

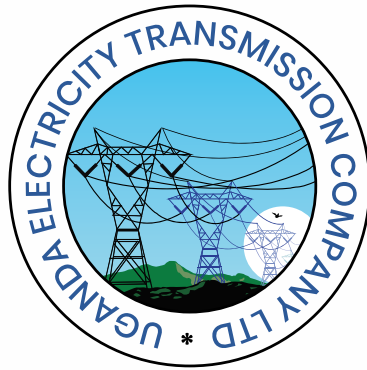
# UETCL

*Transmitting for Transformation*



# GRID DEVELOPMENT PLAN 2025 - 2040





**UETCL**

*Transmitting for Transformation*

# GRID

## DEVELOPMENT PLAN

### 2025 – 2040





**HON. DR. CANON RUTH NANKABIRWA SSENTAMU**  
**MINISTER OF ENERGY & MINERAL DEVELOPMENT**

## FOREWORD BY THE MINISTER OF ENERGY AND MINERAL DEVELOPMENT



The role of Government is to formulate sound policies, legal, institutional and investment frameworks that attract adequate financing to reinforce Uganda's energy security and ensure reliable, affordable and sustainable energy for social and economic transformation.

The Grid Development Plan (2025–2040) builds upon the achievements of the earlier Grid Development Plan (2018–2040), with renewed emphasis on supporting the targets of the National Development Plan IV, the Tenfold Growth Strategy, the Energy Policy (2023) and Vision 2040. It provides a clear roadmap for the investments required in generation evacuation, transmission, and transformation capacity as Uganda advances towards high middle-income status.

This Plan also supports Government's broader development agenda by identifying the energy infrastructure needed to power strategic projects such as the Kabalega Industrial Park, which will facilitate the delivery of first oil in 2026 and the electrification of the Standard Gauge Railway from Malaba to Kampala. These initiatives will significantly reduce the cost of transporting goods and people between Uganda and Kenya, thereby enhancing regional trade and competitiveness.

In consultation with the Uganda Investment Authority, the Plan also anticipates industrial expansion by providing for adequate transformation capacity to supply planned industrial park substations, key enablers of Uganda's industrial growth and job creation.

I take pride in the fact that this document was developed through close collaboration among all power sector institutions and stakeholders, with the Uganda Electricity Transmission Company Limited (UETCL) providing technical leadership.

In conclusion, I wish to express my sincere appreciation to His Excellency Yoweri Kaguta Museveni, President of the Republic of Uganda, for his unwavering commitment to prioritising energy development as a cornerstone of Uganda's socio-economic transformation.

**Hon. Dr. Canon Ruth Nankabirwa Ssentamu**  
**MINISTER OF ENERGY & MINERAL DEVELOPMENT**

## THE CHAIRPERSON OF THE UETCL BOARD OF DIRECTORS



It is my pleasure to present the Grid Development Plan (GDP) 2025–2040, a strategic roadmap document to guide the development and expansion of Uganda’s electricity transmission network.

The national transmission grid plays a critical role in ensuring the reliable delivery of bulk power from generation sources to power supply distributors and the large power consumers nationwide. As Uganda advances its agenda for industrialisation, regional integration and sustainable economic growth, the continued expansion and modernisation of the transmission system remain a national priority.

The Board of Directors of Uganda Electricity Transmission Company Limited (UETCL) remains committed to providing strategic oversight and sound governance in line with the UETCL mandate of bulk power supply, operation of high voltage grid, power system


operator, import and export of power, and public infrastructure provision.

Furthermore, the Board of Directors undertakes to ensure that the Company’s transmission infrastructure is planned and implemented in a prudent, efficient, and sustainable manner.

