147       Mifndi       E       2033       6,225       0       3,113       0       0       0         148       Masai       E       2033       16,445       0       8,473       8,473       0       0       0         150       Myaraa       E       2033       7,445       0       3,523       0       0       0       153       Saranga Fungu       E       2033       7,445       0       3,523       0       0       0       155       Maranai       E       2034       4,400       0       0       0       10       0       155       Maranai       E       2034       4,400       0       0       0       4,478       0	141	Somanga Fungu	E	2031	6,820	3,410	0	0	0	0
143         Avasha (wijic)         E         2032         1b,341         6,421         6,421         6,421         6,421         6,421         6,421         6,421         6,421         6,421         6,421         6,421         6,421         6,421         6,421         6,445         6,422         2,223         0,223         0,233         6,445         422,335         4468         466         0         0         0           144         Masasi         E         2033         6,225         0         3,113         0         0           148         Masasi         E         2033         7,045         0         3,523         0         0         0         0         0         0         15         Myanopo         E         2033         7,045         0         3,523         0         0         0         15         Nyanopo         E         2033         4,400         0         2,200         0         0         0         15         Tunduru         E         2034         4,020         0         0         2,010         0         15         15         Tunduru         E         2034         14,020         0         0         4,738         4,738         0	142	langa		2031	4,445	2,223	0	0	0	0
Instructure         Losa	143	Arusna (Njiro)		2032	10,841	8,421	8,421	0	0	0
146         Marind         E         2032         133         146         648         168         0         0         0           147         Mulindi         E         2032         935         468         468         0         0         0           148         Messal         E         2033         6.225         0         3.113         0         0           149         Moeya         E         2033         16.345         0         468         468         0         0           151         Mwanza         E         2033         7.045         0         3.523         3.623         0         0           153         Somanga Fungu         E         2033         4.400         0         2.200         0         0           155         Tunduru         E         2034         4.020         0         0         2.010         0           156         Chalinze         E         2034         4.020         0         0         4.738         4.738         0         0           156         Chalinze         E         2034         4.020         0         0         4.68         0         0	144		F	2032	935 4 445	2 223	2 223	0	0	0
147       Muindi       E       2032       935       468       468       0       0       0         148       Measi       E       2033       6.225       0       3.113       3.113       0       0         150       Myera       E       2033       16.945       0       8.473       0       0         151       Myanza       E       2033       7.045       0       3.523       3.523       0       0       0         152       Nyamongo       E       2033       7.045       0       3.523       0	146	Madaba	E	2032	935	468	468	0	0	0
148         Mesasi         E         2033         6.225         0         3.113         0         0           149         Meyera         E         2033         395         0         468         468         0         0           150         Myara         E         2033         7.045         0         3.523         3.523         0         0           151         Myarongo         E         2033         4.445         0         2.223         2.223         0         0         0           153         Somanga Fungu         E         2033         4.440         0         2.200         0         0           154         Tabora         E         2033         6.225         0         3.113         0         0           156         Chalinze         E         2034         4.400         0         0         2.010         0           158         Madaba         E         2034         9.475         0         0         4.788         4.788         0           160         Shinyanga         E         2034         1.4090         0         0         2.040         0         0         0         8.508	147	Mufindi	Ē	2032	935	468	468	0	0	0
149       Mbeya       E       2033       935       0       468       468       0       0         150       Myvera       E       2033       7.045       0       3.623       3.623       0       0         151       Myamopo       E       2033       7.045       0       2.223       2.223       0       0       0         154       Tabora       E       2033       7.045       0       3.623       0	148	Masasi	E	2033	6,225	0	3,113	3,113	0	0
150       Myanza       E       2033       16,945       0       8,473       0       0         151       Myanongo       E       2033       7,045       0       3,523       3,523       0       0         153       Somanga Fungu       E       2033       4,440       0       2,200       2,200       0       0         154       Tabora       E       2033       7,045       0       3,523       3,523       0       0         155       Tunduru       E       2033       6,225       0       3,113       0       0         156       Chalinze       E       2034       935       0       0       468       468       0         158       Madaba       E       2034       9,475       0       0       4,738       4,738       0         160       Shiryanga       E       2034       1,400       0       0       7,045       0       0       2,473       0       0       0       2,473       0,0       0       0       2,473       0,0       0       0       2,473       2,473       0       0       0       2,473       2,473       0       0	149	Mbeya	E	2033	935	0	468	468	0	0
151       Mwanza       E       2033       7.045       0       3.523       0       0         152       Nyamongo       E       2033       4.445       0       2.223       2.223       0       0         153       Somanga Fungu       E       2033       4.445       0       2.223       2.223       0       0         154       Tabora       E       2033       6.225       0       3.113       3.113       0       0       0         156       Chalinze       E       2034       4.020       0       0       2.010       0       0         158       Madaba       E       2034       9.475       0       0       4.788       4.78       0         160       Shinyanga       E       2034       1.4090       0       0       7.045       0       0         161       Songwe Hydro, B.S/S       E       2035       1.7015       0       0       2.643       2.873         168       Bulyanhulu       E       2035       1.870       0       0       2.873       3.935         167       Burgania       E       2035       1.870       0       0	150	Mnyera	E	2033	16,945	0	8,473	8,473	0	0
152       Nyamongo       E       2033       4,440       0       2,223       2,223       0       0         153       Somanga Fungu       E       2033       7,045       0       3,523       0       0         156       Chundru       E       2033       7,045       0       3,113       3,113       0       0         156       Chalinze       E       2034       4,020       0       0       2,010       2,010       0         157       Kihansi       E       2034       9,355       0       0       468       468       0         158       Madaba       E       2034       9,475       0       0       4,738       4,738       0         160       Shinyanga       E       2034       1,400       0       0       7,045       0       0       2,040       2,040       0	151	Mwanza	E	2033	7,045	0	3,523	3,523	0	0
153       Somanga rungu       E       2033       4,400       0       2,200       0       0       0         154       Tabora       E       2033       7,045       0       3,523       3,523       0       0         156       Chalinze       E       2034       4,020       0       0       2,010       0         156       Chalinze       E       2034       935       0       0       468       468       0         158       Medaba       E       2034       9,475       0       0       4,738       4,738       0         160       Shinyanga       E       2034       1,4090       0       0       7,045       0       0       2,400       0       162       2,640       0       163       2,640       0       0       0       0       0       0       2,873       2,873       166       164       Babati       E       2035       1,870       0       0       0       2,873       2,873       2,873       1,870       0       0       0       9,935       3,935       166       Buhanhulu       E       2035       1,870       0       0       0       10,098 <td>152</td> <td>Nyamongo</td> <td>E</td> <td>2033</td> <td>4,445</td> <td>0</td> <td>2,223</td> <td>2,223</td> <td>0</td> <td>0</td>	152	Nyamongo	E	2033	4,445	0	2,223	2,223	0	0
Iabora         E         2033         7,045         0         3,523         3,523         0         0           155         Tunduru         E         2033         6,225         0         3,113         3,113         0         0           156         Chalinze         E         2034         4,020         0         0         2,010         0           157         Kihansi         E         2034         935         0         0         468         468         0           168         Myakanazi         E         2034         9,475         0         0         4,736         4,738         0           160         Shinyanga         E         2034         1,409         0         0         7,045         0           161         Songwe Hydro_A S/S         N         2034         1,400         0         0         0         8,508         8,508           164         Babati         E         2035         1,870         0         0         0         9,35         935           166         Bulyanhulu         E         2035         1,870         0         0         0         9,35         935           <	153	Somanga Fungu	E	2033	4,400	0	2,200	2,200	0	0
135         1010010         E         2033         0.225         0         3,113         0         0           156         Challarze         E         2034         4,020         0         0         12,010         2,010         2,010         2,010         2,010         0         157         Kihansi         E         2034         935         0         0         468         468         0           158         Madaba         E         2034         9,475         0         0         4,738         4,738         0           160         Shinyanga         E         2034         1,4090         0         0         7,045         0           161         Songwe Hydro, B S/S         E         2035         1,715         0         0         0         8,508         1,630         0         0         9,35         935         1,670         0         0         0         9,410	154			2033	7,045	0	3,523	3,523	0	0
Ibb         Chainze         E         2004         4020         0         2010         2010         2010           157         Kinansi         E         2034         935         0         0         468         468         0           158         Myakanzi         E         2034         9475         0         0         4738         4738         0           160         Shinyanga         E         2034         14.090         0         7.045         7.045         0         0         17.045         0         0         17.045         0         0         17.045         0         0         17.045         0         0         2.040         0         0         163         Arusha (Miro)         E         2035         17.745         0         0         0         8.508         8.508         8.508         166         Burda         E         2035         1.870         0         0         0         9.35         935         167         Buzwagi         E         2035         1.870         0         0         0         9.35         935         168         Kigoma         E         2035         1.870         0         0         10.988         <	155	Chaliaza		2033	0,220	0	3,113	3,113	2 010	0
Industa         E         2004         935         0         0         488         408           158         Madaba         E         2034         9,475         0         0         4,738         4,738         0           160         Shinyanga         E         2034         14,090         0         0         7,045         0           161         Songwe Hydro A S/S         N         2035         17,015         0         0         2,040         2,040         0         0           163         Arusha (Njiro)         E         2035         17,015         0         0         0         8,508         8,508           164         Babati         E         2035         1,870         0         0         0         935         935           166         Bunda         E         2035         1,870         0         0         0         935         935           168         Chalinze         E         2035         1,870         0         0         0         10,098         10,098           169         Kigoma         E         2035         1,870         0         0         0         1,435         1,435	150	Kihansi		2034	4,020	0	0	2,010	2,010	0
Instruct         E         2024         9.475         0         0         4.738         4.738         0           160         Shinyanga         E         2034         14.090         0         0         7.045         7.045         0           161         Songwe Hydro, A S/S         E         2034         14.090         0         0         2.040         0           162         Songwe Hydro, B S/S         E         2035         17.715         0         0         0         8.508         8.508           164         Babati         E         2035         1.7745         0         0         0         9.355         9.355           166         Burda         E         2035         1.870         0         0         0         9.355         9.355           167         Buzwagi         E         2035         1.870         0         0         0         9.35         9.355           168         Bugoma         E         2035         18.820         0         0         0         10.098         10.098         10.098         10.998         10.941         170         Kinyerezi         E         2035         2.775         0 <t< td=""><td>158</td><td>Madaba</td><td>F</td><td>2034</td><td>935</td><td>0</td><td>0</td><td>468</td><td>468</td><td>0</td></t<>	158	Madaba	F	2034	935	0	0	468	468	0
160         Shinyanga         E         2034         14,090         0         7,045         7,045         0           161         Songwe Hydro, A S/S         N         2034         4,080         0         0         2,040         2,040         0         0           162         Songwe Hydro, B S/S         E         2035         17,015         0         0         0         8,508         8,508           164         Babati         E         2035         5,745         0         0         0         935         935           166         Bunda         E         2035         1,870         0         0         0         935         935           167         Buzwagi         E         2035         1,870         0         0         0         935         935           168         Chalinze         E         2035         16,435         0         0         0         10,098         10,098         10,098         10,098         10,098         10,098         10,098         10,098         10,098         10,098         10,098         10,098         10,098         10,098         10,098         10,098         10,098         10,098         10,098	159	Nyakanazi	F	2034	9,475	0	0	4,738	4,738	0
161         Songwe Hydro, A S/S         N         2034         4,080         0         0         2,040         2,040         0           162         Songwe Hydro, B S/S         E         2034         1,400         0         0         700         700         0         0           163         Arusha (Niiro)         E         2035         17,715         0         0         0         8,508         8,508           164         Babati         E         2035         1,870         0         0         0         935         935           166         Bunda         E         2035         1,870         0         0         0         935         935           166         Bunda         E         2035         1,870         0         0         0         9,9410         9,416	160	Shinvanga	E	2034	14.090	0	0	7.045	7.045	0
162         Songwe Hydro B S/S         E         2034         1,400         0         0         700         700         0           163         Arusha (Njrc)         E         2035         17,015         0         0         0         8,508         8,508           164         Babati         E         2035         5,745         0         0         0         2,873         2,873           165         Bulyanhulu         E         2035         1,870         0         0         0         935         935           166         Buzwagi         E         2035         1,870         0         0         0         9,35         935           167         Buzwagi         E         2035         16,825         0         0         0         9,341         9,410	161	Songwe Hydro_A S/S	N	2034	4,080	0	0	2,040	2,040	0
163       Arusha (Njiro)       E       2035       17,015       0       0       0       8,508       8,508         164       Babati       E       2035       5,745       0       0       0       2,873       2,873         165       Bulyanhulu       E       2035       1,870       0       0       0       935       935         166       Burwagi       E       2035       1,870       0       0       0       935       935         167       Buzwagi       E       2035       1,870       0       0       0       935       935         168       Chalinze       E       2035       1,870       0       0       0       9,410 </td <td>162</td> <td>Songwe Hydro_B S/S</td> <td>E</td> <td>2034</td> <td>1,400</td> <td>0</td> <td>0</td> <td>700</td> <td>700</td> <td>0</td>	162	Songwe Hydro_B S/S	E	2034	1,400	0	0	700	700	0
164         Babati         E         2035         5,745         0         0         0         2,873         2,873           165         Bulyanhulu         E         2035         1,870         0         0         0         935         935           166         Burwagi         E         2035         1,870         0         0         0         935         935           167         Buzwagi         E         2035         1,870         0         0         0         935         935           168         Kigoma         E         2035         1,870         0         0         0         9,413         1,435         1,435         1,435         1,435         1,435         1,435         1,435	163	Arusha (Njiro)	E	2035	17,015	0	0	0	8,508	8,508
165       Bulyanhulu       E       2035       1,870       0       0       0       935       935         166       Burda       E       2035       1,870       0       0       0       935       935         167       Burwagi       E       2035       1,870       0       0       0       935       935         168       Chalinze       E       2035       1,870       0       0       0       9,410       9,410         170       Kinyerezi       E       2035       16,835       0       0       0       9,410       9,410         170       Kinyerezi       E       2035       16,435       0       0       0       1,635       1,635         171       Kyaka       E       2035       2,975       0       0       0       1,485       1,485         173       Mpanda       E       2035       3,690       0       0       0       2,223       2,223         176       Musara       E       2035       1,845       0       0       2,223       2,223       2,223         176       Musara       E       2035       1,245       0	164	Babati	E	2035	5,745	0	0	0	2,873	2,873
166         Burda         E         2035         1.870         0         0         0         935         9355           167         Buzwagi         E         2035         1.870         0         0         0         935         9355           168         Chalinze         E         2035         18,820         0         0         0         9,410         9,410           170         Kinyerezi         E         2035         16,435         0         0         0         8,218         8,218           171         Kyaka         E         2035         2,975         0         0         0         1,635         1,635           172         Mkuranga         E         2035         2,975         0         0         0         1,488         1,485           173         Mpanda         E         2035         3,690         0         0         0         2,223 <td>165</td> <td>Bulyanhulu</td> <td>E</td> <td>2035</td> <td>1,870</td> <td>0</td> <td>0</td> <td>0</td> <td>935</td> <td>935</td>	165	Bulyanhulu	E	2035	1,870	0	0	0	935	935
167       Buzwagi       E       2035       1,870       0       0       0       935       935         168       Chalinze       E       2035       20,195       0       0       0       10,098       10,098         169       Kigoma       E       2035       16,435       0       0       0       8,218       8,218         171       Kyaka       E       2035       3,270       0       0       0       8,218       8,218         172       Myaraga       E       2035       6,225       0       0       0       1,485       1,485         173       Mpanda       E       2035       6,225       0       0       0       1,485       1,485         175       Mwara       E       2035       4,445       0       0       0       2,223       2,223         176       Mwara       E       2035       12,245       0       0       0       2,223       2,223         177       Mwara       E       2035       12,245       0       0       0       2,223       2,223         177       Mwara       E       2035       2,555       0 <th< td=""><td>166</td><td>Bunda</td><td>E</td><td>2035</td><td>1,870</td><td>0</td><td>0</td><td>0</td><td>935</td><td>935</td></th<>	166	Bunda	E	2035	1,870	0	0	0	935	935
168       Chainze       E       2035       20,195       0       0       0       10,098       10,098         169       Kigoma       E       2035       18,820       0       0       0       9,410       9,410         170       Kinyerezi       E       2035       16,435       0       0       0       8,218       8,218         171       Kyaka       E       2035       2,975       0       0       0       1,635       1,635         172       Mkuranga       E       2035       6,225       0       0       0       1,448       1,488         173       Mpanda       E       2035       3,690       0       0       0       1,445       1,845         175       Mtwara       E       2035       1,870       0       0       0       935       935         176       Musoma       E       2035       12,245       0       0       0       2,763       2,763         177       Mwaraa       E       2035       26,850       0       0       0       13,425       13,425         178       North DSM       E       2035       26,850       0 </td <td>167</td> <td>Buzwagi</td> <td>E</td> <td>2035</td> <td>1,870</td> <td>0</td> <td>0</td> <td>0</td> <td>935</td> <td>935</td>	167	Buzwagi	E	2035	1,870	0	0	0	935	935
Top       Kigoma       E       2035       18,820       0       0       0       9,410       9,410       9,410         170       Kinverezi       E       2035       16,435       0       0       0       8,218       8,218         171       Kyaka       E       2035       3,270       0       0       0       1,635       1,635         172       Mkuranga       E       2035       6,225       0       0       0       1,488       1,488         173       Mpanda       E       2035       3,690       0       0       1,845       1,845         174       Mtisoma       E       2035       4,445       0       0       0       2,223       2,223       2,223         176       Musoma       E       2035       1,2245       0       0       0       2,763       2,763         177       Mwanza       E       2035       12,245       0       0       0       6,123       6,123         179       Nyakanazi       E       2035       935       0       0       0       468       468         181       Rusumo       E       2035       32,715<	168	Chalinze		2035	20,195	0	0	0	10,098	10,098
170       Kinyelezit       E       2035       16,435       0       0       0       0,216	169	Kigoma		2035	18,820	0	0	0	9,410	9,410
111       Nyana       E       2003       3,270       0       0       0       0       1,033       1,033         172       Mkuranga       E       2035       2,975       0       0       0       1,488       1,488         173       Mpanda       E       2035       6,225       0       0       0       1,488       1,488         174       Mibwa       E       2035       3,690       0       0       0       1,488       1,845         175       Mkusoma       E       2035       4,445       0       0       0       2,223       2,223         176       Mkusoma       E       2035       1,870       0       0       0       9,35<935	170	Kuaka		2035	10,435	0	0	0	0,210	0,210
173       Mpanda       E       2035       2,25       0       0       0       1,13       3,113         174       Mtibwa       E       2035       3,690       0       0       0       1,845       1,845         175       Mtwara       E       2035       1,870       0       0       0       2,223       2,223         176       Musoma       E       2035       1,870       0       0       0       2,763       2,763         177       Mwanza       E       2035       5,525       0       0       0       6,123       6,123         177       Myanongo       E       2035       26,850       0       0       0       6,123       6,123         177       Nyakanazi       E       2035       935       0       0       0       6,123       6,123         180       Nyamongo       E       2035       935       0       0       0       13,078       13,078         182       Segera       E       2035       32,715       0       0       0       16,358       16,358         184       Somanga Fungu       E       2035       12,245       0<	172	Mkuranga	F	2035	2 975	0	0	0	1,035	1,035
174         Mitowa         E         2035         3,690         0         0         1,845         1,845           175         Mtwara         E         2035         3,690         0         0         0         2,223         2,223           176         Musoma         E         2035         1,870         0         0         0         2,223         2,223           176         Musoma         E         2035         5,525         0         0         0         2,763         2,763           177         Mwanza         E         2035         12,245         0         0         0         6,123         6,123           179         Nyakanazi         E         2035         26,850         0         0         0         468         468           181         Rusumo         E         2035         935         0         0         0         468         468           182         Segera         E         2035         3,2,715         0         0         0         16,358         16,358           183         Shinyanga         E         2035         12,245         0         0         0         6,123         6,	173	Mpanda	F	2035	6,225	0	0	0	3,113	3,113
175         Mtwara         E         2035         4,445         0         0         0         2,223         2,223           176         Musoma         E         2035         1,870         0         0         0         935         935           177         Mwarza         E         2035         5,525         0         0         0         2,763         2,763           178         North DSM         E         2035         12,245         0         0         0         6,123         6,123           179         Nyakanazi         E         2035         26,850         0         0         0         13,425         13,425           180         Nyamongo         E         2035         935         0         0         0         468         468           181         Rusumo         E         2035         26,155         0         0         0         13,078         13,078           183         Shinyanga         E         2035         32,715         0         0         0         6,123         6,123           186         South DSM         E         2035         12,245         0         0         0	174	Mtibwa	E	2035	3.690	0	0	0	1.845	1.845
176         Musoma         E         2035         1,870         0         0         0         935         935           177         Mwanza         E         2035         5,525         0         0         0         2,763         2,763           178         North DSM         E         2035         12,245         0         0         0         6,123         6,123           179         Nyakanazi         E         2035         26,850         0         0         0         13,425         13,425           180         Nyamongo         E         2035         935         0         0         0         468         468           181         Rusumo         E         2035         26,155         0         0         0         16,358         16,358           183         Shinyanga         E         2035         32,715         0         0         0         6,123         6,123           184         Somanga Fungu         E         2035         12,245         0         0         0         6,123         6,123           185         South DSM         E         2035         12,245         0         0         0	175	Mtwara	E	2035	4,445	0	0	0	2,223	2,223
177       Mwanza       E       2035       5,525       0       0       0       2,763       2,763         178       North DSM       E       2035       12,245       0       0       0       6,123       6,123         179       Nyakanazi       E       2035       26,850       0       0       0       13,425       13,425         180       Nyamongo       E       2035       935       0       0       0       468       468         181       Rusumo       E       2035       26,155       0       0       0       468       468         182       Segera       E       2035       32,715       0       0       0       16,358       16,358         183       Shinyanga       E       2035       12,245       0       0       0       6,123       6,123         184       Somanga Fungu       E       2035       12,245       0       0       0       6,123       6,123         185       South DSM       E       2035       12,245       0       0       0       6,123       6,123         186       Southeast DSM       E       2035       12,245 <td>176</td> <td>Musoma</td> <td>E</td> <td>2035</td> <td>1,870</td> <td>0</td> <td>0</td> <td>0</td> <td>935</td> <td>935</td>	176	Musoma	E	2035	1,870	0	0	0	935	935
178         North DSM         E         2035         12,245         0         0         0         6,123         6,123           179         Nyakanazi         E         2035         26,850         0         0         0         13,425         13,425           180         Nyamongo         E         2035         935         0         0         0         468         468           181         Rusumo         E         2035         935         0         0         0         468         468           182         Segera         E         2035         26,155         0         0         0         13,078         13,078         13,078           183         Shinyanga         E         2035         32,715         0         0         0         16,358         16,358           184         Somanga Fungu         E         2035         12,245         0         0         0         6,123         6,123           185         South DSM         E         2035         12,245         0         0         0         6,123         6,123           186         Southeast DSM         E         2035         12,245         0	177	Mwanza	E	2035	5,525	0	0	0	2,763	2,763
179       Nyakanazi       E       2035       26,850       0       0       0       13,425       13,425         180       Nyamongo       E       2035       935       0       0       0       468       468         181       Rusumo       E       2035       935       0       0       0       468       468         182       Segera       E       2035       26,155       0       0       0       13,078       13,078         183       Shinyanga       E       2035       32,715       0       0       0       16,358       16,358         184       Somanga Fungu       E       2035       12,245       0       0       0       6,123       6,123         185       South DSM       E       2035       12,245       0       0       0       6,123       6,123         186       Southaast DSM       E       2035       12,245       0       0       0       6,123       6,123         187       Sumbawanga       E       2035       12,245       0       0       0       0       2,223         189       Chalinze       E       2036       4,445	178	North DSM	E	2035	12,245	0	0	0	6,123	6,123
180       Nyamongo       E       2035       935       0       0       0       468       468         181       Rusumo       E       2035       935       0       0       0       468       468         182       Segera       E       2035       26,155       0       0       0       13,078       13,078         183       Shinyanga       E       2035       32,715       0       0       0       468       468         184       Somanga Fungu       E       2035       32,715       0       0       0       4,880       4,880         185       South DSM       E       2035       12,245       0       0       0       6,123       6,123         186       Southeast DSM       E       2035       12,245       0       0       0       6,123       6,123         187       Sumbawanga       E       2035       12,245       0       0       0       6,123       6,123         188       West DSM       E       2036       8,500       0       0       0       4,250         190       Lusu       E       2036       4,445       0       0 </td <td>179</td> <td>Nyakanazi</td> <td>E</td> <td>2035</td> <td>26,850</td> <td>0</td> <td>0</td> <td>0</td> <td>13,425</td> <td>13,425</td>	179	Nyakanazi	E	2035	26,850	0	0	0	13,425	13,425
181       Rusumo       E       2035       935       0       0       0       468       468         182       Segera       E       2035       26,155       0       0       0       13,078       13,078         183       Shinyanga       E       2035       32,715       0       0       0       16,358       16,358         184       Somanga Fungu       E       2035       9,760       0       0       0       4,880       4,880         185       South DSM       E       2035       12,245       0       0       0       6,123       6,123         186       Southeast DSM       E       2035       12,245       0       0       0       6,123       6,123         187       Sumbawanga       E       2035       12,245       0       0       0       6,123       6,123         188       West DSM       E       2035       12,245       0       0       0       4,250         190       Lusu       E       2036       8,500       0       0       0       2,223         191       Mtwara       E       2036       9,280       0       0       <	180	Nyamongo	E	2035	935	0	0	0	468	468
182         Segera         E         2035         26,155         0         0         0         13,078         13,078           183         Shinyanga         E         2035         32,715         0         0         0         16,358         16,358           184         Somanga Fungu         E         2035         9,760         0         0         0         4,880         4,880           185         South DSM         E         2035         12,245         0         0         0         6,123         6,123           186         Southeast DSM         E         2035         12,245         0         0         0         6,123         6,123           187         Sumbawanga         E         2035         6,225         0         0         0         6,123         6,123           188         West DSM         E         2035         12,245         0         0         0         4,250           190         Lusu         E         2036         8,500         0         0         0         2,223           191         Mtwara         E         2036         4,445         0         0         0         2,223	181	Rusumo	E F	2035	935	0	0	0	468	468
183       Shiftyanga       E       2035       32,715       0       0       0       0       16,336       16,336       16,336         184       Somanga Fungu       E       2035       9,760       0       0       0       4,880       4,880         185       South DSM       E       2035       12,245       0       0       0       6,123       6,123         186       Southeast DSM       E       2035       12,245       0       0       0       6,123       6,123         187       Sumbawanga       E       2035       6,225       0       0       0       3,113       3,113         188       West DSM       E       2036       8,500       0       0       0       6,123       6,123         189       Chalinze       E       2036       8,500       0       0       0       4,250         190       Lusu       E       2036       4,445       0       0       0       2,223         191       Mtwara       E       2036       6,225       0       0       0       2,223         192       Musoma       E       2036       6,225       0	182	Segera		2035	26,155	0	0	0	13,078	13,078
104       Sommarigar lange       E       2035       3,700       0       0       0       4,000       4,000         185       South DSM       E       2035       12,245       0       0       0       6,123       6,123         186       Southeast DSM       E       2035       12,245       0       0       0       6,123       6,123         187       Sumbawanga       E       2035       6,225       0       0       0       3,113       3,113         188       West DSM       E       2035       12,245       0       0       0       6,123       6,123         189       Chalinze       E       2036       8,500       0       0       0       4,250         190       Lusu       E       2036       4,445       0       0       0       2,223         191       Mtwara       E       2036       4,445       0       0       0       2,223         192       Musoma       E       2036       6,225       0       0       0       2,223         193       Songea       E       2036       6,225       0       0       0       2,223	18/	Somanga Fungu		2035	9 760	0	0	0	10,000	10,000
186       South Dolm       E       2036       12,245       0       0       0       6,123       6,123         187       Sumbawanga       E       2035       12,245       0       0       0       6,123       6,123         187       Sumbawanga       E       2035       6,225       0       0       0       3,113       3,113         188       West DSM       E       2035       12,245       0       0       0       6,123       6,123         189       Chalinze       E       2036       8,500       0       0       0       4,250         190       Lusu       E       2036       4,445       0       0       0       2,223         191       Mtwara       E       2036       4,445       0       0       0       2,223         192       Musoma       E       2036       6,225       0       0       0       2,223         193       Songea       E       2036       4,445       0       0       0       2,223         194       Tanga       E       2036       4,445       0       0       0       2,223         (Th	185	South DSM	F	2035	12 245	0	0	0	6 123	6 123
187         Sumbawanga         E         2035         6,225         0         0         0         3,113         3,113           188         West DSM         E         2035         12,245         0         0         0         6,123         6,123           189         Chalinze         E         2036         8,500         0         0         0         4,250           190         Lusu         E         2036         4,445         0         0         0         2,223           191         Mtwara         E         2036         4,445         0         0         0         2,223           193         Songea         E         2036         4,445         0         0         0         3,113           194         Tanga         E         2036         4,445         0         0         0         2,223           193         Songea         E         2036         4,445         0         0         0         0         2,223           194         Tanga         E         2036         4,445         0         0         0         0         2,223            E         2036	186	Southeast DSM	F	2035	12,245	0	0	0	6.123	6.123
188         West DSM         E         2035         12,245         0         0         0         6,123         123         123         14,250         0         0         0         0         2,223         133         Songea         E         2036         4,445         0         0         0         0         2,223         1313         194         Tanga         E         2036         4,445         0         0         0<	187	Sumbawanda	Ē	2035	6.225	0	0	0	3.113	3.113
189         Chalinze         E         2036         8,500         0         0         0         4,250           190         Lusu         E         2036         4,445         0         0         0         2,223           191         Mtwara         E         2036         9,280         0         0         0         2,223           192         Musoma         E         2036         4,445         0         0         0         2,223           193         Songea         E         2036         6,225         0         0         0         3,113           194         Tanga         E         2036         4,445         0         0         0         2,223           (Thousand USD)	188	West DSM	Ē	2035	12,245	0	0	0	6,123	6,123
190         Lusu         E         2036         4,445         0         0         0         0         2,223           191         Mtwara         E         2036         9,280         0         0         0         0         4,640           192         Musoma         E         2036         4,445         0         0         0         0         2,223           193         Songea         E         2036         6,225         0         0         0         0         3,113           194         Tanga         E         2036         4,445         0         0         0         0         2,223           (Thousand USD)	189	Chalinze	E	2036	8,500	0	0	0	0	4,250
191         Mtwara         E         2036         9,280         0         0         0         0         4,640           192         Musoma         E         2036         4,445         0         0         0         0         2,223           193         Songea         E         2036         6,225         0         0         0         0         3,113           194         Tanga         E         2036         4,445         0         0         0         0         2,223           (Thousand USD)	190	Lusu	E	2036	4,445	0	0	0	0	2,223
192         Musoma         E         2036         4,445         0         0         0         0         2,223           193         Songea         E         2036         6,225         0         0         0         0         3,113           194         Tanga         E         2036         4,445         0         0         0         0         2,223           (Thousand USD)           422,169	191	Mtwara	E	2036	9,280	0	0	0	0	4,640
193         Songea         E         2036         6,225         0         0         0         0         3,113           194         Tanga         E         2036         4,445         0         0         0         0         2,223           (Thousand USD)           422,169	192	Musoma	E	2036	4,445	0	0	0	0	2,223
<u>E 2036 4,445 0 0 0 0 2,223</u> (Thousand USD) 422.169	193	Songea	E	2036	6,225	0	0	0	0	3,113
(1 housand USD) 422.169	194	Tanga	I E	2036	4,445	0	0	0	0	2,223
					(I nousand USD)			422,169		