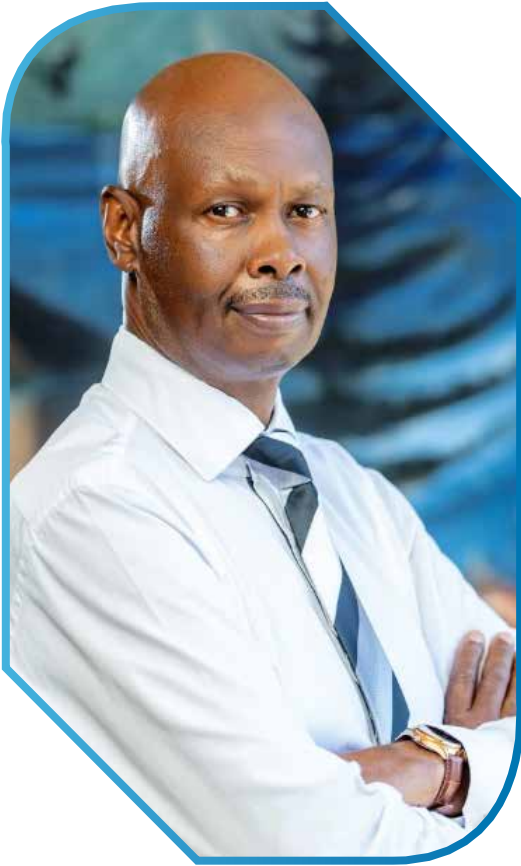
The Board also recognises that long-term planning is essential to ensure that the transmission network is aligned with national development priorities and emerging opportunities within the regional power market. Through strong governance and close collaboration with sector stakeholders, UETCL shall continue to play its pivotal role in delivering a resilient and future-ready transmission system.

This Grid Development Plan outlines a clear framework for identifying priority investments for system expansion, strengthening grid reliability, fostering regional power trade, meeting power evacuation needs, and the growing demand.

On behalf of the Board of Directors, I commend the UETCL Management team, UETCL staff, Electricity Supply Industry players, and the development partners, whose collective efforts have contributed to the preparation of the GDP 2025–2040.

  
**Kwame Ejalu Ejuku**  
**CHAIRMAN, BOARD OF DIRECTORS**

## FOREWORD BY THE CHIEF EXECUTIVE OFFICER, UETCL



The 2025 – 2040 edition of the Grid Development Plan provides a 15-year outlook of the Uganda transmission system with 2023/2024 serving as the base year.



I am pleased to introduce to you the latest edition of the Grid Development Plan (GDP) 2025 – 2040. The GDP is a strategic document in the Uganda Electricity Transmission Company Limited (UETCL's) overall planning, and is in line with the Corporate Strategy Plan, Energy Sector objectives, National Development Plan and Vision 2040. It details future grid requirements in terms of projects and investment costs to meet the national load growth, generation developments and regional interconnection requirements.

The 2025 – 2040 edition of the Grid Development Plan provides a 15-year outlook of the Uganda transmission system with 2023/2024 serving as the base year.

The Electricity Sector is one of the major enablers of economic transformation and with this in mind, the GDP will aid UETCL and the sector at large to make the right investments for the grid to enable sustainable economic growth. The GDP is therefore a necessary guide to Government of Uganda on the required investments for the transmission grid and will aid resource planning. This document provides sufficient guidance in determining power transmission grid investments to be prioritized and the necessary prerequisites for investment.

Finally, I would like to thank and appreciate the efforts of all our stakeholders who have made invaluable contributions towards the development of this document. Your contribution is much appreciated.

**Eng. Richard Matsiko**  
CHIEF EXECUTIVE OFFICER

## PREFACE

The purpose of the Grid Development Plan (GDP) is to inform stakeholders about the anticipated developments in Uganda's electricity transmission network, as proposed by Uganda Electricity Transmission Company Limited (UETCL), the National Transmission Company.

UETCL is a public limited company wholly owned by the Government of Uganda, represented by Minister of Energy and Mineral Development (majority shareholder) and the Minister of Finance, Planning and Economic Development.

### UETCL Vision is:

To be Eastern Africa's Leading Electricity Transmission Company

### UETCL Mission is:

To Buy, Transmit and Sell Reliable and Quality Bulk Power for Sustainable Regional Development.

### UETCL's Mandate

UETCL is a power transmission company which is licensed to operate and maintain the high voltage power transmission grid. It is also responsible for grid planning and development. As such, UETCL has the following licenses:

- Bulk Power Supply
- Operation of High Voltage Transmission Grid
- System Operator
- Power Export and Import; and
- Public Infrastructure Provider for owning and operating the optic fibre infrastructure

Prior to the Electricity Amendment Act 2022, UETCL was the designated single buyer of bulk power in Uganda. However, the space has now been opened and allowed for direct purchase by big customers from either transmission or generation companies, and it has also opened the transmission space to include Independent Power Transmitters (IPTs).

The roles of UETCL following these changes have been defined in the big consumers and IPT Regulations that have been published by the Electricity Regulatory Authority.

The 2024- 2040 edition of the Grid Development Plan provides an outlook of the Uganda transmission system for the next 15 years. The GDP presents the demand forecast, generation expansion plan, Demand – Supply Balance for the current and subsequent years, power system analysis results, the Grid Investment Requirements and Grid Investment plan.

This edition also presents an outlook of four scenarios showing the assumptions, planned implementation strategy and associated recommendations:

- The base case scenario looks at the Business-As-Usual model.
- The National Development Plan IV (FY2025/26 – FY2029/30) scenario under the theme "Sustainable Industrialization for inclusive growth, employment and wealth creation" that aims at strengthening Uganda's competitiveness through sustainable industrialization for

inclusive growth, employment and wealth creation, with set targets to be implemented within 5 years.

- The Ten-Fold Growth scenario that assumes a ten-fold growth of existing installed generation capacity from 2,050MW to 22GW by 2040.
- Uganda's Vision 2040 scenario that aims at transforming Ugandan Society from a Peasant to a Modern and Prosperous Country within 30 years.

In addition, the Energy Policy 2023 was launched by the Ministry of Energy and Mineral Development of Uganda.

This edition of the GDP will serve as the planning document for the financial years FY2024/2025 –FY2039/2040 with the year FY2023/2024 acting as the base year.

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## ABBREVIATIONS AND ACRONYMS

<b>AAAC</b>	All Aluminium Alloy Conductor
<b>ACSR</b>	Aluminium Conductor Steel Reinforced
<b>AFD</b>	French Development Bank
<b>AfDB</b>	African Development Bank
<b>BAU</b>	Business-As-Usual
<b>CSP</b>	Corporate Strategy Plan
<b>CAA</b>	Civil Aviation Authority
<b>CGV</b>	Chief Government Valuer
<b>CPI</b>	Consumer Price Index
<b>EAPP</b>	East African Power Pool
<b>EPC</b>	Engineering Procurement and Construction
<b>ERA</b>	Electricity Regulatory Authority
<b>ESIA</b>	Environmental and Social Impact Assessment
<b>EXIM</b>	Export and Import
<b>FS</b>	Feasibility Study
<b>GDP</b>	Grid Development Plan
<b>GIP</b>	Grid Investment Plan
<b>GIS</b>	Geographical Information System
<b>GoU</b>	Government of Uganda
<b>GWh</b>	Giga Watt Hour
<b>HFO</b>	Heavy Fuel Oil
<b>HPP</b>	Hydro Power Plant
<b>HVTG</b>	High Voltage Transmission Grid
<b>Hz</b>	Hertz
<b>IPP</b>	Independent Power Producer
<b>IPT</b>	Independent Power Transmitter
<b>JICA</b>	Japan International Cooperation Agency
<b>kA</b>	Kilo Amperes
<b>KCCL</b>	Kasese Cobalt Company Limited
<b>KFW</b>	German Development Bank
<b>km</b>	Kilo meter
<b>KML</b>	Kilembe Mines Limited
<b>kV</b>	Kilo Volt (1kV=1000 Volts)
<b>kW</b>	Kilo Watt (1kW=1000 Watts)