#### Table 4-25: Phased substation cost estimates 2031-2035

		New	Year to be	Construction	Annual Expenditure (Thousand USD)				))
No	Substation	or	Com-	Cost	2020	0007	2020	2020	20.40
		Expansion	missioned	(T. USD)	2036	2037	2038	2039	2040
189	Chalinze	E	2036	8,500	4,250	0	0	0	0
190	Lusu	E	2036	4,445	2,223	0	0	0	0
191	Mtwara	E	2036	9,280	4,640	0	0	0	0
192	Musoma	E	2036	4,445	2,223	0	0	0	0
193	Songea	E	2036	6,225	3,113	0	0	0	0
194	Tanga	E	2036	4,445	2,223	0	0	0	0
195	Arusha (Njiro)	E	2037	10,375	5,188	5,188	0	0	0
196	Kyaka Mihawa	E	2037	4,445	2,223	2,223	0	0	0
197		E F	2037	15,975	7,988	7,988	0	0	0
190	Nyamanga		2037	7,045	3,523	ა, <b>⊃∠ა</b> ე ეეე	0	0	0
200	Tabora	E	2037	4,445	2,223	2,223	0	0	0
200	Arusha (Niiro)	F	2037	7,045	0,525	3,523	3 523	0	0
201	Shinyanga	F	2030	7,045	0	3,523	3 523	0	0
202	Somanga Fungu	F	2030	4 400	0	2 200	2 200	0	0
200	Chalinze	F	2039	10,805	0	2,200	5,403	5,403	0
205	Nvakanazi	Ē	2039	9.475	0	0	4.738	4,738	0
206	Arusha (Niiro)	Ē	2040	47.280	0	0	0	23.640	23.640
207	Bagamovo	Ē	2040	8.580	0	0	0	4.290	4.290
208	Chalinze	Ē	2040	72,205	0	0	0	36,103	36,103
209	Dodoma	E	2040	64,465	0	0	0	32,233	32,233
210	Iringa	E	2040	21,150	0	0	0	10,575	10,575
211	Kigoma	E	2040	8,060	0	0	0	4,030	4,030
212	Kin-Som SwS1	E	2040	56,910	0	0	0	28,455	28,455
213	Kin-Som SwS2	E	2040	14,280	0	0	0	7,140	7,140
214	Kin-Som SwS3	E	2040	44,370	0	0	0	22,185	22,185
215	Kinyerezi	E	2040	50,320	0	0	0	25,160	25,160
216	Kisada	E	2040	36,360	0	0	0	18,180	18,180
217	Lusu	E	2040	935	0	0	0	468	468
218	Mbe-Sum SwS	E	2040	7,760	0	0	0	3,880	3,880
219	Mbeya	E	2040	36,540	0	0	0	18,270	18,270
220	Mkuranga	E	2040	55,380	0	0	0	27,690	27,690
221	Mku-Som SwS-1	E F	2040	17,700	0	0	0	8,850	8,850
222	Nku-Som SwS-2		2040	48,540	0	0	0	24,270	24,270
223	Maanda		2040	4,440	0	0	0	19 9/0	18 840
224	Mparida Mpa-Sum SwS	F	2040	46 080	0	0	0	23 040	23 040
226	Mpa-Tab SwS	F	2040	17 080	0	0	0	8 540	8 540
227	Mtwara	F	2040	5,160	0	0	0	2,580	2,580
228	Mwanza	E	2040	8.945	0	0	0	4.473	4.473
229	North DSM	Ē	2040	24,490	0	0	0	12,245	12,245
230	Nyakanazi	Е	2040	19,775	0	0	0	9,888	9,888
231	Rusumo	E	2040	935	0	0	0	468	468
232	Segera	E	2040	27,810	0	0	0	13,905	13,905
233	Shinyanga	E	2040	58,550	0	0	0	29,275	29,275
234	Singida	E	2040	21,490	0	0	0	10,745	10,745
235	Somanga Fungu	E	2040	12,460	0	0	0	6,230	6,230
236	South DSM	E	2040	24,490	0	0	0	12,245	12,245
237	Sumbawanga	E	2040	27,420	0	0	0	13,710	13,710
238	Tab-Mpa SwS	E	2040	17,080	0	0	0	8,540	8,540
239	I abora	E	2040	60,890	0	0	0	30,445	30,445
240	West DSM	E	2040	13,180	0	0	0	6,590	6,590
				(I nousand USD)			1 125 565		
							.,0,000		

#### Table 4-26: Phased substation cost estimates 2036-2040

#### 4.9.1 Summary of cost estimate

The overall phased costs for the transmission lines, transformers, substation and reactive power compensation over the planning horizon (2016-2040) are summarized in Table 4-27 below;

Cost of		Total				
COSLOI	2015-2020	2021-2025	2025-2030	2031-2035	2036-2040	IOlai
Transmission Lines	3,717	814	714	1,197	152	6,593
Substation	1,207	465	417	422	1,126	3,637
Total	4,925	1,279	1,131	1,619	1,277	10,230
% of Each Period	48%	12%	11%	16%	12%	100%

#### Table 4-27: Cost Estimate Summary

#### 4.9.2 Connection of Isolated Network to the National Grid

The current independent network system is expected to connect to the national grid in accordance with the transmission project. The connection plans are summarized in Table 4-28 below;

Region	Isolated area	Source of Power/Fuel	Installed Capacity (MW)	Earliest Connection to the Nation Grid (Year)	Transmission Project Name
	Biharamulo	Diesel/HFO	0.85	2018	Geita - Nyakanazi
Kagera	Ngara	Diesel/HFO	0.75	2018	Masaka-Ngara-Rusumo
	Bukoba	Diesel/HFO	2.56	2018	Masaka-Ngara-Rusumo
	Kibondo	Diesel/HFO	2.50	2020	North West Grid
Kigoma	Kasulu	Diesel/HFO	2.50	2020	North West Grid
	Kigoma town	Diesel/HFO	12.48	2020	North West Grid
Pwani	Mafia	Diesel/HFO	2.13	2018	Somangafungu - Kinyerezi
Lindi	Somanga	Gas	7.50	2018	Somangafungu - Kinyerezi
Lindi	Liwale	Diesel/HFO	0.85	2023	Mtwara -Songea
	Songea	Diesel/HFO	8.10	2018	Makambako - Songea
Dungang	Mbinga	Diesel/HFO	2.00	2018	Makambako - Songea
Ruvuma	Namtumbo	Diesel/HFO	0.34	2018	Makambako - Songea
	Tunduru	Diesel/HFO	1.98	2023	Mtwara - Songea
Mauro		Cas	19.00	2010	Dar - Somanga - Mtwara/Mtwara -
witwara	na Namtumbo Diesel/HFO Tunduru Diesel/HFO a Mtwara GPP Gas Mpanda Diesel/HFO	18.00	2019	Songea	
Katavi	Mpanda	Diesel/HFO	3.60	2020	North West Grid
Rukwa	Sumbawanga	Diesel/HFO	5.00	2020	North West Grid
Njombe	Ludewa	Diesel/HFO	1.27	2018	Makambako - Songea
Arusha	Loliondo	Diesel/HFO	5.00	2018	REA extension (33kV Karatu -Mto wa Loliondo)
		Total	77.41		

#### Table 4-28: Plan for Connection of Isolated Network to the National Grid

#### **CHAPTER FIVE**

#### 5 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

#### 5.1 Environmental Institutional Arrangement

The Environmental Management Act, 2004 sets up the institutional framework for environmental management in the country. The overall coordination and policy articulation of environmental management and provision of the central support functions are conferred to the Vice President's Office. The direct operational role on management of specific natural resources or environmental services such as water, agriculture, fisheries, forestry, wildlife, energy, mining, and waste management is conferred to sector ministries and local government authorities (LGAs). Figure below shows the institutional arrangement in relation to the implementation of the PSMP2016 Update.

Figure 5-1: Environmental Institutional Arrangement in relation to the implementation of the PSMP2016 Update



#### 5.2 Legal Framework

Environmental management in Tanzania is guided by the National Environmental Policy, 1997, Environmental Management Act, 2004, National Environmental Action Plan (NEAP), 2013, and related sectorial polices and legal instruments. The followings are the major policies and legal framework related to implementing the PSMP2016 Update.

#### 5.2.1 Policies

(a) **National Environmental Policy, 1997:** This policy provides the framework for making fundamental changes that are needed to mainstream environmental considerations into decision making in Tanzania. The policy provides guidelines for determining priority actions, and provides monitoring and regular review of polices, plans and programmes.

<u>Relation to the PSMP</u>: This policy is related to mainstreaming environmental considerations into decision making on PSMP implementation as well as the adoption of Environmental Impact Assessment (EIA) as a tool for screening development proposed projects in PMSP.

(b) National Energy Policy, 2015: It aims at improving the security of supply through effective use of energy resources; promotion of energy efficiency and conservation; facilitating the adoption of renewable energies technologies to increase its contribution to electricity generation mix; improving energy sector planning through integrated plans, ensuring that prudent environmental, social, health and safety considerations are factored in energy sector developments.

<u>Relation to the PSMP</u>: As a cross-cutting issue, promotion of environmental protection, health and safety management in the energy sector is stated in 4.2. Promotion of disaster prevention and response plans is part of this statement.

(c) **National Water Policy, 2002**: The main objective is to develop a comprehensive framework for sustainable development and management of the nation's water resources and putting in place an effective legal and institutional framework for its implementation. It emphasizes that water related activities are to be planned to enhance or to cause least detrimental effects on the environment.

<u>Relation to the PSMP</u>: Hydropower is still important power source and thermal power plants also use water for cooling. Sustainable water resource management is a key issue for the implementation of planned projects under PSMP2016 Update.

(d) Wildlife Policy, 2007: The Policy focuses on wildlife protection and conservation in order to ensure sustainability of wildlife ecosystems. Some of the objectives include establishment, maintenance and development of Protected Areas network in order to enhance biological diversity; conservation of wildlife and its habitats outside the core areas by establishing Wildlife Management Areas (WMAs); and conservation of Wetlands.

<u>Relation to the PSMP</u>: The planned projects under PSMP are located all over in Tanzania and it is necessary to consider wildlife habitat in locating the identified projects under PSMP2016 Update.

(e) **National Land Policy, 1997**: The overall aim of this policy is to address the various ever-changing land use needs and to promote or ensure a secure land tenure system; to encourage the optimal use of land resources and; to facilitate broad-based social and economic development without endangering the ecological balance of the environment.

<u>Relation to the PSMP</u>: PSMP involves land use change and it is necessary to consider optimal land use in implementing the projects under PSMP2016 Update.

(f) **National Health Policy, 2007**: The overall objective of this policy is to improve the health and well-being of all Tanzanians. In line with environmental health, the Policy seeks to protect community health, emphasizing on community adherence to environmental health standards; improvement of waste management system.

<u>Relation to the PSMP</u>: All the projects proposed under PSMP2016 Update have considered mitigation measures for air emission and waste generation which would affect human health.

(g) **National Human Settlements Development Policy, 2000:** This policy stresses on the need for ensuring that human settlements are kept clean and pollution effects of solid and liquid wastes do not endanger the health of residents.

<u>Relation to the PSMP</u>: All the projects proposed under PSMP2016 Update have considered mitigation measures for the impact on human settlement or urban environment.

#### 5.2.2 Legislation

(a) The Environmental Management Act, 2004: The act 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 2013, a total of 21 regulations have been developed to facilitate implementation of the Act. Some of them are as follows.

Category	Environmental Management Regulation
Environmental	Environmental Impact Assessment and Audit Regulations (2005)
management framework	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)

Table 5-1: List of Environmental Management Regulation

<u>Relation to the PSMP</u>: In implementing the identified projects under PSMP2016 Update, all necessary Acts and related regulations have to be taken into consideration.

(b) 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).

<u>Relation to the PSMP</u>: All the projects identified under PSMP2016 Update have been taken into consideration the necessary environmental standards to ensure the implementation of PSMP is in compliance with such standards.

(c) 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,1999 relates to land-use planning processes and land-use management and guidance to land ownership in Tanzania. Acquisition of way leave is governed by this Act.

<u>Relation to the PSMP</u>: The projects identified under PSMP2016 Update is expected to involve the land acquisition and it needs to be in line with this Act.

(d) **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.

<u>Relation to the PSMP</u>: PSMP implementation is expected to involve the rural land acquisition and it needs to be in compliance with this Act.

(e) Land Acquisition Act, 1967: Any land acquisition that shall be done during the implementation of PSMP 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.

<u>Relation to the PSMP</u>: The implementation of PSMP involves the rural and urban land acquisition and it needs to be in compliance with this Act.

(f) Land Use Planning Act, 2007: It provides for the procedures for the preparation, administration and enforcement of land use plans. Among the objectives of the Act as given in Section 4 are to facilitate the orderly management of land use and to promote sustainable land use practices.

<u>Relation to the PSMP</u>: PSMP is expected to affect land use and livelihood therefore shall comply with the provisions of this Act. If there is any conflict with existing land use plans, shall need consultation with land use planning authorities.

(g) Water Resources Management Act, 2009: It provides the legal framework for the management of water resources within the integrated water resource management (IWRM) framework including environmental flow of rivers. It provides for pollution control and issues discharge permits of effluents to water bodies. Dam Safety Regulation, 2013 under this Act is also related to hydropower.

<u>Relation to the PSMP</u>: Hydropower projects planned under this PSMP2016 Update consists of 20% of the generation mix by the year 2040 and all of them are to be implemented under this Act.

(h) **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.

<u>Relation to the PSMP</u>: Gas-fired thermal power plants are expected to be located along the coastal area where mangrove reserves are also located. Forest reserves are also considered in siting the PSMP components including transmission lines.

(i) 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.

<u>Relation to the PSMP</u>: The planned projects under PSMP are located all over in Tanzania and it is necessary to consider wildlife habitat in locating the identified projects under PSMP2016 Update.

(j) National Parks Act, 2002: The Act provided for the establishment, control and management of national parks in the country. Tanzania National Parks Authority (TANAPA) is governed by this Act. This Act avoids or prohibits developments of projects within the national parks.

<u>Relation to the PSMP</u>: If any projects planned under PSMP2016 Update are expected to have impact on National Parks, it is subjected to this Act.

(k) **Marine Parks and Reserves 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.

<u>Relation to the PSMP</u>: Gas-fired thermal power plants are expected to be located along the coastal area and if PSMP components are expected to have impact on Marine Parks and reserves, it is subjected to this Act.

(I) Energy and Water Utilities Regulatory Authority Act, 2001: EWURA is an autonomous multi-sectoral regulatory authority and is responsible for technical and economic regulation of the electricity, petroleum, natural gas and water sectors in Tanzania.

<u>Relation to the PSMP</u>: EWURA as a regulatory authority for electricity needs to take into account the need to protect and preserve the environment based on this Act.

(m) **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.

<u>Relation to the PSMP</u>: 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.

(n) Petroleum Act, 2015: It covers both oil and natural gas and has health & safety regulation in PART VI, and environmental principles in PART VII. It provides a comprehensive framework to regulate oil and gas development in petroleum value chain (up-stream, mid-stream and down-stream activities).

<u>Relation to the PSMP</u>: According to the generation mix target of the PSMP, 40% is expected to be sourced from gas-fired power plants. This Act is related to regulate natural gas supply to power plants.

#### 5.3 Major potential impacts

In revising the PSMP, the following six different generation mix scenarios were considered as indicated in Table 5-2. Considering various aspects such as the investment and operational cost, energy security perspective, and the potential environmental and social impacts, then PSMP2016 Update adopted scenario 2 which is consisted of 40% of energy from gas-fired thermal power, 35% from coal-fired thermal power, 20% from hydropower, and 5% from others including renewables.

	Generation Mix							
Scenario	Gas	Coal	Hydro	Renewables and others*				
Scenario 1	50%	25%	20%	5%				
<u>Scenario 2</u>	<u>40%</u>	<u>35%</u>	<u>20%</u>	<u>5%</u>				
Scenario 3	35%	40%	20%	5%				
Scenario 4	25%	50%	20%	5%				
Scenario 5	50%	35%	10%	5%				
Scenario 6	40%	30%	20%	10%				

#### Table 5-2: Generation Mix Scenarios in 2040 for the PSMP

\*: Renewables and others include solar, wind, biomass, geothermal and power import.

The potential impacts in implementing the PSMP, based on the selected power generation mix, are as follows:

#### 5.3.1 Air emission and pollution

Under the power generation mix target, coal plays an essential role in the national energy mix. The primary emissions to air from the combustion of fossil fuels including coal are sulfur dioxide (SO<sub>2</sub>), nitrogen oxides (NOx), particulate matter (PM), carbon monoxide

(CO), and greenhouse gases (GHG) such as carbon dioxide (CO<sub>2</sub>).

The estimated emissions of GHG, SO<sub>2</sub> and NOx in implementing the PSMP are shown in Figure 5-2 and Figure 5-3. The amount of emissions was estimated based on the projected annual fuel consumption and related guidelines, namely, "2006 IPCC Guidelines for National Greenhouse Gas Inventories," and "EMEP/EEA air pollutant emission inventory guidebook 2013."

During the study period of 25 years up to 2040, emissions of GHG increases from 3.4 million tonnes to 46.0 million tonnes (by 13.5 times) and NOx from 6.3 thousand tonnes to 78.6 thousand tonnes (by 12.5 times). SOx releases increase from 37.8 thousand tonnes in 2020 to 256.9 thousand tonnes in 2040 (by 6.8 times) if abatement is not considered. Air pollution contributes to the incidence of respiratory diseases. The impact radius is usually within about 10 km to 20 km from the thermal power plant. The impact radius varies depending on the geography, the wind and the height of the gas emission source. The level of impacts on human health, the ecology and others also varies depending on the proportion of polluted airs in the air and the density of the pollution sources.

Pollutants like Sulphur Oxide (SOx) and Nitrogen Oxide (NOx) contribute to the incidence of acid rain or acidification. It could cause impacts on freshwater aquatic ecosystems, vegitation and drinking water. The acidification of soils can also have an adverse impact on agricultural productivity.

# Figure 5-2a: Estimated GHG emission in implementing PSMP (comparison of senarios)



# Figure 5-3a: Estimated SOx emissions in impelmenting PSMP(comparison of scenarios)



#### Figure 5-4a: Estimated NOx emissions in impelmenting PSMP



# Figure 5-2b: Estimated GHG emission in implementing PSMP (scenario-2 by source)

GHG Emission by fuel type (selected scenario 2)



# Figure 5-3b: Estimated SOx emission in implementing PSMP (scenario-2 by source)



## Figure 5-4b: Estimated NOx emission in implementing PSMP (scenario-2 by source)



#### 5.3.2 Water use

Since many of the proposed hydropower plants are located in Rufiji Basin, which is the largest basin in Tanzania covering 20.1% of mainland Tanzania, it is recommended to coordinate and harmonize the water use in the Basin with other water user such as domestic and irrigation use. It is projected that the human water demand in agricultural and domestic use would increase in the most of the sub-basins of Rufiji Basin. This human water use demand could affect the hydropower generation downstream.

Furthermore, catchment degradation resulting from indiscriminate tree cutting for fuel and poor agricultural practices among others have caused land degradation at many places in Tanzania resulting into increased sedimentation and reduced dry season flows.

According to Tanzania Hydropower Sustainability Assessment: Hydropower Vulnerability Report (MEM, World Bank, 2014), improved operation of both irrigation and hydropower schemes are essential in Tanzania. It has shown that the development of hydropower, as well as the expansion of irrigation, can both be achieved if well-planned and operated.

#### 5.3.3 Water quality

(a) Hydropower: The damming of rivers can cause water quality deterioration due to the reduced oxygenation and dilution of pollutants, flooding of biomass and resulting underwater decay, and/or reservoir stratification (where deeper lake waters lack oxygen). Where poor water quality would result from the decay of flooded biomass, selective forest clearing within the impoundment area should be completed before reservoir filling.



Figure 5-5: Location of planned power plants of the PSMP

(b) Thermal power: Thermal power stations require large quantities of cooling water for their thermal powers, with temperature increases of about 3 to 8 degrees when released. Main impact of cooling water discharge is the temperature increases that may affect aquatic organisms, including phytoplankton, zooplankton, fish, crustaceans, shellfish, and many other forms of aquatic life. Wastewater discharges from thermal power plants carry variable amounts of pollutants depending on the types of thermal plant. If not properly treated, wastewater discharges from thermal power plants tend to cause pollution to surface water.

#### 5.3.4 Waste generation

Coal ash produced from the coal combustion process in thermal power plants accounts for the largest proportion of solid waste. As the number and capacity of the coal thermal power plants increases, the amount of coal ash produced from the power plants also increases. In PSMP2016 Update, the amount of solid waste (coal ash) from thermal power production is estimated about 0.24 million tonnes in 2020 and 1.36 million tonnes in 2040. It increases by 6.8 times from 2020 to 2040. The land area required for managing solid waste will increase accordingly; therefore appropriate management of coal ash is required for implementing planned projects. If coal ash is not managed properly, it can cause serious impacts on water resources and air pollution in waste dump areas because coal ash contains a few lethal substances such as heavy metals.



Figure 5-6: Estimated coal ash amount in implementing the PSMP

#### 5.3.5 Natural Environment

- (a) Thermal power plants: Gas-fired power plants are planned along the coastal area of Tanzania, while coal power plants are planned in the southwestern part of Tanzania nearby coal mining sites. Mangrove forests and coral reefs are located along the coastal area and the areas for fishing are also identified in these area. Water withdrawal and discharge would have potential impacts on these habitat and fishery activity.
- (b) **Hydropower:** Hydropower projects often have major effects on fish and other aquatic life and reservoirs permanently flood natural habitats. The presence of a hydro dam can cause changes to river ecology downstream due to changes in water flow (in both volume flow rate and time), water chemical properties, physical structure of the river bed and river basin, and the hydrological connectivity between upstream and downstream water. Chemical and physical changes to the river often lead to ecological changes, notably the loss of high economic value fauna and flora that local residents use as food, construction materials, and effects on other entertainment, tourism and cultural purposes.
- (c) Transmission lines: Construction of transmission lines may result in alteration and disruption to terrestrial habitat, including impacts to avian species depending on the characteristics of existing vegetation, topographic features, and installed height of the transmission lines. It includes fragmentation of forested habitat; loss of wildlife habitat, therefore it is necessary to identify which transmission line passes through areas of biodiversity interest and forest area. Large birds are sometimes killed in collisions with power lines, or by electrocution. Multiple transmission lines closer to important bird areas like Kilombero valley, south coast corridor from Mtwara to Dar es Salaam and southern highland areas could interfere free flying zone particularly for migratory birds.

#### 5.3.6 Social impacts

- (a) PSMP contains plans for the significant improvement and extension of the transmission grid across the country. These investments are essential for the continued development and improvement of power supply system; however, their construction and the associated land clearance would have socio-economic impacts including the displacement of affected people and crop clearance. According to the way-leave requirements, 50 meter clearance for 400kV lines, 35 meter clearance for 220kV lines, and 27 meter clearance for 132kV lines are required. Issues associated with transmission line include significant land take to allow establishment of way leave for transmission line.
- (b) Since there is diversity of sources with varying generation capacity, there will be varying magnitude of impacts on land acquisition for specific power plant. Hydropower development could affect the current livelihood of the local people due to dam inundation and water flow change.

#### 5.4 Mitigation measures to potential impacts

#### 5.4.1 Thermal power:

- (a) Particular care needs to be taken when planning and selecting the site of thermal power plants to (i) ensure that the quantities of water used will not disrupt local hydrological conditions and (ii) avoid locations where cooling waters will be released close to or affecting areas of high ecological and biodiversity value or sensitivity: especially areas such as mangroves and coral reefs that are extremely sensitive to water temperature changes. The coastal location of many thermal power plants means that this is a particularly sensitive issue and it is to be assessed in project EIAs.
- (b) Measures to prevent, minimize, and control environmental impacts associated with water withdrawal should be established based on the results of a project EIA and EMP, considering the availability and use of water resources locally and the ecological characteristics of the project affected area.
- (c) All waste water from thermal power plants should be collected, and thoroughly recycled or treated before discharging into receiving water bodies. Wastewater with high temperature should be cooled, recycled or treated before discharged into receiving bodies.
- (d) It is necessary to assess the cumulative effects of cooling water of several power stations located near each other in project EIAs.
- (e) Fly ash and other wastes should be disposed in an appropriate area such as designated landfills or as backfill on abandoned mines, while some amounts are recycled into useful products, such as briquettes, cement and building materials.
- (f) Abatement technologies for air emissions are to be considered such as flue gas desulfurization (FGD) for SO<sub>2</sub>, low NOx burners, a selective catalytic reduction (SCR)

system, a selective noncatalytic reduction (SNCR) system, fabric filters and electrostatic precipitators (ESPs) for particulate matter, where necessary to meet the emission limits.

#### 5.4.2 Hydropower:

- (a) When affected people need to be relocated, resettlement plan needs to be appropriately implemented and monitored in order to ensure that the means for displaced people are to be established in a new location and they can gain access to adequate services and reconstruct their livelihoods. This cost should be considered as a part of project cost for hydropower sustainable development and social responsibility.
- (b) In optimizing water releases from the turbines, it is necessary to consider adequate downstream water supply for riparian ecosystems, reservoir and downstream fish survival, reservoir and downstream water quality, aquatic weed and disease vector control, irrigation and other human uses of water, and downstream flood protection in addition to power generation.
- (c) Environmental management plans for hydropower projects should specify environmental water releases.

#### 5.4.3 Transmission lines:

- (a) Under the legal requirement, acquisition of way leave is governed by the Land Act of 1999 and its Regulations of 2001, whereby full, fair and prompt compensation is required before land acquisition.
- (b) 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.
- (c) 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.
- (d) In areas with concentrations of vulnerable bird species, the top (grounding) wire should be made more visible by using plastic objects.
- (e) Electrocution (mainly of large birds of prey) should be avoided through bird-friendly tower design and proper spacing of conducting wires.

#### 5.4.4 Cross-cutting issue

#### 5.4.4.1 Inter-ministerial cooperation for water resource management

Different institutions as shown in Table 5-3 are responsible for water use and its management at basin level. Therefore, these institutions should work closely for the benefit of efficient water resource management.

Roles	Responsible Institution			
PSMP implementation including hydropower	Ministry of Energy and Minerals and TANESCO			
Management of water bodies	Ministry of Water and Basin Water Offices			
Allocation of water	Basin Water Offices			
Catchment forest management	Ministry of Natural Resources and Tourism			

#### Table 5-3: Key institutions for sustainable water use for power generation

Payment for Ecosystem Services (PES) for water management and erosion control is a potential measure to ensure sustainable water supply for power generation.

#### 5.4.4.2 Land use change

The implementation of the planned projects under PSMP2016 Update involves the change of land use. During the implementation of project EIAs, the implications need to be understood in each locality and strategies developed in consultation with local communities to manage extra pressure on remaining resources such as agriculture, grazing and fishing rights.

#### 5.5 Environmental Management and 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 PSMP, the Environmental Management Unit of MEM should work collaboratively with TANESCO, other sub-project owners, and related institutions.

**Monitoring:** The project owners should take charge of the monitoring of each project in accordance with project EIA and Environmental Management Plan (EMP). The Environmental Management Unit of MEM should conduct monitoring in cooperation with NEMC through reports submission.

		Related component					
Category	Potential key monitoring item	Hydro	Thermal	Renew	Transmission		
		power	power	ables	line		
Physical Environ	nent						
Air quality	<ul> <li>Emission of SOx, NOx, PM</li> </ul>		✓	✓			
	<ul> <li>Emission of GHG (ton-CO2eq/year)</li> </ul>			e.g.			
	Ambient air quality			Geothermal			
				Biomass			
Water quality	Temperature of discharged cooling water	$\checkmark$	✓	✓			
	from thermal power plants			e.g.			
	· Temperature of ambient water (river, lake,			Geothermal			
	coastal area)						
	<ul> <li>Discharged wastewater quality</li> </ul>						
	Waste water recycling						
Waste	<ul> <li>Amount of coal ash waste generated</li> </ul>		✓				
	(ton/year)						
Natural Environm	ent		1		1		
Natural habitat	<ul> <li>Interference with habitats</li> </ul>	<b>v</b>					
	<ul> <li>Impacts on ecosystems and sensitive areas</li> </ul>		~	✓	✓		
	including national parks, nature reserves,						
	wetlands, wildlife habitat, forest area, etc.						
Vegetation	Vegetation clearance (ha)	$\checkmark$	✓	✓	✓		
Social Environme	nt		1	1	1		
Land acquisition	<ul> <li>Implementation of resettlement plan,</li> </ul>	$\checkmark$	✓	✓	~		
	compensation of affected persons						
Water use	<ul> <li>Acquisition of water use permit</li> </ul>						
	<ul> <li>Water withdrawal (m<sup>3</sup>/s) of thermal power</li> </ul>						
	plants	$\checkmark$	✓	✓			
	<ul> <li>Number of conflicts on water reported</li> </ul>						
	<ul> <li>Number of water users within the project</li> </ul>						
	area						
Access to	% of access to electricity	$\checkmark$	✓	✓	✓		
electricity	<ul> <li>Electricity consumption (kWh/capita)</li> </ul>						

#### Table 5-4: Potential key items for monitoring the projects under PSMP2016 Update

**Reporting:** The Environmental Management Unit of MEM reports to the Permanent Secretary of Energy and Minerals on the status of environmental and social consideration in implementing the projects outlined under PSMP2016 Update including implementation progress of mitigation measures and changes in environmental quality referring to the relevant regulations and environmental standards in Tanzania.

#### CHAPTER SIX

#### 6 ECONOMIC AND FINANCIAL ANALYSIS

This chapter presents economic and financial analysis of the proposed power investment plan. It identifies planning criteria used in the analysis that covers three major themes, namely:

- a) A financial analysis of the proposed generation and transmission expansion plans
- b) An estimate of the long-run marginal cost of generation, transmission, distribution and debt balance; and
- c) An assessment of whether and when the isolated load centers should be connected to the main grid

Furthermore, the chapter shows the project costs and returns involved in the implementation of the proposed plan so that the players can identify the projects to implement either independently or in partnership. The modality of implementing these projects can either be purely Government or purely private sector or in partnership (PPP). The Government's role in this respect will be two folds: to mobilize financial resources to implement some of the earmarked projects and to create conducive environment of attracting investors in the power sector. In additional, this chapter also analyzes economics of interconnecting the isolated load centers as well as estimating long run marginal cost.

#### 6.1 Main Assumptions

#### 6.1.1 Discount rate

The discount rate may be considered as the time value of money, and is used to calculate the present value of a series of future costs. The selection of an appropriate discount rate value should reflect the opportunity cost of capital, and therefore it tends to be higher in regions where capital is relatively scarcer. The choice of discount rate is discretionary. Use of a higher discount rate will tend to favor thermal plants in cost comparisons with hydro due to their lower initial costs, but higher yearly operating costs, while lower interest rates would favor hydroelectric plants, where most of the expenditures are at the beginning of the project cycle. A real discount rate of 10 percent (i.e. excluding inflation) was used in converting capital costs into equivalent annual costs over the life of an asset and for comparisons of unit generation costs for initial screening of options.

#### 6.1.2 Debt Equity Ratio

The debt equity ratio of 70:30 is a standard ratio preferred by most financiers/banks, and has been adopted in this study. Although somehow it may be difficult for the project developers (in this case, the Government and/or private sector) to raise such equity, it reflects their commitment towards implementation of the projects and its operations to be able to service the debt.

#### 6.1.3 Interest Rate

Different source of finance have different cost of the loan to be offered. Loan interest rate is varied from 1.0% to 7.1% in the long-term borrowing of TANESCO. For the purpose of this document, an interest rate of 7 percent has been assumed which is considered to represent required return by the international investors for the Tanzanian government in the current international bond market.

#### 6.1.4 Loan Condition

Different source of finance have different cost of the loan to be offered. For the purpose of this assignment, loan tenor for financing project is set at 14years with 4 years grace period.

#### 6.1.5 Interest During Construction (IDC)

This is interest incurred directly as the result of investment cost obtain as loan. This has impact on the overall project cost as it is added on the project cost by capitalizing them. A 7% per annum equivalent to the interest rate has been assumed in calculating IDC of projects by WASP model based on the investment plan.

#### 6.1.6 Inflation Rate on Capital Cost

The analyses and comparisons made in this PSMP process are based on constant prices of the year 2015. This constant price method avoids the assumption of the price escalation, as forecasting inflation rate in long term is not reliable. Also, 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.

### 6.1.7 Discount Rate for Debt Stock

This is an interest rate to discount debt stock to GDP. Discount rate of 5% per annum is used for this assignment as this discount rate is used in "TANZANIA NATIONAL DEBT SUSTAINABILITY ANALYSIS, 2013", Ministry of Finance, Tanzania.

#### 6.1.8 Method to calculate Internal Rate of Return (IRR)

Cash flow basis is used for calculating IRR as a standard methodology. Internal Rate of Return (IRR) is used to evaluate financial and economic viability of a project. IRR means a discount rate when NPV (Net Present Value) of a project becomes 0 (zero). NPV is the sum of annual cost and benefit of a project discounted to the base year (present time) using a discount rate.

NPV = 
$$\sum_{i=1}^{n} (Bi - Ci)/(1+r)^{i}$$

Where:

n: Project lifeBi: Benefit of the project in year "*i*"Ci: Cost of the project in year "*i*"r: Discount rate

#### 6.1.9 Foreign Exchange Rate

Tsh. 2200 against 1 US Dollar is used for this document. This value is calculated by analyzing the trend of the past period from June 2015 to November 2016.

#### 6.1.10 Residual Value

Residual value of plants and facilities that still have operational value at year 2040 is counted in benefits for calculating IRR with residual value.

#### 6.1.11 Income Tax

Tanzanian corporate tax rate of 30% is applied. Benefit exceeding cost is subject to be deducted by 30% tax in this investment plan.

#### 6.2 Financial Analysis

This section presents the approach and results of the financial analysis. It follows from the economic analysis and long run marginal costs. The financial analysis looks at the overall Tanzanian PSMP from the financial point of view and takes into consideration the financing for the plan, the total amount of required debt and equity. During the financial forecast period the annual interest costs, repayment of debt, and project IRR and income taxes are presented.

#### 6.2.1 Summary of Financial Analysis

The financing requirement to implement the PSMP (2016 - 2040) is about US\$ 46.2 billion for capital cost, the breakdown of which is indicated in Table 6-1 below and details are presented in Appendix-1, 2 and 3. The financing of capital expenditures is given below and is based on the 70% debt and 30% equity financings for capital expenditures with IDC.

	С	apital Cost includi	ng IDC		Debt: Equity Ratio				
					0.7	0.3			
Year	Generation	Transmission	Distribution	Annual Capital Cost	Financed by Debt	Financed by Equity			
2016	142	215	9	366	256	110			
2017	888	569	35	1,493	1,045	448			
2018	1,674	952	63	2,688	1,882	807			
2019	2,078	1,785	92	3,955	2,768	1,186			
2020	1,771	1,400	76	3,247	2,273	974			
2021	328	57	9	394	276	118			
2022	1,017	321	32	1,370	959	411			
2023	968	296	30	1,294	906	388			
2024	896	337	29	1,262	883	379			
2025	1,332	322	39	1,692	1,185	508			
2026	1,030	23	25	1,078	755	323			
2027	1,816	114	45	1,974	1,382	592			
2028	2,043	128	51	2,221	1,555	666			
2029	1,831	408	52	2,291	1,604	687			
2030	2,437	497	67	3,002	2,101	901			
2031	2,031	131	49	2,211	1,547	663			
2032	2,051	78	47	2,175	1,523	653			
2033	2,366	87	56	2,508	1,756	753			
2034	1,411	692	49	2,151	1,506	645			
2035	2,064	691	65	2,821	1,974	846			
2036	1,696	55	41	1,793	1,255	538			
2037	1,610	41	39	1,690	1,183	507			
2038	1,698	26	41	1,765	1,235	529			
2039	1,589	585	52	2,225	1,558	668			
2040	1,117	574	40	1,732	1,212	520			
Sub Total	37,883	10,383	1,131						
Total	Capital Cost for P	SMP	49,397						
Total Cap	oital Cost Finance	d by Debt	34,578						
Total Capi	ital Cost Financed	by Equity	14,819						

# Table 6-1: Breakdown of Capital Costs including IDC and financing requirement(2016-2040, US Dollar million)

Source: Task Force Team for PSMP 2016 Update

The IDC is added to the debt principal and results in increase in total debt. The increase in debt is marginal since this is the IDC over the study period. At the same time as the IDC is accumulating, the overall debt portion decreases during the study period since the principal including previous accumulated IDC is also being repaid.

#### 6.2.2 Project IRR with different tariff scenarios

Project IRR is calculated based on the different tariff scenarios that are indicated in Table 6-2, 6-3 and 6-4. Independent Power Producer (IPP) ratio is set at 50% for the purpose of this simulation. Details of the project cash flows for calculating IRR are presented in Appendix-4.