<b>kWh</b>	Kilo Watt Hour
<b>MEMD</b>	Ministry of Energy and Mineral Development
<b>MoFPED</b>	Ministry of Finance, Planning and Economic Development
<b>MoWT</b>	Ministry of Works and Transport
<b>MVA</b>	Mega volt Ampere
<b>MVA<sub>r</sub></b>	Mega Volt Ampere- reactive
<b>MW</b>	Mega Watt
<b>NBI</b>	Nile Basin Initiative
<b>NDP</b>	National Development Plan
<b>NELSAP</b>	Nile Equatorial Lakes Subsidiary Action Programme
<b>NEMA</b>	National Environment Management Authority
<b>NFA</b>	National Forestry Authority
<b>PAU</b>	Petroleum Authority Uganda
<b>PPA</b>	Power Purchase Agreement
<b>PPDA</b>	Public Procurement and Disposal of Public Assets Authority
<b>PSA</b>	Power Sales Agreement
<b>PSIP</b>	Public Sector Investments Plan
<b>PSS/E</b>	Power System Simulation for Engineers
<b>RAP</b>	Resettlement Action Plan
<b>REP</b>	Rural Electrification Programme
<b>SCADA</b>	Supervisory, Control, and Data Acquisition
<b>SVC</b>	Static Var Compensator
<b>Tn</b>	Trillion
<b>TSO</b>	Transmission System Operator
<b>UBOS</b>	Uganda Bureau of Statistics
<b>UETCL</b>	Uganda Electricity Transmission Company Limited
<b>UNOC</b>	Uganda National Oil Company
<b>USD</b>	United States Dollar
<b>Ushs</b>	Uganda Shillings
<b>UWA</b>	Uganda Wildlife Authority
<b>Var</b>	Volt Ampere Reactive
<b>WA</b>	Wheeling Agreements

## EXECUTIVE SUMMARY

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Uganda Electricity Transmission Company Limited (UETCL) has a leading role in developing, operating and maintaining an efficient High Voltage Transmission Grid (HVTG) to evacuate generation plants, meet national demand and regional power exchange requirement through regional interconnections within the national and international technical, social-economic and environmental standards.

A key responsibility in this respect, is to constantly plan and develop the HVTG. The purpose is to establish a rationale for building a robust network, improve reliability and quality of supply, which will in turn contribute towards the economic development of Uganda.

In line with company strategic objectives, the Grid Development Plan (GDP) is a strategic and tactical document in UETCL's overall planning process and is communicated to all major stakeholders. The plan identifies new proposed grid investments. It is reviewed and updated to reflect latest information on Government policy and strategies. It is also an input to the company's financial projections and annual budget.

The GDP presents results of preliminary technical analyses for various investments to meet the national demand and power exchange obligations. The technical analysis derived from power system studies form a basis for determining technical pre-feasibility of the proposed projects.

The results from the technical analysis are used to determine the Grid Investment plan and the associated cost estimates which culminate into financial projections. The Feasibility, Environmental and Social Impact Assessment are carried out before implementation of each individual project to confirm viability and project specific aspects.

The results from the above analyses indicate high capital investment requirements during the period of 2025/26-2029/30. This is mainly attributed to many generation plants that are to be commissioned during this period and the corresponding power evacuation transmission lines and Substations. To absorb the new generation capacity, several grid and substations extensions and reinforcements are to be implemented in the same period.

## BACKGROUND

UETCL has a major role in contributing to the development of an efficient electricity sub sector in Uganda through planning, developing and maintaining an efficient transmission grid to meet the national electric power requirements within the allowable national, regional and international standards.

UETCL owns, operates, develops and maintains the high voltage transmission grid. The grid connects power generation plants to load centres throughout the country as well as interconnecting with neighbouring countries. UETCL also owns a National Control Centre which coordinates and monitors grid operations and maintenance activities.