		Year	IRR						
Tariff Rate	2016~2020	2021~2030	2031~2040	Overall	IPP				
Tsh, kWh	300	330	350	10 10/	0.00/	10.00/			
US\$, kWh	0.136	0.150	0.159	10.1%	0.0%	12.0%			

Table 6-2: Project IRR with Tariff Scenario –Base Case

Table 6-3: Pro	iect IRR with T	Fariff Scenario -	- Hiaher 7	<b>Fariff Case</b>

		Year	IRR					
Tariff Rate	2016~2020	2021~2030	2031~2040	Overall	IPP			
Tsh, kWH	310	350	380	11 /0/	0.99/	14 59/		
US\$, kWH	0.141	0.159	0.173	11.4%	9.0%	14.5%		

#### Table 6-4: Project IRR with Tariff Scenario – Lower Tariff Case

		Year	IRR					
Tariff Rate	2016~2020	2021~2030	2031~2040	Overall	IPP			
Tsh, kWH	300	300	300	0.00/	7.00/	10.10/		
US\$, kWH	0.136	0.136	0.136	0.2%	10.1%			

Source: Task Force Team for PSMP 2016 Update

#### 6.2.3 Public Debt balance and stock to GDP with different IPP ratio

#### (The following debt balance scenarios are calculated with base tariff case).

- a) With IPP ratio 50%, Present Value (PV) of public debt balance will be peaked around US\$ 3.9 billion at year 2031 and Debt stock to GDP is peaked at 5.0% at year 2020.
- b) With IPP ratio 60%, Present Value (PV) of public debt balance will be peaked around US\$ 3.1 billion at year 2031 and Debt stock to GDP is peaked at 4.0% at year 2020.
- c) With IPP ratio 40%, Present Value (PV) of public debt balance will be peaked around US\$ 4.6 billion at year 2031 and Debt stock to GDP is peaked at 6.0% at year 2020.

Debt balance is presented in the Figure 6-1 and Debt ratio to GDP is presented in the Figure 6-2. Details of the cash flows for financing the project are presented in Appendix-5.



Figure 6-1: Public Debt balance with IPP 40%, 50% and 60%

Source: Task Force Team for PSMP 2016 Update





Source: Task Force Team for PSMP 2016 Update

# 6.2.4 Public Debt balance and stock to GDP with different Interest Rate on Debt

#### (The following debt balance scenarios are calculated with base tariff case).

Public debt balance and debt stock to GDP is calculated with different interest rate cost. IPP ratio is set at 50% and the base tariff scenario is used for the purpose of this simulation.

(	(Loan teno	r 14 vear	s with 4	vears	arace	period
	Loan teno			yours	grace	periou

				,				
Loan Interest Rate	PV of Deb	ot Balance	PV of Debt Stock/GDP					
	Peak balance (US\$, million)	Peak Year	Peak rate	Peak Year				
5%	3,259	2030	4.87%	2020				
7%	3,870	2031	5.05%	2020				
9%	4,699	2032	5.23%	2020				

Source: Task Force Team for PSMP 2016 Update

#### 6.2.5 Sensitivity analysis with the different fuel and O&M cost

#### (The following IRR are calculated with base tariff case).

a) Sensitivity analysis of the project IRR is calculated with changes in cost of the fuel and O&M for generation. IPP ratio is set at 50% and the base tariff scenario is used for the purpose of this simulation.

#### Table 6-6: Sensitivity of the project IRR for the changes in Fuel and O&M cost

Changes in cost of Fuel and O&M for generation											
Variation of Fuel and O&M cost         -10%         0%         10%         20%         30%											
Overall Project IRR	11.2%	10.1%	9.2%	8.2%	7.2%						

Source: Task Force Team for PSMP 2016 Update

b) Sensitivity analysis for IRR of TANESCO is calculated with changes in IPP ratio for generation. IRR for the overall project and IPP is unchanged.

#### Table 6-7: Sensitivity of the TANESCO IRR for the changes in IPP ratio

Changes in IPP Ratio for generation									
IPP share	IPP 40%	IPP 50%	IPP 60%						
TANESCO IRR	9.2%	8.8%	8.3%						

Source: Task Force Team for PSMP 2016 Update

#### 6.3 Estimate of Long Run Marginal Costs

From an economic perspective, the long run marginal cost is the cost of supplying an incremental unit of electricity (kWh) to the system at a future date.

The rationale for using marginal costs as a basis for electricity pricing is to direct the customer, through the price charged for electricity, towards the most efficient use of resources available. Theoretically, if the price is equal to the marginal cost of supply, an optimal allocation of resources takes place and economic efficiency will result.

Marginal cost is one of many considerations used in the development of electricity tariffs. The long run marginal costs (LRMC) of electricity supply are computed to satisfy the criterion of economic efficiency. Marginal costs are usually adjusted to arrive at an appropriate tariff structure that meets various other goals and constraints, including, the financial viability of the electric power sector, social objectives, metering and billing constraints etc. This report focuses exclusively on the estimate of long-run marginal costs and does not address the financial viability or tariff structure issues.

#### 6.3.1 Approach Used to Estimate Marginal Costs

Two broad categories of cost are considered: demand or capacity-related costs and energy-related costs. Marginal capacity costs (also referred to as marginal demand costs) are taken as the costs of investment in generation, transmission and distribution to supply additional kilowatts plus the fixed costs of operation and maintenance. To establish these demand costs the projected capital investment is required for the generation and transmission aspects. Marginal energy costs are the costs of fuel, energy purchases and the variable operating and maintenance costs needed to provide additional kilowatt-hours.

One issue that needs particular attention is the estimate of the capital costs for the expansion of the distribution system to meet the system needs at the end of this plan (2040). The mandate for the master plan considered only the expansion of the generation and transmission system. An estimate of the distribution investments is required, even though it was not part of the mandate for the study. Based on studies elsewhere, it is assumed that the distribution costs for the Tanzania's system will amount to about twice the investment costs in transmission. For instance, SNC-Lavalin calculated the marginal costs for a specific system in India where Generation = 64% of the total, transmission = 11 to 13% and distribution = 23 to 25%.

#### 6.3.2 Summary of Results

The long run marginal cost of power in Tanzania was calculated on a year-by-year basis by examining the incremental cost over the base year. This approach is closer to the strict definition of long run marginal cost.

From the analyses, the unit cost of generation, transmission and distribution are calculated for each year. These are presented below.

Marginal Cost	Marginal Cost	Marginal Cost	Marginal Cost for				
Production	Transmission	Distribution	Supply				
0.103	0.009	0.025	0.137				

 Table 6-8: Marginal cost (\$ per kWh) for the period 2016-2040

## Appendix-1: Capital Cost for Generation (US Dollar, million)

ANNUAL EXPEN	DITURE OF C	ONSTRU		DST																									
Plant name	Туре	Capacity (MW)	Unit Cost (\$/kW)	Const. period (vr)	IDC(%)	Total Const. Cost (\$million) 2014	2015	2016	2017	2018	2019	2020	2021 2022	Annual Exp	enditure of	Construct 2026	ion Cost (l	US\$ millio	n, Not Disc	counted)	2031	2032	2033 2034	2035	2036	2037	2038	2039	2040
Kinyerezi I Extension	GT	185	900	1	2.90%	171.3	2010	2010	171.3	2010	2010	2020	2021 2022	2020 2024	2020	2020	2021	2020	2020	2000	2001	2002	2000 2004	2000	2000	2007	2000	2000	2040
Kinyerezi II	C/C	240	1200	2	6.08%	305.5		94.7	210.8																				
Somanga Fungu-1	GI ST add-on	210	1200	2	6.08%	267.3			82.9	184.5 /3./	96.6								-										┢────┤
Kinverezi III(Ph1) 1-3	GT	300	900	1	2.90%	277.8				277.8	30.0																		
Kinyerezi III(Ph2) 1-2	C/C	300	900	2	6.08%	286.4			88.8	197.6																			
Kinyerezi IV 1-2	C/C	330	900	2	6.08%	315.1					97.7	217.4																	
Mtwara	C/C	400	900	2	6.08%	381.9				118.4	263.5		00.0 407.0						-										┟────┤
Somanga (PPP) 1-2	C/C	300	900	2	6.08%	286.4					88.8	197.6	00.0 197.0																<b>├</b> ───┤
Bagamoyo(Zinga)	C/C	200	900	2	6.08%	190.9										59.2	131.8												
Future CGT1(1&3)	CGT1	110	1200	2	6.08%	140.0																		43.4	96.6		43.4	96.6	
Future CGT1(2)	CGT1	110	1200	2	6.08%	140.0												43.4	<u>96.6</u>	610.0					43.4	96.6			┟────┤
Future CGT3(1-2)	CGT3	470	900	2	6.08%	446.7													270.2	278.2	619.2								
Future CGT3(5-6)	CGT3	470	900	2	6.08%	448.7														210.2	010.2	278.2	<mark>619.2</mark>						
Future CGT3(7-8)	CGT3	470	900	2	6.08%	448.7																	278.2	619.2					
Future CGT3(9)	CGT3	470	900	2	6.08%	448.7																		139.1	309.6	000.0			<b>└───</b> │
Future CGT3(10)	CGT3	470	900	2	6.08%	448.7 448.7	-		ł	<u> </u>						<u> </u>	ł	1		<u> </u>				1	139.1	309.6 139.1	309.6		<b>├</b> ────┤
Future CGT3(12)	CGT3	470	900	2	6.08%	448.7	1		t	t						1	t	1	1	t				1	t	.00.1	139.1	309.6	
Future CGT3(13-15)	CGT3	470	900	2	6.08%	448.7																						417.3	928.8
	0.0.01				0.00		+												+										
Mchuchuma-1(1)	SBCL	150	2000	3	9.29%	327.9		32.8	190.2	104.9	200.8																		<b>├</b> ───┤
Mchuchuma-1(4)	SBCL	150	2000	3	9.29%	327.9			00.0	32.8	190.2	104.9																	
Ngaka 1-3	SBCL	200	2000	3	9.29%	437.2							131.1 760.7	419.7															
Ngaka (Exp)1-2	ASUB	300	2000	3	9.29%	655.7																131.1	760.7 419.7	<b>'</b>					
Ngaka (Exp)2-3	ASUB	300	2000	3	9.29%	655.7																				131.1	760.7	419.7	200.9
Kiwira 1-2	SBCL	200	2000	3	9.29%	437.2				87.4	507.1	279.8															05.0	500.5	209.0
Kiwira (Exp)1-2	ASUB	300	2000	3	9.29%	655.7										131.1	760.7	419.7	7										
Mchuchuma(Exp)1	ASUB	300	2000	3	9.29%	655.7								6	5.6 380.3	209.8													
Mchuchuma(Exp)2	ASUB	300	2000	3	9.29%	655.7										65.6	380.3	3 209.8	3				65.0	200.2	200.9				┢────┤
Mchuchuma(Exp)3	ASUB	300	2000	3	9.29%	655.7																	0.00	65.6	380.3	209.8			
Rukwa 1	ASUB	300	2000	3	9.29%	655.7							65.6	380.3 20	9.8									00.0	000.0	200.0			
Rukwa Exp-1	ASUB	300	2000	3	9.29%	655.7											65.6	380.3	3 209.8	5									
Rukwa Exp-2	ASUB	300	2000	3	9.29%	655.7											65.6	380.3	3 209.8	<mark>;</mark>					131.1	760.7	419.7		<b>└───</b> │
Singida Wind (50MM	0	50	2 720	1	2 90%	139.9	-			139.9																			┟───┤
Singida Wind (75MW	/)	75	2,213	1	2.90%	170.8				100.0	170.8																		
Makambako Wind (1	00MW)	100	2,213	1	2.90%	227.7					227.7																		
Dodoma solar (50M	<b>∧</b> )	50	4,183	1	2.90%	215.2					215.2	170.0																	<b>└───</b> │
Singida Wind (75MW	() Extension	75 100	2,213	1	2.90%	170.8						170.8							-										┢────┤
Kishapu-Shinyanga	Solar	150	3,873	1	2.90%	597.8						597.8																	
Singida Wind (75MW	<ol> <li>Extension</li> </ol>	50	2,213	1	2.90%	113.9							113.9																
GEO-1	Geothermal	50	6500	) 3	9.29%	355.2								35.5 20	6.0 <u>113.7</u>														<b>⊢−−−</b>
GEO-2 GEO-3	Geothermal	50	6500	) 3	9.29%	355.2	1							ა <u>ა</u> .ა ვ	5.5 206 0	113.7	•		1										
GEO-4	Geothermal	50	6500	) 3	9.29%	355.2								3	5.5 206.0	113.7	•												
Rusmo	Hydro-Dam	30.0	1,670.2	2 3	9.29%	54.8		5.5	31.8	17.5			40.4	104.7	7.0					<u> </u>									<b>⊢</b>
Rumakali	Hydro-Dam Hydro-Dam	44.7 222.0	3,695.7	9 6	9.29%	669.8							18.1	104.7 5	<mark></mark>			20 1	1 46.9	140 7	247.8	167.5	46.9						
Mpanga	Hydro-Dam	160.0	2,626.4	4 5	16.06%	487.7											19.5	5 73.2	2 165.8	175.6	<u>53.6</u>								
Iringa-Nginayo	Hydro-Dam	52.0	2,412.7	7 3	9.29%	137.1								1	3.7 79.5	43.9			+										
iringa-ibosa Movera Ruaba	Hydro-Dam Hydro-Dam	36.0	3,418.3	5 3 2 3	9.29%	134.5 278.8			-	+				1	5.4 78.0	43.0 27 0	161 7	80.0	>	+				+	-				┟────┤
Mnyera-Pumbwe	Hydro-Dam	122.9	1,783.2	2 3	9.29%	239.5										21.5	101.7	24.0	138.9	76.6									
Mnyera-Kwanini	Hydro-Dam	143.9	1,140.5	5 3	9.29%	179.4											17.9	104.0	57.4	-									
Mnyera-Kisingo	Hydro-Dam	119.8	2,617.1		9.29%	342.7												22.5	34.3	198.7	109.6								
Mnyera-Mnyera	Hydro-Dam	137.4	1,994.7	7 3	9.29%	299.5				1						1	30.0	173.7	7 <u>95.9</u>	12.0				1					ł
Songwe Manolo	Hydro-Dam	88.1	2,662.8	3 5	16.06%	272.3								1	0.9 40.8	92.6	98.0	29.9	9										
Lower Kihansi	Hydro-Dam	120.0	1,839.6	6 4	12.62%	248.6	-	12.4	64.6	121.8	49.7			17.0	20 4545	400.4	40.0		+										┟────┤
Songwe Sofre	Hydro-Dam	87.0	4,412.4	+ 5	16.06%	445.5 271.9	1							17.8 6	0.0 151.5	160.4	49.0	<mark>/</mark>	1	10.9	40.8	92.5	97.9 29 9	)					
Masigira	Hydro-Dam	118.0	2,213.6	6 5	16.06%	303.2												12.1	1 45.5	103.1	109.1	<u>33.3</u>							
Ruhudji	Hydro-Dam	358.0	1,860.4	4 6	19.64%	796.8											23.9	55.8	3 167.3	294.8	199.2	<u>55.8</u>	000.0						
Kikonge Stjeglers Gorge Ph-1	Hydro-Dam Hydro-Dam	300.0	2,235.6	6 5 0	19.64% 31.16%	802.4 3.221.3										<u> </u>	64.4	64 /	24.1 1 193 3	56.2 483.2	168.5 483.2	296.9	200.6 56.2 515.4 418.9	96.6					┢────┤
Stieglers Gorge Ph-2	2 Hydro-Dam	1,048.0	<u>1,1</u> 61.3	3 3	9.29%	1,330.1											04.4			-100.2	100.2	002.0	133.0	) <u>7</u> 71.5	4 <mark>25.</mark> 6				
Upper Kihansi	Hydro-Dam	47.0	11,061.4	4 5	16.06%	603.4	-													24.1	90.5	205.1	217.2 66.4	ŀ					
	Total Ani	nual Expe	nditure (US	S\$ million)		0.0	0.0	145.4	905.9	1,706.5	2,117.1	1,796.0	333.8 1,041.9	993.6 92	1.1 1,369.5	1,060.8	1,868.3	2,102.5	5 1,894.2	2,533.3	2,121.7	2,162.4	2,457.9 1,467.7	2,115.7	1,735.7	1,647.0	1,738.0	1,623.5	1,138.7

## Appendix-2: Capital Cost for Transmission Line (US Dollar, thousand)

#### Annual Expenditure of Transmission Line Construction Cost

GOT Base

<u>F</u>	uture (2	2016-2040)			1			O			-												A		9 d I												
	Rated				Route	No of		Conductor	Year to be	Unit Cost	Construction											1	Annual Exp	enditure (I	housand L	ISD)			1								
No	Voltage	from	to	Remarks	Length	Circuit	Code	Cond per Section	III Com-	(T. USD/km)	Cost	2015	2016	2017	2018	2010	2020	2021	2022	2023	2024	2025	2026	2027	2028	2020	2030	2031	2032	2033	2034	2035	2036	2037	2038	2030	2040
	(kV)				(KM)		Name	Phase Area (mn	missioned m2)		(T. USD)	2010 2	2010	2017	2010	2013	2020	2021	2022	2023	2024	2025	2020	2021	2020	2023	2000	2001	2002	2000	2004	2000	2000	2001	2000	2000	2040
1	400	Dodoma	Singida	Backbone Project	210	2	Bluejay	/ 2 564	2016	380	79,800 *3	39,900	39,900	0	0	0	0	0	0	0	0	) 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
2	400	Iringa	Dodoma	Backbone Project	237	2	Bluejay	2 564	2016	380	90,060 *3	45,030	45,030	0	0	0	0	0	0	0	0	) 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
3	400	Singida	Shinyanga	Backbone Project	200	2	Bluejay	/ 2 564	2016	380	76,000 *3	38,000	38,000	0	0	0	0	0	0	0	0	) 0	0	0	0	0	С	0	) (	) (	0 0	0	0	0	0	0	0
4	220	Kinverezi	Ubungo-Pai	Completed	8	1	Blueia	2 564	2016	-	, in the second s	0	0	0	0	0	0	0	0	0	0	) 0	0	0	0	0	0	0	) (	) (	0 0	0	0	0	0	0	0
5	220	Ubungo-Pai	Kinverezi	Completed	8	1	Blueia	2 564	2016	-		Ö	0	0	0	0	0	0	0	0	0	) 0	0	0	0	0	- C	Ō	) (	) (	) 0	0	0	0	0	0	0
6	132	Kinverezi	F7-II	Completed	5	1	Wolf	1 150	2016	-		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0		) (		0	0	0	0	0	0
7	132	Morogoro	Mtibwa	MCC_F/S completed	88	1	Hawk	1 242	2016	170	14 960	7 480	7 480	0	0	0	0	0	0	0	0	0	0	0	0	0		0				0	Ő	0	0	0	0
. 8	220	Wind Project	Singida	ine et i /e completed	10	1	Blueia	/ 2 564	2017	230	2,300	0	1,150	1 150	0	0	0	0	0	0	0	0	0	0	0	0	د ۱	0				0	0	0	0	0	0
9	400	Kin-Som SwS1	Kin-Som SwS2		53	2	Blueia	/ 8 564	2018	850	45 050	0	0	22 525	22 525	0	0	0	0	0	0	0	0	0	0	0	د ۱	0				0	0	0	0	0	0
10	400	Kin-Som SwS2	Kin-Som SwS3		53	2	Blueia	/ 8 564	2018	850	45 050	0	0	22 525	22 525	0	0	0	0	0	0	0	0	0	0	0		0				0	0	0	0	0	0
11	400	Kin-Som SwS3	Somanga Fungu P/	S 210 MW	53	2	Blueia	8 564	2018	850	45 050	0	0	22 525	22 525	0	0	0	0	0	0	0 0	0	0		0		0		)		0	0	0	0	0	0
12	400	Kinverezi	Kin-Som SwS1	0 210 1111	53	2	Blueia	8 564	2018	450	23 850	0	0	11,925	11,925	0	0	0	0	0	0	0	0	0	0	0	с (	0				0	0	0	0	0	0
13	400	Kisada	Iringa		106	2	Blueia	/ 8 564	2018	850	90 100	0	0	45.050	45 050	0	0	0	0	0	0	0	0	0	0	0	0	0				0	0	0	0	0	0
14	400	Kisada	Madaba		243	2	Blueia	/ 8 564	2018	850	206 550	0	0	103 275	103 275	0	0	0	0	0	0		0	0	0	0		0				0	0	0	0	0	0
15	400	Muchuchuma P/S	Madaba	Total 1 800 MW	15	2	Blueia	4 564	2018	560	8 400	0	0	4 200	4 200	0	0	0	0	0	0	0	0	0	0	0	с (	0				0	0	0	0	0	0
16	220	Geita	Nyakanazi		130	2	Blueia	2 564	2018	320	41,600	0	0	20,800	20,800	0	0	0	0	0	0	0	0	0	0	0	-	0		) (		0	0	0	0	0	0
17	220	Madaba	Songea		171	1	Blueia	2 564	2018	230	39,330	0	0	19 665	19,665	0	0	0	0	Ő	0	0	Ő	0	0	0	0	0			j Ö	0	Ő	0 0	0	0	0
18	220	Makambako	Madaba		162	1	Blueia	2 564	2018	230	37.260	Ő	Ő	18.630	18.630	0	0	0	0	0	0 0		0	0	0	0	0 (	0		j i		n n	n n	n n	0	0	0
19	220	Nyakanazi	Rusumo Falls P/S	30 MW	.02	1	Blueia		2018	340	32,980	n	ñ	16 490	16 490	0	0	0	0	0	<del>ا</del>		0	0	0 0	0	n	1 0				۰ ۱	0 0	0	0	0	0
20	220	Rusumo Falls P/S	Kvaka	30 MW	150	1	Blueia	4 564	2018	340	51 000	ő	Ő	25 500	25 500	0	0	0	0	0	n 0			0	0	0		0				n n	0 0	0	0		0
21	220	Shinvanga	Geita		240	2	Blueia	4 564	2018	450	108 000	ő	Ő	54 000	54 000	0	0	0	0	0	0 0		0 0	0	0	0	0 0	0				0 0	0 0	0	0		0
22	400	Arusha	Singida		317	2	Blueia	2 564	2019	380	120.460	Ő	Ő	0	60.230	60.230	0	n N	, N	0	n n	) 0	ň	0	n N	0	0	n n			) Ő	n n	ñ	0	0	0	0
23	400	Arusha	Isinva (Kenva)	up to Kenva border	114	2	Flint	3 375	2019	450	51.300 *3	Ő	Ő	n N	25 650	25.650	0	0	0	0	n 0		n n	0		0	0	0				n	n n	0	0		0
24	400	Lindi	Somanga Fungu		216	2	Blueia	/ 8 564	2019	450	97,200	0	0	0	48 600	48 600	0	0	0	0	0	0 0	0	0	0	0		0				0	0	0	0	0	0
25	400	Mtwara P/S	Lindi	400 MW	74	2	Blueia	4 564	2019	450	33,300	Ö	0	0	16,650	16.650	0	0	0	0	0	0	0	0	0	0	C	Ő				0	0	0	0	0	0
26	220	Arusha	Niiro (Arusha existin	a)	5	2	Blueia	4 564	2019	450	104 020	0	0	0	52 010	52 010	0	0	0	0	0	0	0	0	0	0		0		)		0	0	0	0	0	0
27	220	Iringa	Lower Kihansi P/S (Hydro	(36+52+120) MW	120	1	Blueia	2 564	2019	230	27 600	0	0	0	13,800	13 800	0	0	0	0	0	0	0	0	0	0		0				0	Ő	0	0	0	0
28	220	Solar I	Dodoma	50 MW	10	1	Blueia	1 242	2019	190	167 680	0	0	0	83 840	83 840	0	0	0	0	0	0	0	0	0	0	د ۱	0				0	0	0	0	0	0
29	132	Wind Project	Makambako	100 MW	10	1	Hawk	1 242	2019	170	6 650	0	0	0	3 325	3 325	0	0	0	0	0	0	0	0	0	0	-	0		) (		0	0	0	0	0	0
30	400	Chalinze	Segera		175	1	Blueia	4 564	2020	-	80,180 *4	0	0	0	0,0_0	40.090	40.090	0	0	0	0	0 0	0	0	0	0		0			0 0	0	0	0	0	0	0
31	400	Chalinze	Dodoma		336	1	Blueiay	2 564	2020	300	100.800	0	0	0	0	50,400	50,400	0	0	0	0	0	0	0	0	0	C	Ő				0	0	0	0	0	0
32	400	Chalinze	Segera		175	1	Blueia	4 564	2020	400	70.000	0	0	0	0	35.000	35.000	0	0	0	0	) 0	0	0	0	0		0	) (	) (	0 0	0	0	0	0	0	0
33	400	Kigoma	Mpanda		290	2	Blueiav	8 564	2020	850	246.500	0	0	0	0	123.250	123.250	0	0	0	0	) 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
34	400	Kinverezi	Chalinze		138	2	Blueiav	4 564	2020	-	104.020 *4	Ö	0	0	0	52.010	52.010	0	0	0	0	) 0	0	0	0	0	C	Ō	) (	) (	0 0	0	0	0	0	0	0
35	400	Kisada	Mbeva		186	2	Blueiav	8 564	2020	850	158,100	0	0	0	0	79.050	79.050	0	0	0	0	) 0	0	0	0	0	C	0		) (		0	0	0	0	0	0
36	400	Kiwira P/S	Mbeva	400MW in 2020	110	2	Blueiav	v 8 564	2020	850	93.500	0	0	0	0	46.750	46.750	0	0	0	0	) 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
37	400	Mbea	Nakonde(Zambia)	up to Zambia border	93	2	Bluejay	/ 2 564	2020	380	35,340	0	0	0	0	17,670	17,670	0	0	0	0	) 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
38	400	Mbe-Sum SwS	Sumbawanga		150	2	Bluejay	/ 8 564	2020	850	127,500	0	0	0	0	63,750	63,750	0	0	0	0	) 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
39	400	Mbeva	Mbe-Sum SwS		150	2	Blueia	v 8 564	2020	850	127,500	0	0	0	0	63.750	63.750	0	0	0	0	) 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
40	400	Mpanda	Mpa-Sum SwS		119	2	Bluejay	/ 8 564	2020	850	101,150	0	0	0	0	50,575	50,575	0	0	0	0	) 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
41	400	Mpa-Sum SwS	Sumbawanga		119	2	Bluejay	/ 8 564	2020	850	101,150	0	0	0	0	50,575	50,575	0	0	0	0	) 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
42	400	Mtwara	Namialo(Mozambiqu	e) up to Mozambique border	51	2	Bluejay	2 564	2020	380	19,257	0	0	0	0	9,628	9,628	0	0	0	0	) 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
43	400	Nyakanazi	Kigoma		317	2	Bluejay	8 564	2020	850	269,450	0	0	0	0	134,725	134,725	0	0	0	0	) 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
44	400	Segera	Arusha		366	1	Bluejay	4 564	2020	-	167,680 *4	0	0	0	0	83,840	83,840	0	0	0	0	0 0	0	0	0	0	С	0	) (	) (	0 0	0	0	0	0	0	0
45	400	Somanga Fungu F	P/S Somanga P/S(PPP	) 300MW	20	2	Bluejay	2 564	2020	380	7,600	0	0	0	0	3,800	3,800	0	0	0	0	) 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
46	220	Bagamoyo (Zinga)	Kibaha-Pai		45	1	Bluejay	/ 1 564	2020	-	6,650 *4	0	0	0	0	3,325	3,325	0	0	0	0	0 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
47	220	Bunda	Musona		60	1	Bluejay	/ 4 564	2020	340	20,400	0	0	0	0	10,200	10,200	0	0	0	0	00	0	0	0	0	C	00	) (	) (	00	0	0	0	0	0	0
48	220	Kibaha-Pai	Bagamoyo (Zinga)		45	1	Bluejay	/ 1 564	2020	-	6,650 *4	0	0	0	0	3,325	3,325	0	0	0	0	0 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
49	220	Kinyerezi	Ubungo		12	2	Bluejay	/ 1 564	2020	220	2,640	0	0	0	0	1,320	1,320	0	0	0	0	0 0	0	0	0	0	C	0	) (	) (	00	0	0	0	0	0	0
50	220	Kishapu Solar	Shinyanga	150 MW	10	1	Bluejay	/ 1 382	2020	190	1,900	0	0	0	0	950	950	0	0	0	0	0 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
51	220	Kyaka	Masaka(Uganda)	up to Uganda border	30	1	Bluejay	/ 2 564	2020	230	6,900	0	0	0	0	3,450	3,450	0	0	0	0	0 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
52	220	Kyela	Karonga(Malawi)	up to Malawi border	20	1	Bluejay	/ 2 564	2020	230	4,600	0	0	0	0	2,300	2,300	0	0	0	0	0 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
53	220	Lusu	Tabora		139	1	Bluejay	2 564	2020	230	31,970	0	0	0	0	15,985	15,985	0	0	0	0	) 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
54	220	Mbeya	Kyela		106	1	Bluejay	/ 2 564	2020	230	24,380	0	0	0	0	12,190	12,190	0	0	0	0	0 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
55	220	Musona	Nyamongo		90	1	Bluejay	/ 4 564	2020	340	30,600	0	0	0	0	15,300	15,300	0	0	0	0	0 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
56	220	Mwanza	Bunda		150	1	Bluejay	/ 4 564	2020	340	51,000	0	0	0	0	25,500	25,500	0	0	0	0	) 0	0	0	0	0	C	0	) (	) (	) 0	0	0	0	0	0	0
57	220	Segera	Tanga		76	2	Bluejay	/ 2 564	2020	-	33,470 *4	0	0	0	0	16,735	16,735	0	0	0	0	0 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
58	220	Shinyanga	Lusu		64	1	Bluejay	/ 1 564	2020	190	12,160	0	0	0	0	6,080	6,080	0	0	0	0	0 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
59	132	Kinyerezi	FZ-II		5	2	Hawk	2 242	2020	230	1,150	0	0	0	0	575	575	0	0	0	0	0 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
60	132	Morogoro	Mtibwa		88	1	Hawk	1 242	2020	170	14,960	0	0	0	0	7,480	7,480	0	0	0	0	0 0	0	0	0	0	0	0	) (	) (	0 0	0	0	0	0	0	0
61	66	Babati	Mbulu		85	2	Wolf	2 150	2020	150	12,750	0	0	0	0	6,375	6,375	0	0	0	0	0 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
62	400	Kinyerezi	Mkuranga P/S	300 MW	70	2	Bluejay	/ 8 564	2022	850	59,500	0	0	0	0	0	0	29,750	29,750	0	0	0 0	0	0	0	0	C	0	)  (	) (	0 0	0	0	0	0	0	0
63	400	Madaba	Songea		171	2	Bluejay	/ 2 564	2023	380	64,980	0	0	0	0	0	0	0	32,490	32,490	0	0 0	0	0	0	0	0	0	) (	) (	0 0	0	0	0	0	0	0
64	400	Masasi	Lindi		141	2	Bluejay	/ 4 564	2023	560	78,960	0	0	0	0	0	0	0	39,480	39,480	0	0 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
65	400	Ngaka P/S	Songea	600MW in 2023	37	2	Bluejay	/ 4 564	2023	560	20,720	0	0	0	0	0	0	0	10,360	10,360	0	0 0	0	0	0	0	C	0	) (	) (	0 0	0	0	0	0	0	0
66	400	Songea	Tunduru		230	2	Bluejay	4 564	2023	560	128,800	0	0	0	0	0	0	0	64,400	64,400	0	0 0	0	0	0	0	0	0	) (	) (	0 0	0	0	0	0	0	0

	Rated			Route			Conductor		Year to be Unit Cost Construction Cost Cost Cost Cost Cost Cost Cost Cost														Annual Ex	penditure (	Thousand U	ISD)											
No	Voltage	from	to Remarks	Length	No. of Circuit	Code	No. of Cond. per	Aluminum Sectional	Com-	(T. USD/km)	Cost	2015	2016	2017	2018	2010	2020	2021	2022	2023	2024	2025	2026	2027	2028	2020	2030	2031	2032	2033	2034	2035	2036	2037	2038	2030	2040
	(kV)			(km)		Name	Phase	Area (mm2)	missioned	. ,	(T. USD)	2013	2010	2017	2010	2019	2020	2021	2022	2023	2024	2023	2020	2027	2020	2029	2030	2031	2032	2033	2034	2033	2030	2037	2030	2039	2040
67	400	Tunduru	Masasi	194	2	Bluejay	4	564	2023	560	108,640	0	(	) (	0 0	0	0	0	54,320	54,320	0	0 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	400	Sumbawanga	Rukwa P/S 300MW in 2024	46	2	Bluejay	8	564	2024	850	39,100	0	(			0	0	0	(	19,550	19,550	0 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	400	Chalinze	Rigonia 44.7 WW	102	2	Blueiav	8	242 564	2024	850	86 700	0				0	0	0		0,290	43 350	43 350	0	0	0	0	0	0	0	0	0	0	0		0		0
71	400	Shinyanga	Mwanza	140	2	Bluejay	8	564	2025	850	119,000	0	(	) (		0	0	0	(	0	59,500	59,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	220	Bagamoyo	North DSM	40	2	Bluejay	4	564	2025	450	18,000	0	(	) (	0 0	0	0	0	(	0	9,000	9,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	220	Geothermal 1	Mbeya (2 x 50 MW) x2	35	1	Bluejay	1	564	2025	190	6,650	0	(	) (	0 0	0	0	0	(	0	3,325	3,325	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
/4 75	220	Kinyerezi	South DSM	25 50	2	Bluejay	4	564	2025	450	11,250	0	(			0	0	0		0	5,625	5,625	0	0	0	0	0	0	0	0	0	0	0		0		0
76	220	South DSM	South-east DSM	30	2	Bluejay	2	564	2025	320	9.600	0	(			0	0	0	(	0	4.800	4.800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	132	Kyaka	Kibeta/Bukoba	54	1	Hawk	2	242	2025	200	10,800	0	(	) (	0 0	0	0	0	(	0	5,400	5,400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	66	Mbulu	Karatu	65	2	Wolf	2	150	2025	150	9,750	0	(	) (	) 0	0	0	0	(	0	4,875	4,875	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	220	Geothermal 1	Geothermal 2 2 x 50 MW	20	1	Bluejay	1	564	2026	190	3,800	0		) (	0 0	0	0	0	(	0	0	1,900	1,900	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	220	Ibosa P/S (Hydro)	Iringa-L Kihansi Tbranch (36+52+120) MW	20	2	Bluejay	2	564	2026	320	6,400	0	(			0	0	0	(	0		3,200	3,200	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	220	Zinga P/S	Bagamovo 200 MW	15	1	Bluejay	2	564	2020	230	3.450	0				0	0	0	(	0	0	0 0	1.725	1.725	0	0	0	0	0	0	0	0	0	0	0	0	0
83	132	Kakono P/S (Hydro)	Kyaka 87 MW	39	1	Hawk	1	242	2027	170	6,596	0	(	) (	0 0	0	0	0	(	0	0	0 0	3,298	3,298	0	0	0	0	0	0	0	0	0	0	0	0	0
84	400	Mnyera S/S (new)	Kisada (668.2+358) MW	180	2	Bluejay	4	564	2028	560	100,800	0	(	) (	0 0	0	0	0	(	0	0	0 0	0	50,400	50,400	0	0	0	0	0	0	0	0	0	0	0	0
85	220	Ruaha 2 P/S (Hydro)	Mnyera S/S (new) (60.3+137.4+143.9) MW	33	1	Bluejay	2	564	2028	230	7,590	0	(	) (		0	0	0	(	0	0	0	0	3,795	3,795	0	0	0	0	0	0	0	0	0	0	0	0
00 87	132	Songwe Manolo P/S (Hydro)	Songwe B S/S 88.1 MW	17		⊓awk Hawk	1	242	2028	200	2,890	0	(			0	0	0	(	0			0	1 445	1 445	0	0	0	0	0	0	0	0		0	0	0
88	220	Kwanini P/S (Hydro)	Mnyera S/S-Ruaha2 T/L T-branch	10	1	Bluejay	2	564	2020	230	2,300	0	(			0	0	0	(	0	0	0 0	0	1,440	1,150	1,150	0	0	0	0	0	0	0	0	0	0	0
89	220	Mnyera 2 P/S (Hydro	) Mnyera S/S-Ruaha2 T/L T-branch	10	1	Bluejay	2	564	2029	230	2,300	0	(	) (	0 0	0	0	0	(	0	0	0 0	0	0	1,150	1,150	0	0	0	0	0	0	0	0	0	0	0
90	400	Shinyanga	Tabora	200	2	Bluejay	8	564	2030	850	170,000	0	(	) (	0 0	0	0	0	(	0	0	0 0	0	0	0	85,000	85,000	0	0	0	0	0	0	0	0	0	0
91	400	Somanga Fungu S/S	Future CG13-1 4x4/0 MW	20	2	Bluejay	4	564	2030	560	11,200	0	(			0	0	0	(	0		0 0	0	0	0	5,600	5,600	0	0	0	0	0	0	0	0	0	0
92	400	Tabora	Tab-Mpa SwS	150	2	Bluejay	0 8	564	2030	850	127,500	0				0	0	0		0			0	0	0	63 750	63 750	0	0	0	0	0	0	0	0	0	0
94	220	Bagamoyo	Mandizi	40	2	Bluejay	1	564	2030	220	8,800	0	(	) (	0 0	0	0	0	(	0	0	0	0	0	0	4,400	4,400	0	0	0	0	0	0	0	0	0	0
95	220	Kinyerezi	West DSM	20	2	Bluejay	4	564	2030	450	9,000	0	(	) (	0 0	0	0	0	(	0	0 0	0 0	0	0	0	4,500	4,500	0	0	0	0	0	0	0	0	0	0
96	220	Mnyera S/S (new)	Taveta 3 P/S (Hydro) (119.8+83.9+122.9) MW	26	1	Bluejay	2	564	2030	230	5,980	0		) (	0 0	0	0	0		0	0	0 0	0	0	0	2,990	2,990	0	0	0	0	0	0	0	0	0	0
97	220	Pumbwe P/S (Hydro	Mnyera S/S-Taveta3 T/L T-branch	10 20	1	Bluejay	2	564	2030	230	2,300	0	(			0	0	0	(	0		0	0	0	0	1,150	1,150	0	0	0	0	0	0		0		0
99	132	Niiro (Arusha existing)	Kivungi T-branch to KIA	20 77	2	Hawk	4	242	2030	320	24.640	0	(			0	0	0	(	0	0		0	0	0	12.320	12.320	0	0	0	0	0	0	0	0	0	0
100	400	Mkuranga	Mku-Som SwS1	61	2	Bluejay	8	564	2031	850	51,850	0	(	) (	0 0	0	0	0	(	0	0	0 0	0	0	0	0	25,925	25,925	0	0	0	0	0	0	0	0	0
101	400	Mku-Som SwS1	Mku-Som SwS2	61	2	Bluejay	8	564	2031	850	51,850	0	(	) (	0 0	0	0	0	(	0	0	0 0	0	0	0	0	25,925	25,925	0	0	0	0	0	0	0	0	0
102	400	Mku-Som SwS2	Somanga Fungu S/S	61	2	Bluejay	8	564	2031	850	51,850	0	(	) (		0	0	0	(	0	0	0	0	0	0	0	25,925	25,925	0	0	0	0	0	0	0	0	0
103	220	Taveta 3 P/S (Hvdro)	Kisingo P/S (Hydro) 119 8MW	00 15	1	Bluejay	2	564	2031	230	3 450	0				0	0	0		0			0	0	0	0	1,475	1,475	0	0	0	0	0	0	0	0	0
105	220	Masigira P/S (Hydro)	Madaba 118 MW	73	1	Bluejay	2	564	2032	230	16,790	0	(			0	0	Ő	(	0	0	Ö	Ő	0	Ö	0	0	8,395	8,395	0	0	0	0	0	0	0	0
106	400	Somanga Fungu S/S	Future CGT3-2 6x470 MW	20	2	Bluejay	4	564	2033	560	11,200	0	(	) (	0 0	0	0	0	(	0	0 0	0 0	0	0	0	0	0	0	5,600	5,600	0	0	0	0	0	0	0
107	220	Mbeya	Rumakali P/S (Hydro) 222MW	104	1	Bluejay	2	564	2033	230	23,920	0	(	) (		0	0	0	(	0	0	0 0	0	0	0	0	0	0	11,960	11,960	0	0	0	0	0	0	0
108	220	Minyera S/S (new)	Runudji P/S (Hydro) 358 MW	88 10	1	Bluejay	2	564	2033	100	20,240	0	(			0	0	0	(	0			0	0	0	0	0	0	10,120	10,120	0	0	0		0	0	0
110	220	Kikonge P/S (Hvdro)	Madaba 300 MW	49	1	Blueiav	2	564	2034	230	1,300	0	(			0	0	0	(	0	0	0 0	0	0	0	0	0	0	0	5.635	5.635	0	0	0	0	0	0
111	132	Songwe A S/S	Songwe B S/S	40	1	Hawk	1	242	2034	170	6,800	0	(	) (	0 0	0	0	0	(	0	0 0	0 0	0	0	0	0	0	0	0	3,400	3,400	0	0	0	0	0	0
112	132	Songw e Sofre P/S (Hydro)	Songwe A S/S 79.5 MW	16	1	Hawk	1	242	2034	170	2,720	0		) (	0 0	0	0	0		0	0	0 0	0	0	0	0	0	0	0	1,360	1,360	0	0	0	0	0	0
113	400	Chalinze	Segera	175	1 2	Bluejay	4	564	2035	400	/0,000	0	(	) ( )		0	0	0	(	0		0	0	0	0	0	0	0	0	0	35,000	35,000	0	0	0	0	0
115	400	Somanga Fungu S/S	Chalinze	284	2	Blueiav	-+	564	2035	850	204,300	0	(			0	0	0	(	0			0	0	0	0	0	0	0	0	120.700	120.700	0	0			0
116	400	Stiegler's Gorge	Chalinze 2 x 1,048 MW	195	2	Bluejay	8	564	2035	850	165,750	0	(		00	0	0	0		0	00	00	Ŏ	0	Ő	0	0	0	0	0	82,875	82,875	0	0	0	Ő	0
117	220	Bulyanhulu	Shinyanga	130	2	Bluejay	4	564	2035	450	58,500	0	(	) (	0 0	0	0	0	(	0	0	0 0	0	0	0	0	0	0	0	0	29,250	29,250	0	0	0	0	0
118	220	Bunda	Musona	60	1	Bluejay	4	564	2035	340	20,400	0	(	) (		0	0	0	(	0	0	0	0	0	0	0	0	0	0	0	10,200	10,200	0	<u> </u>	0	0	0
120	220	Musona	Iviasaka(Uganua) up tu Uganda border Nvamondo	30 90	1	Blueiav	4	564	2035 2035	<u>230</u> 340	0,900 30,600	0				0	0	0		0			0 0	0	0 0	0	0	0	0	0	ა,450 15 300	3,450 15,300	0		0	0	0
121	220	Mwanza	Bunda	150	1	Bluejay	4	564	2035	340	51,000	0	(			0	0	0	(	0	0		0	0	0	0	0	0	0	0	25,500	25,500	0	0	0	0	0
122	220	Nyakanazi	Rusumo Falls P/S	97	1	Bluejay	4	564	2035	340	32,980	0	(	) (	0 0	0	0	0	(	0	0 0	0 0	0	0	0	0	0	0	0	0	16,490	16,490	0	0	0	0	0
123	220	Rusumo Falls P/S	Kyaka	150	1	Bluejay	4	564	2035	340	51,000	0	(	) (	0 0	0	0	0	(	0	0	0 0	0	0	0	0	0	0	0	0	25,500	25,500	0	0	0	0	0
124	220	Sninyanga Kuaka	Buswagi Kibeta/Bukoba	108	2	Bluejay	4	564 242	2035	450	48,600	0		) ( ) (		0	0	0	(	0			0	0	0	0	0	0	0	0	24,300	24,300	0	0	0	0	0
120	66	Babati	Kondoa	85	2	Wolf	2	150	2035	150	12,750	0	(			0	0	0	(	0			0	0	0	0	0	0	0	0	6.375	6.375	0	0	0	0	0
127	400	Mtwara	Future CGT1 P/S 330MW	50	2	Bluejay	2	564	2036	380	19,000	0	(			0	0	Ö	(	0	0 0	Ö	Ő	0	Ö	0	0	0	0	0	0	9,500	9,500		Ő	Ŏ	Ö
128	400	Somanga Fungu	Future CGT3-3 5x470 MW	20	2	Bluejay	4	564	2038	560	11,200	0	(	) (	0 0	0	0	0	(	0	0	0 0	0	0	0	0	0	0	0	0	0	0	0	5,600	5,600	0	0
129	220	Kinyerezi	West DSM	20	1	Bluejay	4	564	2040	340	6,800	0	(	) (		0	0	0	(	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,400	3,400
130	220	Singida	INWanza Rabati	140 150	2	Blueiay	1	564 564	2040	220	30,800	0		ן ( ער בי		0	0	0		0				0		0	0	0	0	0	0	0	0			15,400	15,400
132	220	Singida	Shinyanga	200	2	Blueiav	1	564	2040	220	44.000	0	(			0	0	0	(	0			0	0		0	0	0	0	0	0	0	0		0	22.000	22.000
133	132	Chalinze	Morogoro	82	2	Hawk	1	242	2040	200	16,400	0	(		0 0	0	0	0		0	0	0 0	0	0	Ő	0	0	0	0	0	0	0	0	0	0	8,200	8,200
										Total Fananditum (Arrows	6.593.363	130 410	131.560	388.260	691,215	1,340,058	1.035.953	29,750	230 800	226 890	172,965	153 175	11.073	61.363	58.640	248.960	333 635	95 370	36 075	39 025	514 165	512 320	9.500	5.600	5,600	65,500	65 500
										(Thousand	USD)	,	,	000,200	001,210	.,	.,			,000	,000	1.00,110	,010	01,000	00,010	2.0,000	300,000	00,010	00,010	00,020	5,100	5.2,020	0,000	0,000	0,000	30,000	
						Note:	*1 Source	: SURAL cat	talogue					3	,717,457					813,580					713,671					1,196,955					151,700		