At present, the transmission grid comprises circuit length of 606km for 400kV overhead line, 1,002km for 220kV overhead line, 3,773.32km for 132kV overhead line, 1.14km for 132kV underground cable line & 35.2km for 66kV overhead line and 43 substations and switching stations (including Isimba & Nalubaale switching stations and as well as the Mobile substation at Mbale Industrial Park).

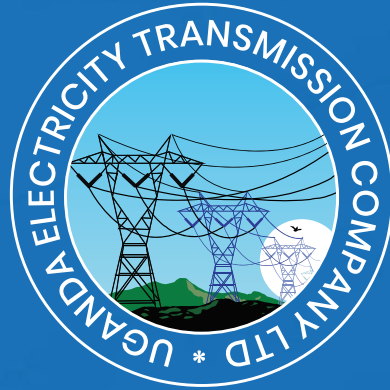
With reference from the previous GDP 2018–2040 in the period from 2018–2024, a total of 3,888.96 km of transmission line length was achieved, representing 62.44% of the target 6,228.6 km. 28 substations were commissioned out of the planned 55, while 5,096MVA of transformation capacity was achieved, accounting for 36.45% of the target 13,979 MVA.

The GDP is a planning document that is written in line with the Corporate Strategic Plan, Energy Sector objectives, National Development Plan and Vision 2040. It details present and future transmission grid infrastructure that will support National demand growth, generation requirements and regional power trade obligations.

The GDP is reviewed to cater for power evacuation, grid reinforcement, grid expansion and regional interconnection projects in line with government programs such as National Development Plan, Tenfold, Vision 2040, and Energy Policy, among others.

The updated GDP has the following deliverables: Demand and Supply Balance, Power System Improvement Recommendations, the Grid Investment Plan, Financial and Economic analysis projections; Project Implementation Schedule, Monitoring & Evaluation and Risk & Opportunities Analysis.

The 2025 – 2040 edition of GDP is UETCL's planning reference guide for the years 2024/2025 - 2039/2040 with the year 2023/2024 serving as the base year.



# **REVIEW OF THE PREVIOUS GDP 2018–2040**

## 1. REVIEW OF THE PREVIOUS GDP 2018–2040

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The previous Grid Development Plan was drawn and envisaged to be implemented over the planning horizon 2018–2040 with the year 2017 serving as the base year. This chapter highlights an analysis of assumptions versus actual out-turn, the achievements that were realized, the challenges that were faced while implementing the plan and their mitigation measures. The assessments were done under the following categories.

- Demand Prognosis
- Generation expansion plan
- Transmission expansion plan

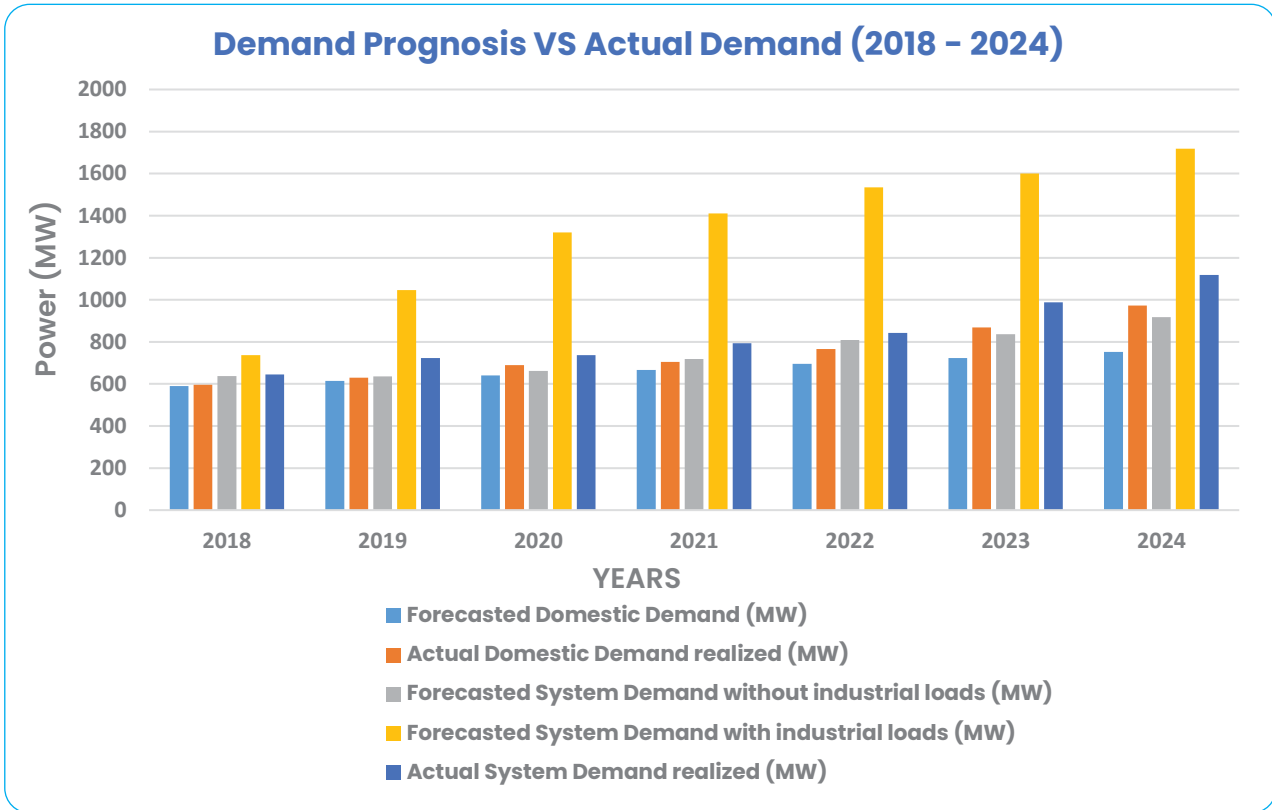
### 1.1. DEMAND PROGNOSIS 2018–2024 Table 1 and Figure 1 here under show the demand prognosis 2018–2024 Vs actual observed.

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**Table 1: Demand prognosis 2018–2024 (Forecasted Vs Actual)**

Year	Forecasted Domestic Demand (MW)	Actual Domestic Demand realized (MW)	Variance in Domestic Demand (MW/%)	Forecasted System demand with industrial load (MW)	Forecasted System demand without industrial load (MW)	Actual System demand realized (MW)	Variance in System demand with industrial load (MW/%)	Variance in System demand without industrial load (MW/%)
2018	590	596.2	+6.2 (1.05%)	737	637	645.4	-91.6 (-12.43%)	+8.4 (1.32%)
2019	615	629.5	+14.5 (2.36%)	1046	636	723.8	-322.2 (-30.80%)	+87.8 (13.81%)
2020	641	689.0	+48 (7.49%)	1320	662	736.7	-583.3 (-44.19%)	+74.7 (11.28%)
2021	667	705.0	+38 (5.70%)	1410	718	794.0	-616 (-43.69%)	+76 (10.58%)
2022	695	766.6	+71.6 (10.30%)	1535	809	843.0	-692 (-45.08%)	+34 (4.03%)
2023	723	867.9	+144.9 (20.04%)	1600	837	987.8	-612.2 (-38.26%)	+150.8 (18.02%)
2024	753	973.0	+220 (29.22%)	1718	917	1,117.9	-600.1 (-34.93%)	+200.9 (21.91%)

**Figure 1: Demand prognosis 2018–2024 Vs actual observed**



**Observations and deductions**

- In all cases, the realized domestic demand exceeds the forecasted domestic demand, primarily because it also includes industrial loads. The variance between the demand values lies within the acceptable tolerance band of +/-10% for only 2018–2021. Beyond this, it ranges from 10.30% (in 2022) to 29.22% (in 2024).
- Similarly, the realized system demand exceeds the forecasted demand (without industrial loads) for all cases.
- The forecast demand (inclusive of industrial loads) and realized system demand did not grow as envisaged largely due to the limited realization of planned industrial loads. As a result, the variance between the forecasted and actual demand largely mirrored historical growth patterns observed in system demand.
- The variance in system demand from 2019 is significantly higher because of the increased import requirements by Kenya.