		0 500 000	400 440	404 500	000 000	004.045	4 0 40 050	4 005 050	00 750	000 000	000 000	470.005	450 475	44.070	04.000	50.040	0.40,000	000.005	05 070
	Total Expenditure (Annual)	6,593,363	130,410	131,560	388,260	691,215	1,340,058	1,035,953	29,750	230,800	226,890	172,965	153,175	11,073	61,363	58,640	248,960	333,635	95,370
	(Thousand U	JSD)																	
rce: SURAL catalogue	-				3,	717,457					813,580					713,671			

\*2: Normal Rating=Full Rating x 80% \*3: Should be replaced with the contract amount \*4: Assumed allocation from the contract amount obtained from TANESCO

## Appendix-3: Capital Cost for Substation (US Dollar, thousand)

Annual Expenditure of Substatio	n Construction & Expansion Cost
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		New Year to								-					Annual	Expenditur	e (Thousar	nd USD)											
No	Substation	Or Com	Cost	0015	0016	0017	0010	2010	2020	2024	0000	0000	2024	2005	2006		0000	0000	2020	2021	2022	2022	2024	0005	0006	2027	2029	2020	2010
	1	Expansion mission	ed (T. USD)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1	Arusha (Njiro)	N 2019	46,590 *1	(	0 0	) 0	) 23,295	23,295 ز	, 0	0	(	<u>) C</u>	0	) 0	0	0	0	) (	0	0	0	0	0	) <u>(</u>	<u>ງ</u> 0	0	0	0	0
2	Arusha (Njiro)	E 2020	27,295	(	0 0	<u></u>	<u></u> 0	13,648	13,648	0	0.500	) <u> </u>	0	0	0	0	0		0	0	0	0	0	<u>)                                    </u>	<u>) 0</u>	0	0	0	0
3	Arusha (Njiro)	E 202.	3 7,045		0 0	<u>.</u>				U	3,523	3 3,523	<u> </u>	<u> </u>	U	<u> </u>	2 5 2 2	) (	U U	<u> </u>	<u> </u>	<u> </u>	U	<u>) (</u>		<u> </u>	<u> </u>	U 0	<u>-</u>
<del>4</del> 5	Arusha (Njiro)	E 2023	10 375	+	0 0	<u></u>			, <u> </u>	0	,				0		3,523	5 <u>5</u> ,5∠3	5 188		, 0		, č	) <u> </u>		,č	, <u> </u>	0	0
6	Arusha (Nijro)	E 203	2 16.841	1	n c	j <del>i</del> č	j <del>i</del> č		j <del>i j</del>	Ŭ	j č	á č	j Ö	ŏ	ŭ	, <del>j</del>	itö	0 0,100	0,100	8.421	8.421	0	i <del>l č</del>	j č		j – č	, j	ŏ	0
7	Arusha (Njiro)	E 203	5 17,015	(	0 0	j c	j j	0 0	0	0	j c	j c	i o	j ō	0	0	0		0	0	0	0	8,508	3 8,508	3 0	i c	j o	0	0
8	Arusha (Njiro)	E 203	7 10,375	(	0 0	00	0(	0	0	0	) (	J <u>C</u>	0	0 0	0	0	0	) C	0	0	0	0	0		J 5,188	5,188	0	0	0
9	Arusha (Njiro)	E 203	3 7,045	(	0 0	0	<u>ر</u> 0	) 0	0	0	, <u> </u>	<u>)</u> 0	0	) 0	0	0	0	) C	0	0	0	0	0	<u>с</u> с	<u>ں</u> 0	3,523	3,523	0	0
10	Arusha (Njiro)	E 2040	) 47,280	(	0 0	0	0	) 0	0	0	<u> </u>	0 0	0	0	0	0	0		0	0	0	0	0	2 0	0 1	0	0	23,640	23,640
11	Babati	E 2020	) 700		0 0	<u> </u>	<u>1</u>	350	350	U	<u> </u>	<u>)                                    </u>	0	0	0	U	<u> </u>		0	<u> </u>	<u> </u>	<u> </u>	U		<u>)</u> <u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
12	Babati	E 2023	) 5,745 5 745	+					<u> </u>		,		2,013	2,013	0		<u> </u>						2 872	287		<u> </u>		0	
14	Baball	NI 200	13 040		<u>v</u>	Y C		6 520	6 520		,		<u> </u>		0								2,013	) <u>2,01</u> n (		<u>,                                    </u>	, <u> </u>		0
15	Bagamoyo	E 202	36,680	Ť,	o c	j č	j č	) 0	0,020	Ö	j č	ő c	18,340	18,340	0	, j	j Ö		Ő	j <u> </u>	i – – – – j	Ö	j č	j č	5 0	j č	j <u>ŏ</u>	Ŏ	0
16	Bagamoyo	E 202 <sup>-</sup>	7 935	(	0 0	0 0	0 0	0 0	0	0	) (	ό c	0	0	468	468	0	) C	0	0	0	0	0 C		0 0	0	0	0	0
17	Bagamoyo	E 2029	16,665	(	0 0	<u>) 0</u>	0 C	) 0	0	0	, (	<u>ა</u> ი	0 1	0 0	0	0	8,333	8,333	0	0	0	0	0	ງ ເ	J 0	0	0	0	0
18	Bagamoyo	E 2030	) 2,090	(	0 0	0	) 0	) 0	0	0	, c	<u>) (</u>	0	0	0	0	0	1,045	1,045	0	0	0	0	<u>)</u> (	<u>) 0</u>	0	0	0	0
19	Bagamoyo	E 2040	) 8,580	(	0 0	<u> </u>	<u> </u>	1 0	0	0	<u> </u>	<u>) 0</u>	0	0	0	0	0	) (	0	0	0	0	0	<u>) (</u>	<u>) 0</u>	0	0	4,290	4,290
20	Bulyanhulu	E 203:	5 <u>1,870</u>		<u>0</u> <u>0</u>	<u></u>	<u></u>		U	U	<u> </u>	<u>j</u>	<u> </u>	4 4	U	U	<u> </u>		U	<u> </u>	<u> </u>	<u> </u>	935	<u>ن 9</u> 35		<u> </u>	<u> </u>	U	0
22	Bunda	N 2020	10,700			<u> </u>		1 0,300	5,350			<u>) v</u>	<u> </u>		0		<u> </u>	2 2 2 2 2	2 2 2 2 3		<u> </u>		, <u> </u>			<u> </u>	0	0	
23	Bunda	F 203	5 1.870	1		il c	it m	1 0			j č		j <del>i</del> o		ŭ				2,220				935	5 935		i č	jŏ	0	0
24	Buzwagi	E 203	5 1,870	1	0 0	j <del>r</del>	j c	) 0	0	0	,	ő c	0	) Ö	- 0	0	0		0	0	0	0	935	5 935	5 0	, c	- 0	0	0
25	Chalinze	N 202(	) 47,930 *1	í <u>(</u>	0 0	<u>ں ار</u>	0(	23,965	23,965	0	)(	j c	0 0	0 (	0	0	, <u> </u>	) C	0	0	0	0	0	j(	0 0	0	00	0	0
26	Chalinze	E 2025	i 11,425	(	0 0	) 0	<u>ر</u>	) 0	0	0	, c	J C	5,713	5,713	0	0	0	) C	0	0	0	0	0	ງ (	J 0	0	, 0	0	0
27	Chalinze	E 2034	4,020	(	0 0	0	0	) <u> </u>	0	0	<u> </u>	<u> </u>	0	0	0	0	0	) (	0	0	0	2,010	2,010	<u>) (</u>	<u>) 0</u>	0	0	0	0
28	Chalinze	E 203	<u>ک 20,195</u>		<u>0</u> <u>0</u> <u>0</u>	ų <u> </u>	<u>/</u>	<u>, v</u>	<u> </u>	ļ		ງ	<u> </u>	4 9	<u> </u>	<u> </u>	<u>.</u>		U U	<u> </u>	<u> </u>	<u> </u>	10,098	3 10,098	3 0	ļ	<u> </u>	<u> </u>	L
29 30	Chalinze	E 2030	δ,ουυ 10,805			<u> </u>			<u> </u>		,				0		<u> </u>						<u> </u>	) <u>4,200</u>	) <u>4,2</u> 00	<u> </u>	5 403	5 403	
31	Chalinze	F 200	72.205				<u>.</u>				,č		, <u> </u>		0					0			ilč			i c	0,400	36,103	36,103
32	Dodoma	E 201/	52,250 *1	26,12	25 26,125	si č	ŭ č	0 0	j <u>ö</u>	0	, č	o c	j õ	) õ	0	, O	0		0	0	, Ö	0	ŏ	j č	j <u> </u>	ŭ č	ŏ	00,100	00,100
33	Dodoma	E 201	935	(	0 0	00	468	3 468	<u>0</u> ز	0	)(	<u>с</u>	0	0 0	0	0	0	) C	0	0	0	0	0	j(	j <u>0</u>	0	00	0	0
34	Dodoma	E 2040	) 64,465	(	0 0	) 0	<u>ں</u> ر	) <u> </u>	0	0	/ (	<u>ງ</u> ເ	0	) 0	0	0	0	) C	0	0	0	0	0	<u>ງ</u> ເ	<u>ງ</u> 0	0	0	32,233	32,233
35	Geita	N 2018	3 8,400	(	0 0	4,200	4,200	0	0	0	<u> </u>	<u> </u>	0	0	0	0	0	0 0	0	0	0	0	0	<u>) (</u>	0 0	0	0	0	0
36	Geothermal A S/S	N 2025	i 6,305		0 0	<u></u>	40	<u>i</u>	0	0	ļ	<u>j</u>	3,153	3,153	0	0	0		0	0	0	0	0	<u>)</u> <u>c</u>			0	0	0
31	Geothermal A S/S	E 2020	935			<u> </u>					<u>.</u>		<u> </u>	468	468 0		<u> </u>		0	. <u> </u>			<u> </u>			<u> </u>		0	
39	bosa	N 2020	3.375	+	0 0				1 0	0		) (		1.688	1 688	0	1 0		0	0	0	0				,	<u> </u>	0	0
40	Ibosa	E 203	2 935	1	0 0	j <del>r</del>	j c	0	0	0	,	ź c	0	0	0	0	0		0	468	468	0	, c	<u>, -</u>	j	<del>.</del>	0	0	0
41	Iringa	N 201(	39,170 *1	19,58	.5 <u>19,585</u>	0ز	0 (	0 (	0 0	0	, (	j c	0 (	) <u> </u>	0	0	0	) C	0	0	0	0	0		J 0	0 0	0	0	0
42	Iringa	E 2018	3 14,500	(	0 0	7,250	7,250	) 0	0	0	<u> </u>	<u>) </u> 0	0	) 0	0	0	0	) (	0	0	0	0	0	<u>) (</u>	<u>)</u> 0	0	0	0	0
43	Iringa	E 2019	935	(	0 0	<u> </u>	468	468	0	0		<u>)</u> 0		0	0	0	0		0	0	0	0	0	<u>) (</u>	<u>)</u> 0	0	0	0	0
44	Iringa		y 935 21 150			<u> </u>			<u></u>					400	900 0		,						, <u> </u>			, <u> </u>	<u> </u>	10 575	10 575
46	KIA (Kilimanjaro Internatio	E 203	) 21,100	7	n č	j <del>i</del> č	it c		jĕ	j – – – – j	j č	ál č	, je na se na s	jŏ	ŭ	, <del>Filler</del>	, <u> </u>		Ĭ			, militaria di seconda di se	ilč	, 		ilč	jŏ	0,0,0	0,575
47	Kigoma	N 202	38,190	(	0 0	0 0	<u> </u>	19,095	19,095	0	) (	ό c	0	j Ö	0	0	0	) C	0	0	0	0	0	່ວ ເ	ό σ	0 0	0	0	0
48	Kigoma	E 202	4 3,485	(	0 0	0 0	0 0	) 0	0	0	, (	J 1,743	1,743	s 0	0	0	0	0 0	0	0	0	0	0	) (	J 0	0	, 0	0	0
49	Kigoma	E 2025	<u>3,310</u>	(	0 0	0	0	1 0	0	0	<u> </u>	<u>) 0</u>	1,655	1,655	0	0	0		0	0	0	0	0	2 0	0 0	0	0	0	0
50	Kigoma	E 2030	) 6,225		0 0	<u>.</u>	<u>.</u>	<u>, v</u>	<u> </u>	<u>U</u>		<u>)                                    </u>	<u> </u>	<u> </u>	U	U	<u> </u>	3,113	3,113	<u> </u>	<u> </u>	<u> </u>	0.410	) (	<u>)</u>		<u> </u>	<u> </u>	U
52	Kigoma	E 203	10,020 N 8 060		<u>0</u> 0			<u> </u>	, <u> </u>		,		<u> </u>		0		,						3,410	) <u>9,410</u> n (		,	,	4 030	4 030
53	Kihansi	F 203	4 935	t	n c	, The second sec	, terre č		j — j	j0	j č	ál č	, Total States and Sta	j o	0	j j	, <u> </u>		Ĭ			468	468	A (		j č	, ŏ		-,000
54	Kin-Som SwS1	N 201/	3 24,810	(	0 0	12,405	12,405	0 ز	0 0	0	) (	ό c	0	0	0	0	0		0	0	0	0	0 0	ζ c	ό o	0	0	0	0
55	Kin-Som SwS1	E 2020	) 7,760	(	0 0	0	0	) 3,880	3,880	0	i c	<u>с</u> с	0	0 0	0	0	0	) C	0	0	0	0	0	<u>з</u> с	J 0	0	0	0	0
56	Kin-Som SwS1	E 2040	56,910	[(	0 0	<u> </u>	0	1 <u>0</u>	0	0	£ç	<u>1</u> 0	<u> </u>	<u> </u>	0	0	0		0	0	0	0	0	<u>) (</u>	<u>v</u> 0	<u> </u>	0	28,455	28,455
51	Kin-Som SwS2	N 2018	3 24,810	<u> </u>	0 0	12,405	12,405	0 2 720	2 720	U 0	<u> </u>	)	<u> </u>		0	U	<u> </u>		0		<u> </u>	U	<u> </u>			<u> </u>	<u> </u>	U	
50	KIN-SOM SWSZ	N 2020	1440 14 280		<u>v</u>	<u> </u>	<u> </u>	1 <u>3,720</u>	3,120		,	<u>,                                    </u>	<u> </u>		<u> </u>		, <u> </u>					<u> </u>	<u>,                                    </u>			<u> </u>	, <u> </u>	7 140	7 140
60	Kin-Som SwS3	N 201	24.810	1		12.405	12.405			0	i č			0	0				0			0	i <del>l c</del>			i <del>l č</del>	, J	0	1,1-10
61	Kin-Som SwS3	N 202	7,440	1	õ õ	) <u> </u>	) <u>'-,</u> C	3,720	3,720	0	,	ź c	j ō	j ō	0	Ö			Ö	0	Ō	0	, c	ź ć	j ō	<u>.</u>	jō	0	0
62	Kin-Som SwS3	E 2040	) 44,370	(	0 0	0 0	0 0	) 0	0	0	, (	<u>з</u> с	0 0	0 (	0	0	0	) C	0	0	0	0	0		J 0	0	0	22,185	22,185
63	Kinyerezi	N 2017	/ 935	(	0 468	468	<u>ر</u>	<u>)</u>	0	0	<u> </u>	<u>) 0</u>	0	<i>,</i> 0	0	0	0	) (	0	0	0	0	0	<u>) (</u>	<u>)</u> 0	0	0	0	0
64	Kinyerezi	E 2018	3 92,945		0 0	46,473	, 46,473	<u>i</u> 0	0	0	4C	<u>) </u> 0	· 0	0	0	0	0		0	0	0	0	0	<u>) (</u>	0	0	0	0	0
65	Kinyerezi	E 2020	) 36,320 ***	4 <u> </u>	0 0	<u> </u>	<u></u>	18,160	18,160	2 410	2 410	<u>)                                    </u>	<u> </u>		U		<u> </u>		U U	<u> </u>	<u> </u>	<u> </u>	U	<u>)                                     </u>	<u>)</u>	<u> </u>		U	U 0
67	Kliyelezi	E 2022	5 1.870		0 0 0 0	il				3,410	3,410		935	935	0							0				<u>,                                    </u>	,	0	
68	Kinyerezi	E 202	) 1,870		0 C					0			0	0	0			935	935	0		0		j (	<u>, 0</u>		0	0	0
69	Kinyerezi	E 203	5 16,435	(	0 C	j Č	j Č	J 0	0 1	0	) (	j c	j Ö	) Ö	0	0	0	) (	0	0	Ö	0	8,218	3 8,218	3 0	j Č	0	0	0
70	Kinyerezi	E 204	50,320	(	0 0	) (	0 (	) 0	0	0	, (	<u>с</u> с	0	0 (	0	0	0	) C	0	0	0	0	C	J (	J 0	0	0	25,160	25,160
71	Kisada	N 2018	3 27,510	(	0 0	13,755	13,755	<u>, 0</u>	· 0	0	(	<u>)</u> C	0	) 0	0	0	0	) C	0	0	0	0	0	) (	) 0	, 0	0	0	0
72	Kisada	E 2020	) 7,900	(	0 0	0	0	3,950	3,950	0	<u> </u>	<u>) (</u>	0	/ 0	0	0	0	) <u>(</u>	0	0	0	0	0	<u>)</u>	) 0	0	0	0	C
73	Kisada	E 2028	3 7,870	(	0 0	<u> </u>	<u> </u>	1 0	0	0		) 0	0	0	0	3,935	3,935		0	0	0	0	0	) (	) 0	0	0	0	0
74	Kisada	E 2040	36,360	······································	0 0	0				0	, (		0	÷	0	0			0	0	0	0	0			0	0	18,180	18,180
76	Kvaka	E 2030	3 9.930	· · · · · · · · · · · · · · · · · · ·		4 965	i 4 965	5 0		0	) (		0	) 0	0				0			0			0 0		0	0	
77	Kyaka	E 202	) 935	(	0 C	) (	) (	468	468	0	, , ,	ό c	j Ö	) Ö	0	0	0		0	0	Ö	0	j č	Ĵ (	j o	jč	, O	0	0
78	Kyaka	E 202'	<del>تا 7</del> 00	Ĩ	0 0	j č	<u>, c</u>	) 0	0	0	, c	<u>) (</u>	350	350	0	0	0	) C	0	0	0	0	C C	<u>)</u>	J 0	Č	0	0	0
70	Kvaka	F 202	7 700	(	0 0	0	) (	) 0	0	0	) (	) (	0	) 0	350	350	0	) (	0	0	0	0	) C	.) (	0 0	0	0	0	0