## 1.2.1. ACHIEVEMENTS (2018–2024) FOR THE BUSINESS-AS-USUAL SCENARIO

### 1.2.1.1. ACHIEVEMENTS (2018–2024) – GENERATION EXPANSION PLAN

The planned generation expansion and the actualized added generation, for the period 2018 to 2024 are presented in Table 2 and Table 3 respectively here under.

**Table 2: Planned Additional Plants between 2018–2024**

Year	Power Plant	Installed Capacity (MW)
<b>2018</b>	Isimba HPP	183
	Sindila HPP	5.25
	Siti II HPP	16.5
	Mahoma HPP	2.7
	Nkusi HPP	9
	Nyamwamba HPP I	9.2
	Mayuge Solar	10
	Agago-Achwa HPP II (ARPE)	42
	Karuma HPP	600
<b>2019</b>	Nyabuhuka Mujunju HPP	3.2
	Kyambura HPP	7.6
	Kakaka HPP	5
	Nyamagasani 1 HPP	15
	Nyamagasani 2 HPP	5
	Nyamabuye	7
	Xsabo Solar	20
	Waki HPP	4.8
	Nyagak III HPP	5.5
	Ndugutu HPP	5.1
	Kanyampara	4.8
<b>2020</b>	Mayuge Sugar Plant	23
	Kikagati HPP	14 (7)
	Bukinda HPP	6.5
	Senok Wind	20
	SCOUL	25
	Nengo Bridge HPP	6.7
	Agago-Achwa HPP I (ARPE)	41
<b>2021</b>	Sironko HPP	7
	Kabeywa HPP	12
	Bukwa HPP	9
	Keere Small HPP	6.3

Year	Power Plant	Installed Capacity (MW)
2021	Kinyara Cogen Plant	35
	Ngoromwo HPP	8
	Maziba	1
	Cresta	5
	Nshongezi HPP	35 (17.5)
	Nyagak 1	3.5
	Albatros Thermal plant	50
	Gas to power (Tilenga and King fisher)	58
	Jinke solar	500
	CP-EM Solar	1000
	Sky Power Solar	500
	Muyembe Sirimityo HPP	7
2022	Muzizi	44.7
	Agago-Achwa III (ARPE)	13
	Agago-Achwa IV (ARPE)	10.5
	Sisi	7.1
	Simu	9.9
	Kigwabya	4.2
2024	Lwakhaka	6
	Agbinika	2
	Okulacere	6.5
<b>Total</b>	<b>52 Plants</b>	<b>3,413.05</b>

**Table 3: Actual Generation plants added 2018–2024**

Year	Power Plant	Installed Capacity (MW)
2018	Lubilia	5.4
	Nyamwamba 1	9.2
	Nkusi	9.6
	Mahoma	2.7
	Waki	4.8
	Isimba	183
	Xsabo solar	20
2019	Bufulubi solar	10
	Sindila	5.25
	Kyambura	7.6
	Siti 2	16.5
	Ndugutu	5.9
	Agago/Achwa 2	41
2020	Bukinda	6.5
	Tororo PV	10
2021	SCOUL	25
	Achwa 1	42
	Nyamagasani 1	15
	Nyamagasani 2	6.1
	Kakaka	4.5
	Kikagati	14
2022	Nyamwamba 2	7.8
2023	Karuma	600
	SM Hydro	6.9
	Kinyara Sugar Works	5
	Mayuge Sugar	32.2
	Busitema	4
2024	Nyagak III	3.5
	Victoria Sugar	26
TOTAL	29 Plants Added	1,129.45MW

**Note:** 29 Power plants (1129.45 MW) were commissioned with in the period of 2018–2024, against the target of 52 power plants (3,413.05) as per GDP 2018–2040.