#### Annual Expenditure of Substation Construction & Expansion Cost

		New	Year to be	Construction												Annual	Expenditur	e (Thousar	nd USD)											
No	Substation	or	Com- missioned	Cost	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
8	0 Kvaka	Expansion	2030	(1. USD)					0					0 0			0		2 2 2 2 3	2 223	2 0		0	0	0	0	0	0	0	
8	1 Kyaka	E	2035	3,270	(				0	0		) (	) (	0 0		0	0 0	0	) 2,223	2,22		) (	0 0	1,635	1,635	0	0	0	0	0
8	2 Kyaka	E	2037	4,445	(	) (	) (	0 0	0	0	0 0	) (	) (	0 (	0 0	0	0	0	0 0		) (	) (	0 0	0	0	2,223	2,223	0	0	C
8	3 Kyela 4 Kyela	N	2020	6,860	(				3,430	3,430							0 0 4 223	4 223		(				0	0	0	0	0	0	0
8	5 Lindi	N	2019	25,990	(	0 0		12,995	12,995	(		) (		0 0		0	0 0	-,220		(		) (	0 0	0	0	0	0	0	0	0
8	6 Lindi	E	2020	7,440	(	0 0	) (	0 0	3,720	3,720	0 0	) (	) (	0 (	0 0	C	0	C	0 0	(	) (	) (	0 0	0	0	0	0	0	0	0
8	7 Lindi		2023	6,630	(			0 0	0	0		3,315	3,31	5 (		0	0		0 0 0	2 112			0 0	0	0	0	0	0	0	0
8	9 Lusu	E	2030	10,700					5,350	5,350				0 0		C	0		) 3,113	3,113			0 0	0	0	0	0	0	0	0
9	0 Lusu	E	2026	4,445	(	) (	) (	0 0	0	C	0 0	) (	) (	0 (	2,223	2,223	0	C	0 0	(	) (	) (	0 0	0	0	0	0	0	0	0
9	1 Lusu	E	2032	4,445	(		) (	0 0	0	0	0 0			0 (	0 0	0	0 0	0 0	0 0		2,223	2,223	3 0	0	0	0	0	0	0	0
9	Z LUSU		2036	4,445					0															0	2,223	2,223	0	0	468	0 468
9	4 Madaba	N	2018	25,330	(	0 0	12,665	12,665	0	0		) (		0 0		0	0		0 0	(		) (	0 0	0	0	0	0	0	00	
9	5 Madaba	E	2020	7,440	(	0 0	) (	) 0	3,720	3,720	0 0	) (	) (	0 (	0 0	C	0	C	0 0	(	) (	) (	0 0	0	0	0	0	0	0	0
9	6 Madaba		2023	6,840	(		) (		0	(	0	3,420	3,420	0 (		0	0	( (		) (			) 0	0	0	0	0	0	0	0
9	8 Madaba	<u>E</u>	2030	935					0							0	0		$\frac{3,113}{0}$	3,113	) 468	468	3 0	0	0	0	0	0	0	0
9	9 Madaba	E	2034	935	(	0 0	) (	0 0	0	0	0 0	) (	) (	0 (	0 0	C	0	0	0 0	(	) (	) (	468	468	0	0	0	0	0	0
10	0 Makambako	E	2018	935	(	0 0	468	3 468	0	0	0 0	) (	) (	0 (	0 0	0	0	0	0 0	(		) (	0 0	0	0	0	0	0	0	0
10	2 Masasi	N E	2019	25 990				) <u>350</u> ) ∩	350			12 994	12 994	u (										0	0	0	0	0	0	0
10	3 Masasi	E	2025	7,440				0 0	0			)(	)(	0 3,720	3,720		0			(			0 0	0	0	0	0	0	0	0
10	4 Masasi	E	2033	6,225	(	0 0	) (	0 0	0	0	0 0	) (	) (	0 (	0 0	C	0 0	C	0 0	(	0 0	3,113	3,113	0	0	0	0	0	0	0
10	5 Mbeya 6 Mbeya	E	2018	30,095	(		15,048	15,048	10 412	10 412						0	0		0 0	(			0	0	0	0	0	0	0	0
10	7 Mbeya	E	2020	11.685		j (		) 0 ) 0	10,413	10,413				0 5.843	3 5.843	0	0		) 0 ) 0	(		, ( ) (	, <u> </u>	0	0	0	0	0	0	0
10	8 Mbeya	E	2028	15,975	(	) (	) (	0 0	0	C	0 0	) (	) (	0 (	) (	C	7,988	7,988	3 0	(	) (	) (	0 0	0	0	0	0	0	0	0
10	9 Mbeya	E	2033	935	(	0 0	) (	0 0	0	0	0 0	) (	) (	0 (	0 0	0	0 0	0	0 0	(		468	3 468	0	0	0	0	0	0	0
11	1 Mbeva		2037	15,975	(				0															0	0	7,988	7,988	0	18 270	18 270
11	2 Mbe-Sum SwS	E	2020	27,120	(	0 0	) (	0 0	13,560	13,560	0 0	) (	) (	0 (	0 0	C	0	C	0 0	(		) (	0 0	0	0	0	0	0	0	0
11	3 Mbe-Sum SwS	E	2040	7,760	(	) (	) (	0 0	0	0	0 0	) (	) (	0 (	0 0	C	0	C	0 0	(	0 0	) (	0 0	0	0	0	0	0	3,880	3,880
11	4 Mkuranga 5 Mkuranga	N	2022	13,930	(				0		6,965	6,965		0 (	) ()	0	0 0			(				0	0	0	0	0	0	0
11	6 Mkuranga	E	2023	2,975	(			0 0	0	0				0 21,230	0 0	0	0	0	1,488	1,488	3 C		0 0	0	0	0	0	0	0	0
11	7 Mkuranga	E	2031	6,420	(	) (	) (	) 0	0	0	0 0	) (	) (	0 (	0 0	C	0 0	C	0 0	3,210	3,210	) (	0 0	0	0	0	0	0	0	0
11	8 Mkuranga	E	2035	2,975	(		) (	0	0		0 0	) (	) (	0 (		0	0	0				) (	0 0	1,488	1,488	0	0	0	27 600	27 600
12	0 Mku-Som SwS-1	N N	2040	17.990	(				0					0 0		0	0			8.995	5 8.995		0 0	0	0	0	0	0	27,030	27,030
12	1 Mku-Som SwS-1	E	2040	17,700	(	0 0	) (	0 0	0	0	0 0	) (	) (	0 (	0 0	C	0	C	0 0	(	) C	) (	0 0	0	0	0	0	0	8,850	8,850
12	2 Mku-Som SwS-2	N	2031	17,990	(	0 0	) (	0 0	0	0	0 0	) (	) (	0 (	0 0	0	0	0	0 0	8,995	5 8,995		0 0	0	0	0	0	0	0	0
12	4 Mandizi		2040	48,540															6 395	6 395				0	0	0	0	0	24,270	24,270
12	5 Mlandizi	E	2040	4,445	(	0 0	) (	0 0	0	Č	0 0	) (	) (	0 (	5 C	C	0	Ċ	0 0	0,000		) (	0 0	0	0	0	0	0	2,223	2,223
12	6 Mnyera	N	2028	52,400	(	) (	) (	0 0	0	0	0 0	) (	) (	0 (	0 0	C	26,200	26,200	0 0	(	0 0	) (	0 0	0	0	0	0	0	0	0
12	7 Minyera 8 Minyera		2030	935	(														) 468 ) 0	468		8 473	0 0 8 8 473	0	0	0	0	0	0	0
12	9 Morogoro	E	2016	700 *1	350	350	) (	0 0	0	Ċ	0 0	) (	) (	0 (	) (	C	0	C C	0 0	(		) (	0 0	0	0	0	0	0	0	0
13	0 Morogoro	E	2020	12,190	(	) (	) (	0 0	6,095	6,095	5 0	) (	) (	0 (	0 0	C	0 0	C	0 0	(	) (	) (	0 0	0	0	0	0	0	0	0
13	1 Morogoro 2 Mpanda	E N	2030	5,745					17 758	17 758									2,873	2,8/3				0	0	0	0	0	0	0
13	3 Mpanda	N	2025	1,120	(		) (	0 0	0	(	0 0	) (		0 560	560	C	0	Ċ	0 0	(		) (	0 0	0	0	0	0	0	0	0
13	4 Mpanda	E	2030	7,050	(	) (	) (	0 0	0	(	0 0	) (	) (	0 (	0 0	C	0	0	3,525	3,525	5 0	) (	0 0	0	0	0	0	0	0	0
13	5 Mpanda 6 Mpanda		2035	6,225	(					(										(				3,113	3,113	0	0	0	18 840	18 840
13	7 Mpa-Sum SwS	N	2020	26,490					13,245	13,245	5 0			0 0						(			0 0	0	0	0	0	0	00	0
13	8 Mpa-Sum SwS	E	2040	46,080	(	0 0	) (	0 0	0	(	0 0	) (	) (	0 0	0 0	C	0	C	0 0	(		) (	0 0	0	0	0	0	0	23,040	23,040
13	9 Mpa-Tab SwS	E	2030	27,330			) (	0	0	0	0			0 (		0	0		13,665	13,665	5 0		0 0	0	0	0	0	0	0	0 = 40
14	1 Mtibwa	E	2040	700 *1	350	350		) 0 ) 0											, <u> </u>	( (			, <u> </u>	0	0	0	0	0	0,540 N	0,540 N
14	2 Mtibwa	Ē	2020	700	(	0 0		o õ	350	350	) Ö	) Č		0 0	o č	Č	0 0	Č	) Ö	Ċ	o č		) Ö	0	Ő	Ő	0	Ő	0	0
14	3 Mtibwa	E	2035	3,690	(	) (	) (	0 0	0	0	0 0	) (	) (	0 (	0 0	C	0	0	0 0	(		) (	0 0	1,845	1,845	0	0	0	0	0
14	4 IVIIWara 5 Mtwara	F	2019	23,330			) ( ) (	11,665	11,665	6 210														0	0	0	0	0	0	0
14	6 Mtwara	E	2025	10,820	(		) (		0,210	0,210				0 5,410	5,410	0	0	0				) (	0 0	0	0	0	0	0	0	0
14	7 Mtwara	E	2030	10,670	(	) (	) (	0 0	0	C	0 0	) (	) (	0 (	o c	C	0 0	C	5,335	5,335	5 C	) (	0 0	0	0	0	0	0	0	0
14	8 Mtwara	E	2035	4,445	(	) (	) (	0	0	0	0 0			0 (	0 0	0	0	0	0 0	(			0 0	2,223	2,223	0	0	0	0	0
14	0 Mtwara	E	2036	9,280				, <u> </u>											, <u> </u>	(			, <u> </u>	0	4,640 0	4,040 0	0	0	2.580	2.580
15	1 Mufindi	E	2032	935	(		) (	0 0	0		0 0		) (	0 0	0 0	C	0	Č	0 0		468	468	3 0	0	0	0	0	0	0	,0
15	2 Musoma	E	2020	10,700	(	) (	) (	0 0	5,350	5,350	0 0	) (	) (	0 (	0 0	C	0	0	0 0	(		) (	0 0	0	0	0	0	0	0	0
15	3 IVIUSOMA 4 Musoma	E F	2028	4,445			) ( ) (										2,223	2,223						025	035	0		0	0	0
15	5 Musoma	E	2036	4,445	(				0					0 0			0 0			(			0 0	0	2,223	2,223	0	0	0	0
15	6 Mwanza	E	2020	5,390	(	) (	) (	0 0	2,695	2,695	5 0	) (	) (	0 (	0 0	C	0	0	0 0	(	0 0	) (	0 0	0	0	0	0	0	0	0
15	7 Mwanza	E	2025	66,890	<u>(</u>	0 (	) (	0	0					0 33,445	5 33,445	- C	0		0	( 			0 0	0	0	0	0	0	0	0
15	o iviwanza 9 Mwanza	<u>E</u>	2033	7,045			) ( ) (												0 0 0 (	(		3,523	) 3,523	2 763	2.763	0	0	0	0	0
16	0 Mwanza	Ē	2037	7,045		o č		0 0	0	0	) Ö	) Č	) (	0 0	o č	C	00	C C	0 0	Č			00	0	0	3,523	3,523	0	0	0
16	1 Mwanza	E	2040	8,945	(	o (	) (	0 0	0	0	0 0	) (		0 (	0 0	0	0	0	0 0		0 0	) (	0 0	0	0	0	0	0	4,473	4,473
16	2 North DSM		2025	19,180	(		) ( )		0		0			0 9,590	9,590	0	0		0	025			0	0	0	0	0	0	0	0
10			L030	1.8/0	. (	. (	. (	л U	. 0	. (	/ 0	. (		טו (		. 0	. 0		JI 935	935	. 0	, (	/ 0	. 0	. 0	. 0	. 0		0	. 0

#### Annual Expenditure of Substation Construction & Expansion Cost

	•	New Year to be Construction										Annual	Expenditure	e (Thousar	nd USD)																
No	Substation	or	C	Com-	Cost	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
		Expansion	ו <sup>mis</sup>	sioned	(T. USD)	2013	2010	2017	2010	2013	2020	2021	2022	2023	2024	2025	2020	2021	2020	2023	2030	2031	2032	2000	2034	2000	2030	2037	2000	2033	2040
164	North DSM	E	2	2035	12,245	0	0	) (	0 0	0	C	0	0	0	) (	0 0	0	0	0 0	0 0	0	0	0	0	6,123	6,123	0	0	0	0	0
165	North DSM	E	2	2040	24,490	0		) (	0 0	0	0	0		0		0 0	0	0		0 0	0	0	0 0	0	0	0		0	0	12,245	12,245
167	Nyakanazi		~ 2	2010	45,890	0		3,010	3,015	22 945	22 945			0		0	0	0			0	0	0	0		0		0	0	0	0
168	Nyakanazi	E	2	2025	1.430	0			0	22,343	22,040	0		0	715	715	0	0	0		0	0	0	0	0	0		0	0	0	0
169	Nyakanazi	Ē	2	2034	9,475	0	C	) (	0 0	0	C	Ō	0	0	) (	0 0	0	0	O O	0 0	0	0	0	4,738	4,738	0	0	0	0	0	0
170	) Nyakanazi	E	2	2035	26,850	0	C	) (	0 0	0	C	0	0	0	) (	0 0	0	0	C	) 0	0	0	0 0	0	13,425	13,425	0	0	0	0	0
171	Nyakanazi	E	2	2039	9,475	0	C	) (	0 0	0	C	0	0	0	) <u> </u>	0 0	0	0	0	0 0	0	0	0	0	0	0	0	0	4,738	4,738	0
172	2 Nyakanazi	E	2	2040	19,775	0	C	) (	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,888	9,888
173	Nyamongo	E	2	2020	9,930	0				4,965	4,965			0		0 2 2 2 3	2 223	0			0	0	0 0	0		0		0	0	0	0
175	Nyamongo	F	2	2020	4 445	0			0	0	0	0		0		) 2,223	2,223	0		0	0	0	2 223	2 223	0	0		0	0	0	0
176	Nyamongo	Ē	2	2035	935	0	C		0	0	C	Č	0	0		0 0	0	0	C	0	0	0	0 0	0	468	468	0	Ő	0	0	0
177	/ Nyamongo	E	2	2037	4,445	0	C	) (	0 0	0	C	0	C	0	0	0 0	0	0	C	0 0	0	0	0	0	0	0	2,223	2,223	0	0	0
178	Rusumo	E	2	2018	2,570	0	C	1,285	1,285	0	C	C	0	0	) (C	0 0	0	0	C	) 0	0	0	0 0	0	0	0	0	0	0	0	0
179	Rusumo	E	2	2035	935	0	C	) (	0 0	0	C	0	0	0	) <u> </u>	0 0	0	0	C	00	0	0	0	0	468	468	C	0	0	0	0
180	Rusumo	E	2	2040	935	0	0		0 0	17 115	17 115	0		0		0 0	0	0	0 0	0	0	0	0 0	0	0	0		0	0	468	468
182	Segera		2	020	0.035	0				17,115	17,115			0			0	0	4 969	1 1 068	0	0	0	0		0		0	0	0	0
183	Segera	E	2	2035	26,155	0			0	0	0	0		0		0	0	0	4,300	) 4,300	0	0	0	0	13.078	13.078		0	0	0	0
184	Segera	E	2	2040	27,810	0	0	) (	0 0	0	C	0	0	0	0 0	0 0	0	0	C	0 0	0	0	0	0	0	0	0	0	0	13,905	13,905
185	Shinyanga	E	2	2016	34,540 *1	17,270	17,270	) (	0 0	0	C	C	0	0	) C	0 0	0	0	C	) 0	0	0	0 0	0	0	0	0	0	0	0	0
186	Shinyanga	E	2	2018	935	0	C	468	468	0	C	C	0	0	) (	0 0	0	0	C	0 0	0	0	0 0	0	0	0	0	0	0	0	0
187	Shinyanga	E	2	2020	10,245	0	0	) (	0 0	5,123	5,123	0	0 (	0	0 0	0 0	0	0	0 0	0 0	0	0	0 0	0	0 0	0	0 0	0	0	0	0
100	Shinyanga		- 2	022	28,975	0				0		14,488	14,488	0	2 5 2 5	2 5 2 5 2 5	0	0			0	0	0	0		0		0	0	0	0
190	Shinyanga	F	- 2	2030	7 890	0									, 3,525	, <u>3,525</u> ) N	0	0		) 3.945	3 945			0					0	0	
191	Shinyanga	E	2	2034	14,090	0			0	0	C	l c		C C		0 0	0	0		) 0	0	0	0	7,045	7,045	0		0	0	0	0
192	Shinyanga	E	2	2035	32,715	0	C	) (	0 0	0	C	0	0 0	0	) (	0 0	0	0	0 0	0 0	0	0	0	0	16,358	16,358	0	0	0	0	0
193	Shinyanga	E	2	2038	7,045	0	C	) (	0 0	0	C	C	0 0	0	) C	0 0	0	0	C	0 0	0	0	0 0	0	0	0	0 0	3,523	3,523	0	0
194	Shinyanga	E	2	2040	58,550	0	(	) (	0 0	0	C	0	0	0	0 0	0 0	0	0	0 0	0 0	0	0	0 0	0	0	0	0	0	0	29,275	29,275
195	Singida	E	2	2016	20,510 *1	10,255	10,255		0 0	0		0		0		0 0	0	0			0	0	0 0	0	0	0		0	0	0	0
190	Singida	F	2	2017	935	0	400	400	7 770	7 770				0			0	0			0	0	0	0		0		0	0	0	0
198	Singida Singida	E	2	2020	33.540	0	0		0	16.770	16.770	0		0		0 0	0	0	0	0	0	0	0	0	0	0		0	0	0	0
199	) Singida	Ē	2	2040	21,490	0	C	) (	0	0	C	C	0	0	0	0	0	0	C	0 0	0	0	0	0	0	0	0	0	0	10,745	10,745
200	) Somanga Fungu	N	2	2018	13,210	0	C	6,605	6,605	0	C	0	0	0	) C	0 0	0	0	C	0 0	0	0	0 0	0	0	0	0	0	0	0	0
201	Somanga Fungu	E	2	2019	16,295	0	C	) (	8,148	8,148	C	0	0	0	) <u> </u>	0 0	0	0	0	0 0	0	0	0	0	0	0	0	0	0	0	0
202	Somanga Fungu	E	2	2020	11,200	0	0	) (	0 0	5,600	5,600	0	0	0	0	0 0	0	0	0	0 7 000	0	0	0 0	0	0	0	0	0	0	0	0
203	Somanga Fungu	E E	- 2	2030	6 820	0				0							0	0		1,033	7,033	3 /10	0	0		0		0	0	0	0
204	Somanga Fungu	F	2	2033	4 400	0				0				0			0	0			3,410	3,410	2 200	2 200		0		0	0	0	0
206	Somanga Fungu	E	2	2035	9,760	0	0		0 0	0	C	C		0		0 0	0	0	C	0 0	0	0	0 0	0	4,880	4,880		0	0	0	0
207	Somanga Fungu	E	2	2038	4,400	0	C	) (	0 0	0	C	C	0 (	0	) (	0 0	0	0	C	) 0	0	0	0 0	0	0	0	0 (	2,200	2,200	0	0
208	Somanga Fungu	E	2	2040	12,460	0	C	) (	0 0	0	C	0	0 0	0	) (C	0 0	0	0	0	0 0	0	0	0 0	0	0	0	0 0	0	0	6,230	6,230
209	Songea	N	2	2018	5,390	0	0	2,695	2,695	0	<u> </u>	0	(	0	0 0	0 0	0	0	0 0	0 0	0	0	0 0	0	0 0	0	0 0	0	0	0	0
210	Songea	E	2	023	31,195	0				0			15,598	15,598	2 7 2 0	0 2 720	0	0			0	0	0 0	0		0		0	0	0	0
212	Songea	E	2	2036	6.225	0			0	0	0			0	) 3,720	0 0	0	0			0	0	0	0	0	3.113	3.113	0	0	0	0
213	Songwe Hydro_A S/S	N	2	2034	4,080	0	C	) (	0 0	0	C	0	0	0	0 0	0 0	0	0	C C	0 0	0	0	0 0	2,040	2,040	0	0 (	0	0	0	0
214	Songwe Hydro_B S/S	N	2	2028	4,560	0	C	) (	0 0	0	C	0	0	0	) (C	0 0	0	2,280	2,280	) 0	0	0	0 0	0	0	0	0	0	0	0	0
215	Songwe Hydro_B S/S	E	2	2034	1,400	0	C	) (	0 0	0	C	0	0	0	) (C	0 0	0	0	0	0 0	0	0	0	700	700	0	0	0	0	0	0
216	South DSM	N E	2	025	20,720	0			0	0				0	10,360	10,360	0	0			0	0	0	0	6 100	6 100		0	0	0	0
217	South DSM	F	2	030	12,240 24 /00	0				0				0			0	0			0	0		0	0,123	0,123		0	0	12 245	12 245
219	Southeast DSM	N	2	2025	20,720	0			0 0	0	0	0		0	10,360	10,360	0	0		0 0	0	0	0 0	0	0	0		0	0	0	0
220	Southeast DSM	E	2	2030	12,245	0	C		0 0	0	C	0	0	0	0	0 0	0	0	0	6,123	6,123	0	0	0	0	0	0	0	0	0	0
221	Southeast DSM	E	2	2035	12,245	0	C	) (	0 0	0	C	C	0	0	0 0	0 0	0	0	C	) 0	0	0	0	0	6,123	6,123	0	0	0	0	0
222	Sumbawanga	N	2	2020	33,560	0			0	16,780	16,780	0		0		0	0	0		0	0	0	0	0	0	0		0	0	0	0
223	Sumbawanga		2	035	5,790 6 225									2,895	2,895		0	0							2 112	2 112			0	0	0
225	Sumbawanga	E	2	2040	27.420	0				0		0		0		0	0	0		) 0 ) 0	0	0	0	0	0 0	0,113		0 0	0	13.710	13.710
226	Tab-Mpa SwS	N	2	2030	27,330	0			0	Ö	C			Ö			0	0		13,665	13.665	Ö	0 0	0		0		Ö	0	0	0
227	Tab-Mpa SwS	E	2	2040	17,080	0	C	) (	0 0	0	C	C	0	0	) (	0 0	0	0	C	0 0	0	0	0	0	0	0	0	0	0	8,540	8,540
228	Tabora	E	2	2020	12,530	0	C	) (	0 0	6,265	6,265	C	0	0	0 0	0 0	0	0	C	0 0	0	0	0	0	0	0	0	0	0	0	0
229	Tabora Tabora	E	2	2026	7,045	0	<u> </u>		0	0	L C	0		0	<u> </u>	3,523	3,523	0			0	0	0	0	0	0		0	0	0	0
230	Tabora		2	030	57,250	0				0							0	0		28,625	28,625	0	2 500	2 500					0	0	0
231	Tabora	F	2	037	7,040												0				0		0,523	3,523			3 523	3 523	0	0	
233	B Tabora	Ē	2	2040	60,890	0			0	Ö	C			Ö		o o	0	0			0	Ö	0 0	0		0	0 (	0	0	30,445	30,445
234	Tanga	E	2	2020	14,020	0	C	) (	0 0	7,010	7,010	C	0	0	) (	0 0	0	0	) C	0 0	0	0	0	0	0	0	0	0	0	0	0
235	Tanga	E	2	2031	4,445	0	C	) (	0 0	0	C	C	0 0	0	0 0	0 0	0	0	C	0 0	2,223	2,223	0	0	0	0	0	0	0	0	0
236	Tanga	E	2	2036	4,445	0	C		0	0	C	C _		0	0 0	0	0	0	<u> </u>	0	0	0	0	0	0	2,223	2,223	0	0	0	0
237		N F	2	023	27,370	0			0	0			13,685	13,685			0	0			0	0	0	0	0	0		0	0	0	0
238		F	2	025	6 225	0				0				0	3,020	00	0	0			0	0	3 112	3 112				0	0	0	
240	Ubungo	Ē	2	2020	18.610	0			0	9.305	9.305	0		0		0 0	0	0		0 0	0	0	0	0,113		0		0	0	0	0
241	West DSM	N	2	2030	20,720	0	C C		00	0	C	0	0 0	0	) (	0 0	0	0	0 0	10,360	10,360	0	00	0	00	0	0 0	0	0	0	0
242	West DSM	E	2	2035	12,245	0	C	) (	0 0	0	C	C	0	0	0 0	0 0	0	0	C	0 0	0	0	0 0	0	6,123	6,123	0	0	0	0	C
243	West DSM	E	2	2040	13,180	0	0 0	) (	0 0	0	0	0	0 0	0	0 0	0 0	0	0	0 0	0 0	0	0	0 0	0	0	0	0 0	0	0	6,590	6,590
	Total	Expenditu	re (Ar	nnual)	3,636.966	73.935	74.870	157.840	222.063	371.755	306.598	24.863	77.398	57.173	149.813	155.765	11.408	47.665	63.670	142.205	152.215	38.878	38.678	44.100	149.655	150.858	43.335	33.910	19.385	519.538	509.398
	Note: *1. Should be real	ad with the	~ ~ "	(т	housand USD)	. 5,000	,	1 00	7 060	,	,,	,000	,000	465.010			,	,000	/17 160		,	- 5,6.0		122 160			. 5,000	5,5 . 0	1 125 565	1.1,000	
	INULE: I: SHOULD DE LEDIACE	eu with thê (		<u></u>				1.20	1.000			1		400.010					417.103					477 109					1.120.005		

#### Appendix-4: Cash flows for the PSMP 2016-2040 (US Dollar, million)

												Co	ost										Tariff		Benefit													Not		
	Domestic Power			Total				Generation				Cost ba	ilance		Transm	ission		Di	stributior	n		Tariff Rate	Rate				Revenue			Income			Tax for		Net 1			Benefit/C	TANES	
Year	Sales, GOT Base Case (GWh)	Export (MW)	Export Sales (GWh)	Power Sales (GWh)	Thermal. Wind & Solar	Capital E Geother mal	xpenditure Hydro	apital Cost for [ Generation	IDC at 70:30 Debt:Equ ity	Fuel, O&M Cost	Cost for Generation	TANESCO Cost for Generation	PP Cost for Generation	Capital Cost	IDC at 70:30 Debt:Equ ity	O&M Cost	Cost for Transmis E sion	Capital Expend iture	O&M Cost	Cost for Distributi on	Total Cost with IDC	(US\$, kWH)	for Export (US\$, kWH)	Domestic Revenue	Revenue from Export	Total Revenue	for TANESC O	Revenue for IPP	Income (Loss)	for TANES CO	Income for IPP	Tax	CO	Tax for IPP	Benefit/ ( Cost	CO Net benefit	PP Net benefit	ost With residual Value	CO Net benefit	IPP Net benefit
2016	6,761	0	0	6,761	119	0	16	135	7	561	704	352	352	206	9	46.1	261	9	92	101	1,066	0.136	0.116	922	0	922	530	392	(144)	(184)	40	0	0	12	(144)	(184)	28	(144)	(184)	28
2017	7,888	0	0	7,888	761	0	86	847	41	656	1,544	772	772	546	23	53.8	623	35	108	142	2,310	0.136	0.116	1,076	0	1,076	618	457	(1,234)	(919)	(315)	0	0	0	(1,234)	(919)	(315)	(1,234)	(919)	(315)
2018	9,196	0	0	9,196	1,473	0	124	1,597	77	1,174	2,848	1,424	1,424	913	39	62.7	1,015	63	125	188	4,051	0.136	0.116	1,254	0	1,254	721	533	(2,797)	(1,906)	(891)	0	0	0	(2,797)	(1,906)	(891)	(2,797)	(1,906)	(891)
2019	10,580	0	0	10,580	1,942	0	44	1,986	92	1,207	3,285	1,643	1,643	1,712	73	72.1	1,857	92	144	237	5,379	0.136	0.116	1,443	0	1,443	830	613	(3,936)	(2,906)	(1,029)	0	0	0	(3,936)	(2,906)	(1,029)	(3,936)	(2,906)	(1,029)
2020	17,343	600	3,679	21,022	1,711	0	0	1,711	59	1,400	3,171	1,585	1,585	1,343	57	118.2	1,518	76	236	313	5,002	0.136	0.116	2,365	426	2,791	1,786	1,005	(2,210)	(1,630)	(580)	0	0	0	(2,210)	(1,630)	(580)	(2,210)	(1,630)	(580)
2021	18,690	600	3,679	22,370	314	0	0	314	14	1,472	1,800	900	900	55	2	140.2	197	9	280	290	2,287	0.150	0.128	2,804	469	3,273	2,081	1,192	986	694	291	296	208	87	690	486	204	690	486	204
2022	20,166	600	3,679	23,845	942	0	17	959	58	1,550	2,567	1,284	1,284	308	13	151.2	473	32	302	334	3,374	0.150	0.128	3,025	469	3,494	2,208	1,286	120	118	2	36	35	1	84	83	1	84	83	1
2023	21,776	600	3,679	25,455	732	65	111	908	60	1,625	2,593	1,296	1,296	284	12	163.3	459	30	327	356	3,408	0.150	0.128	3,266	469	3,736	2,347	1,388	327	235	92	98	71	28	229	165	64	229	165	64
2024	23,580	600	3,679	27,259	252	442	145	839	58	1,715	2,612	1,306	1,306	323	14	176.8	513	29	354	383	3,508	0.150	0.128	3,537	469	4,006	2,503	1,503	498	301	197	150	90	59	349	211	138	349	211	138
2025	25,513	600	3,679	29,192	348	585	310	1,243	89	1,792	3,124	1,562	1,562	309	13	191.3	513	39	383	421	4,059	0.150	0.128	3,827	469	4,296	2,670	1,626	237	173	64	71	52	19	166	121	45	166	121	45
2026	27,526	600	3,679	31,205	428	208	323	959	71	1,832	2,862	1,431	1,431	22	1	206.4	230	25	413	437	3,529	0.150	0.128	4,129	469	4,598	2,843	1,755	1,069	745	324	321	223	97	748	521	227	748	521	227
2027	29,718	600	3,679	33,398	1,288	0	404	1,693	123	1,928	3,743	1,872	1,872	109	5	222.9	337	45	446	491	4,571	0.150	0.128	4,458	469	4,927	3,032	1,895	356	333	23	107	100	7	249	233	16	249	233	16
2028	32,082	600	3,679	35,761	1,313	0	590	1,903	140	2,101	4,144	2,072	2,072	122	5	240.6	368	51	481	532	5,044	0.150	0.128	4,812	469	5,281	3,236	2,045	238	264	(27)	71	79	0	166	185	(27)	166	185	(27)
2029	34,690	600	3,679	38,370	737	0	947	1,684	147	2,212	4,043	2,022	2,022	391	17	260.2	668	52	520	572	5,283	0.150	0.128	5,204	469	5,673	3,461	2,212	389	199	190	117	60	57	273	140	133	273	140	133
2030	37,556	600	3,679	41,235	846	0	1,367	2,213	224	2,312	4,749	2,375	2,375	4//	20	281.7	//9	67	563	631	6,159	0.150	0.128	5,633	469	6,102	3,708	2,394	(56)	(76)	19	245	0	6	(56)	(76)	14	(56)	(76)	14
2031	40,684	600	3,679	44,363	584	0	1,237	1,820	211	2,397	4,428	2,214	2,214	125	5	305.1	436	49	610	659	5,523	0.150	0.128	6,103	469	6,572	3,978	2,594	1,049	669	380	315	201	114	/34	469	266	134	469	266
2032	44,107	600	3,679	47,700 E1 E42	1 290	0	071	1,790	201	2,470	4,529	2,264	2,204	/5	3	350.6	429	4/	702	/40 017	5,706	0.159	0.135	7,017	496	0 1 1 2	4,532	2,962	1,000	1,091	710	543	327	215	1,200	703	502	1,200	703	502
2033	47,003 E1.004	600	3,679	51,545	706	0	571	2,101	210	2,000	4,910	2,459	2,409	664	- 4	300.7 412.4	407	40	007	017	6,203	0.159	0.135	7,010	490	0,112	4,070	3,230	1,909	1,132	1 4 4 0	704	340	420	1,330	020	1 0 0 9	1,330	020	1 009
2034	51,904	600	3,679	60 123	1 164	0	780	1,277	100	2,737	4,147	2,074	2,074	663	20	413.4	1,105	49	9027	063	6 005	0.159	0.135	8,207	490	0,705	5,201	3,513	2,037	1,197	1,440	791	333	432	1,040	778	050	1,040	778	050
2035	61 002	600	3,679	64 691	1 215	0	380	1,545	02	2,020	4,032	2,440	2,440	53	20	495.0	540	41	030	1 012	6322	0.159	0.135	0,300	450	10 202	6.079	4 1 25	3,990	2 140	1 730	1 164	642	522	2 716	1 / 08	1 2 1 8	2 716	1 408	1 2 1 9
2030	65,954	600	3,679	69,633	1,213	0	305	1,004	92	3 221	4,770	2,305	2,305	40	2	524.6	566	30	1 049	1,012	6.485	0.159	0.135	10 493	490	10,202	6 5 3 1	4,123	4 506	2,140	2 044	1 352	738	613	3 154	1,450	1,210	3 154	1,450	1 4 3 1
2038	71 340	600	3,679	75 019	1 604	0	ŏ.,	1,522	94	3 5 2 2	5 220	2,410	2,410	25	1	567.5	594	41	1 135	1,000	6 989	0.159	0.135	11 349	498	11 847	7 023	4 824	4,500	2,401	2,044	1 457	793	664	3 401	1,723	1,550	3 401	1,723	1,451
2039	77 183	600	3,679	80,862	1 508	0	ŏ.,	1 508	81	3,854	5 443	2,010	2 721	561	24	614.0	1 1 9 9	52	1 228	1 280	7 921	0.159	0.135	12 279	498	12 777	7 558	5 219	4 855	2 358	2 4 97	1 457	707	749	3 399	1 651	1 748	3 399	1 651	1 748
2040	83,524	600	3,679	87,203	1,068	0	0 7	1,068	50	4,240	5,358	2,679	2.679	551	23	664.4	1,238	40	1.329	1,369	7,965	0.159	0.135	13,288	498	13,785	8,138	5,647	5,820	2,852	2,968	1,746	855	891	4.074	1,996	2.078	38,766	23,161	15,605
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## Appendix-5: Cash flows for financing the project 2016-2040 (US Dollar, million)

					Debt Payme	ent Projection								Overa	II Debt				Т	ANESCO Del	ot	
			Out Flow (US\$	6, million)			In Flow (	US\$, million	)		Net Cash		Accumulate	Loan		Dobt	Interest	Appulal	Annual	Tanesco	PV Of	PV Of
,	Year	Project Cost for	Loa	an	Total Out	Electric Power		Finance		Total	(USD,	Yea	d Loan	Principal	Year	halance	navment	Debt	Debt to	Debt	TANESC	Debt to
		PSMP Electric	Repayment	Interest	Flow	Revenue	Equity	Debt	Total	Inflow	million)		d Loan	Payment		Dalarice	payment	Debt	GDP	Balance	O Debt	GDP
1	2016	1,066	0	7	1,073	922	45	106	151	1,073	0		1 106		2016	106	7	53	0.11%	53	50	0.11%
2	2017	2,310	0	71	2,381	1,076	392	914	1,306	2,381	0		2 1,020		2017	1,020	71	457	0.89%	510	463	0.90%
3	2018	4,051	0	219	4,270	1,254	905	2,111	3,016	4,270	0		3 3,131		2018	3,131	219	1,056	1.92%	1,566	1,352	2.46%
4	2019	5,379	11	433	5,822	1,443	1,314	3,066	4,379	5,822	0		4 6,197	11	2019	6,186	433	1,533	2.60%	3,093	2,545	4.32%
5	2020	5,002	102	568	5,671	2,791	864	2,016	2,880	5,671	0		5 8,213	102	2020	8,111	568	1,008	1.60%	4,055	3,178	5.05%
6	2021	2,287	313	553	3,153	3,273	0	0	0	3,273	119		6 8,213	313	2021	7,900	553	0	0.00%	3,950	2,947	4.37%
7	2022	3,374	620	585	4,578	3,494	325	759	1,084	4,578	0		7 8,972	620	2022	8,352	585	379	0.53%	4,176	2,968	4.12%
8	2023	3,408	821	625	4,855	3,736	336	784	1,120	4,855	0		8 9,756	821	2023	8,934	625	392	0.51%	4,467	3,024	3.92%
9	2024	3,508	821	674	5,003	4,006	299	698	997	5,003	0		9 10,454	821	2024	9,632	674	349	0.42%	4,816	3,105	3.76%
10	2025	4,059	897	737	5,693	4,296	419	978	1,397	5,693	0	1	0 11,432	897	2025	10,535	737	489	0.55%	5,267	3,234	3.66%
11	2026	3,529	976	765	5,270	4,598	201	470	672	5,270	0	1	1 11,902	976	2026	10,926	765	235	0.25%	5,463	3,194	3.41%
12	2027	4,571	1,045	835	6,451	4,927	457	1,067	1,524	6,451	0	1	2 12,969	1,045	2027	11,923	835	533	0.54%	5,962	3,320	3.35%
13	2028	5,044	1,143	917	7,104	5,281	547	1,276	1,823	7,104	0	1	3 14,244	1,143	2028	13,101	917	638	0.61%	6,551	3,474	3.30%
14	2029	5,283	1,180	1,002	7,465	5,673	538	1,255	1,793	7,465	0	1	4 15,499	1,180	2029	14,320	1,002	627	0.56%	7,160	3,616	3.24%
15	2030	6,159	1,205	1,117	8,481	6,102	714	1,665	2,379	8,481	0	1	5 17,165	1,205	2030	15,959	1,117	833	0.70%	7,980	3,838	3.25%
16	2031	5,523	1,213	1,183	7,919	6,572	404	943	1,347	7,919	0	1	6 18,107	1,213	2031	16,894	1,183	471	0.38%	8,447	3,870	3.09%
17	2032	5,706	1,243	1,212	8,162	7,514	194	453	647	8,162	0	1	7 18,560	1,243	2032	17,317	1,212	226	0.17%	8,659	3,778	2.84%
18	2033	6,203	1,515	1,234	8,952	8,112	252	588	840	8,952	0	1	8 19,149	1,515	2033	17,634	1,234	294	0.21%	8,817	3,664	2.60%
19	2034	6,128	1,811	1,234	9,172	8,765	122	285	408	9,172	0	1	9 19,434	1,811	2034	17,623	1,234	143	0.10%	8,812	3,487	2.34%
20	2035	6,995	1,780	1,263	10,039	9,477	168	393	561	10,039	0	2	0 19,827	1,780	2035	18,047	1,263	196	0.12%	9,023	3,401	2.15%
21	2036	6,322	1,836	1,259	9,418	10,202	0	0	0	10,202	784	2	1 19,827	1,836	2036	17,990	1,259	0	0.00%	8,995	3,229	1.94%
22	2037	6,485	1,874	1,257	9,615	10,990	0	0	0	10,990	1,375	2	2 19,827	1,874	2037	17,953	1,257	0	0.00%	8,977	3,069	1.76%
23	2038	6,989	1,885	1,256	10,130	11,847	0	0	0	11,847	1,717	2	3 19,827	1,885	2038	17,942	1,256	0	0.00%	8,971	2,921	1.60%
24	2039	7,921	1,936	1,252	11,109	12,777	0	0	0	12,777	1,667	2	4 19,827	1,936	2039	17,891	1,252	0	0.00%	8,946	2,774	1.44%
25	2040	7,965	1,876	1,257	11,098	13,785	0	0	0	13,785	2,687	2	5 19,827	1,876	2040	17,951	1,257	0	0.00%	8,975	2,650	1.31%
# **CHAPTER SEVEN**

### 7 CONCLUSION AND RECOMMENDATIONS

## 7.1 Conclusion

Discovery of new natural resources such as deep water natural gas in the southern part of Tanzania, development of coal mines (Mchuchuma, Ngaka, Kiwira and Rukwa) and uranium mining (Mkuju – Ruvuma); and acceleration of industrial activities are changing the structure of Tanzania's economy. All these pose pressure on the electricity demand in the country. Despite the endowment of enormous resources for power generation, critical challenges exist including mobilization of adequate financial resources to implement the proposed power projects and inadequate requisite human resources, skills and knowledge for developing power resources.

Other general challenge, especially in the preparations of this Plan, is related to data issue. Some data and information were found to be inconsistent, outdated and insufficient. Some of the identified projects have not been studied to feasibility level while others have outdated feasibility study reports, thus render it difficult to make meaningful decision on the project implementation. Furthermore, most generation resources are located in the south-west and south-east part of the country while huge loads are located in the north-west and north-east of the country. This implies the need for long transmission lines to deliver power from sources to load centers.

The system expansion plan considered all energy resources available within the country which includes hydro, natural gas, coal, solar, wind and geothermal as well as the import of electric power from neighboring countries to ensure adequate, reliable power and security of supply over the planning horizon.

The development of generation expansion plans covered the six scenarios following the three cases of load forecast, namely, high, base and low. The PSMP2016 Update sought the optimal generation expansion plan using the least cost generation planning software named WASP. LOLP (Loss Of Load Probability) was used as a criteria for power supply reliability, the same as previous PSMP which is 5days/year. Hydro-thermal share was not fixed even though it was targeted to be 40:60 in PSMP2012. In the six generation expansion scenarios, different shares of several power resources such as natural gas, coal, hydro and renewable energy were set and each scenario was evaluated from the aspects of economy, energy balance and environment. As a result, Scenario-2 which has the energy generation mix of 40% gas, 35% coal, 20% hydro and 5% renewable and others was selected to be the best among six scenarios.

The optimal generation plan (scenario-2) has a total installed generation capacity of 5,011MW (excluding renewable and import) by 2020 which is beyond the government target of 4,915MW by 2020. It will increase up to 22,595MW by 2040 consisting of 5,093MW hydro, 10,253MW gas-fired generation, 6,000MW Coal, 850MW renewable and 400MW import.

This Plan suggests countermeasures to satisfy rapidly increasing power demand in the short, medium and long term including the integration of isolated grids and un-electrified areas into the national grid. While the short-term plan requires immediate decision and actions, the mid-long term plans require coordinated planning and project development studies to ensure that future electricity supply utilizes the least cost projects in consistent with sound planning criteria in order to address national interests. It should be noted that associated transmission infrastructure should be constructed in a timely manner in order to evacuate power from the sources to end users.

In view of the above, the country will need a total of US\$11.6 billion in the short term (2016-20), US\$5.9 billion in the mid-term (2021-2025) and US\$31.7 billion in the long term (2026-2040). The cost includes investment on generation, transmission and substation. Generation accounts for almost 80% of total investment cost. The following table shows the summary of investment costs.

Cost of	Five-year investment cost (million USD)					Total
	2016-2020	2021-2025	2025-2030	2031-2035	2036-2040	iotai
Generation	6,671	4,660	9,459	10,325	7,883	38,998
Transmission Lines	3,717	814	714	1,197	152	6,593
Substation	1,207	465	417	422	1,126	3,637
Total	11,595	5,939	10,590	11,945	9,160	49,229
% of Each Period	24%	12%	22%	24%	19%	100%

Table 7-1: Summary of investment costs

# 7.2 Recommendations

# 7.2.1 General Recommendations

The following are recommendations for successful implementation of the PSMP2016 updates.

- For a sustainable development of power sector, there is a need to firm up project implementation schedule as proposed by PSMP 2016 Update particularly those which have element of PPP and IPP arrangements;
- b) There is a need to ensure that strategic power projects are studied to full feasibility level to reduce project implementation lead time and to properly evaluate the viability of the projects in order to make the least cost plan;
- c) To speed up geothermal power development, there is a need to enhance capacity of Tanzania Geothermal Development Corporation (TGDC) to carry out detailed surveys and studies for geothermal resources;
- d) For the Gas-fired power that intends to contribute 40% in total energy generation, investment on gas wells development together with processing and transportation facilities is inevitable to satisfy projected high demand of gas for power generation.

Following power demand projections, not later than the year 2018 new gas processing facilities are needed in addition to the current processing capacity of 465mmscfd. In the same course, not later than the year 2030 new gas processing and transportation facilities are needed to meet the increased gas demand for power generation. The recommendations above are made based on the assumption that 85% of total gas transported is allocated to power generation up to 2025 and 70% after 2025.

- e) There is a need to promote the development of renewable power projects (Wind, geothermal, Solar, and Biomass) to supplement exhaustible resources;
- f) Most of the projects proposed under PSMP 2012 Update have not been completed or commenced as of December 2016. This delay is attributed to (i) the lack of sufficient financing, (ii) the lack of legal binding to implement a proposed project under a private sector, (iii) long approval process and (iv) environmental and social issues which require consent from various stakeholders. These challenges need to be addressed by the measures recommended in this chapter. Particularly, this document should be used as one of working tools during the preparation of annual budgets.
- g) To ensure effective implementation of PSMP2016 Update, the Government may need to establish a monitoring and evaluation unit which is dedicated to accelerate the planned projects. The unit should be consisted of inter-ministerial members so that all stakeholders of power development are deeply involved in the project implementation; and
- h) Capacity building: In order to internalize and broaden up experts of formulating plan of this nature and improve local expertise, the government needs to maintain and retain the core team that will be responsible for the preparation of future Plan. More capacity is required to enhance the process of formulating, reviewing and updating PSMP. This will include training of the core team, procuring of the modelling packages and sharing leaf of experience with institutions involved in related to similar planning works.

### 7.2.2 Specific Recommendations

#### A. Generation

i. Huge investment will be required to implement planned generation expansion, particularly, for the period 2016 - 2020 in order to achieve government target. In order to relieve financial burden to the government on power development, private participation in generation sector should be accelerated. For this purpose, it is recommended to study the experiences of other countries which have successfully introduced IPPs to extract meaningful lessons. However, pros and cons of introducing private sectors in power generation should be carefully examined based on such lessons. The following table shows the examples of incentives for IPPs introduced in Asian countries to accelerate private participation in generation sector. Government guarantee and ensuring payment to purchased power seemed to be key elements to

relieve risks from investors.

	Philippines	Thailand	Indonesia
Fuel supply	National Power Corporation (NPC) guarantees free fuel supply to IPPs (in case of coal)	Petroleum Authority of Thailand provides fuel supply guarantee for gas firing IPPs	N/A
Power Purchase	NPC guarantees to purchase certain amount of electricity from IPPS or pay the amount for which NPC cannot purchase	Electricity Generating Authority of Thailand (EGAT) guarantees to purchase certain amount of electricity from IPPs	PLN (state owned electric utility) guarantees to purchase certain amount of electricity from IPPs
Policy change	The government guarantees to buy back IPP power plants if policy changes obstruct project implementation	EGAT guarantees to buy back IPP power plants if policy changes obstruct project implementation	The government guarantees to buy back IPP power plants if policy changes obstruct project implementation
Tax exemption	Income tax (6years for coal and geo-thermal), customs, VAT	Income tax, customs (depend on location)	Customs, grace period for VAT and sales tax

- ii. In order to avoid power shortages, projects earmarked for implementation in the short term (2016 2020) should be strictly adhered to as there is no room to maneuver.
- iii. Two hydro projects will require removal of significant obstacles before becoming firm candidates for implementation:
  - a) Songwe project is a multipurpose project located on the border between Tanzania and Malawi, its development will involve trade-offs between two countries and various competing uses of the water resource. It is necessary to expedite joint discussions on the best way to develop the project.
  - b) **The Stiegler's Gorge** is located within the Selous Game Reserve; its development is constrained by the Algiers Conventions which defines the developments possibilities within national parks and game reserves. It is therefore important to redefine the game reserve borders and to introduce any other possible mitigation measures.

#### B. Transmission and distribution requirements

- i. Continue implementation of earmarked Transmission lines projects in parallel with generation projects to ensure power evacuation. Wayleave compensation should be taken into consideration in budgeting the construction for transmission lines.
- ii. Reinforce distribution network to meet electrification targets and to accommodate increased power supply.

### C. Financial and Economic Perspective

- i. Implementation of projects planned under PSMP2016 Update requires huge financial resources. Concerted efforts to be exercised in mobilizing required financing for both power generation, transmission and distribution;
- ii. The Government should continue with efforts to invest in power infrastructure to meet long term power demand and at the same time create conducive environment to attract private investment in the power sector.







Load Flow for the Tanzanian interconnected power system - Year 2025 during peak load conditions