Table 4 below presents the plants that were planned to be commissioned within the period 2018–2024 as per GDP 2018–2040 but were not achieved.

**Table 4: Un-achieved generation plants in the period 2018–2024**

No	Power Plant	Installed Capacity (MW)
1	Nyabuhuka Mujunju HPP	3.2
2	Nyamabuye	7
3	Kanyampara	4.8
4	Senok Wind	20
5	Nengo Bridge HPP	6.7
6	Sironko HPP	7
7	Kabeywa HPP	12
8	Bukwa HPP	9
9	Keere Small HPP	6.3
10	Ngoromwo HPP	8
11	Maziba	1
12	Cresta	5
13	Nshongezi HPP	35 (17.5)
14	Nyagak 1	3.5
15	Albatros Thermal plant	50
16	Gas to power (Tilenga and King fisher)	58
17	Jinke solar	500
18	CP-EM Solar	1000
19	Sky Power Solar	500
20	Muyembe Sirimityo HPP	7
21	Muzizi	44.7
22	Agago-Achwa III (ARPE)	13
23	Agago-Achwa IV (ARPE)	10.5
24	Sisi	7.1
25	Simu	9.9
26	Kigwabya	4.2
27	Lwakhaka	6
28	Agbinika	2
29	Okulacere	6.5
16	Gas to power (Tilenga and King fisher)	58
17	Jinke solar	500
18	CP-EM Solar	1000
19	Sky Power Solar	500
20	Muyembe Sirimityo HPP	7
21	Muzizi	44.7
22	Agago-Achwa III (ARPE)	13
23	Agago-Achwa IV (ARPE)	10.5
24	Sisi	7.1
25	Simu	9.9
26	Kigwabya	4.2
27	Lwakhaka	6
28	Agbinika	2
29	Okulacere	6.5

Table 5 below presents the plants that were commissioned within the period of 2018–2024 but were not included in the generation expansion plan as per the GDP 2018–2040.

**Table 5: Generation plants commissioned between 2018–2024 but were not included in expansion plan as per the GDP 2018–2040**

No	Power Plant	Installed Capacity (MW)
1	Lubilia	5.4
2	Tororo PV	10
3	Nyamwamba 2	7.8
4	SM Hydro	6.9
5	Busitema	4
6	Victoria Sugar	26

### 1.2.1.2. ACHIEVEMENTS (2018–2024) – TRANSMISSION EXPANSION PLAN

#### 1.2.1.2.1. TRANSMISSION LINES

The transmission expansion with respect to the planned transmission lines and the actualized added transmission lines, for the period 2018 to 2024 are presented in Table 6 and Table 7 respectively here under.

**Table 6: Planned Transmission lines between 2018–2024 as per the GDP 2018–2040**

Year	Description for the Planned Transmission lines as per GDP 2018 –2040
<b>2018</b>	<p>Mbarara – Nkenda 132kV 160km line</p> <p>Bujagali – Tororo - UG'KY border 220kV 127km line</p> <p>Mbarara – Mirama - UG'RW border 220kV 66km line</p> <p>Kawanda – Masaka 220kV 137km line</p> <ul style="list-style-type: none"> <li>Fort Portal – Hoima 220kV 170km line</li> </ul> <p>Isimba – Bujagali 132kV 42km line</p> <p>Karuma – Olwiyo 400kV 54.2km line</p> <p>Karuma – Lira 132kV 75.5km line</p> <p>Karuma – Kawanda 400kV 248km line</p> <ul style="list-style-type: none"> <li>T Matuga Kapeka 132kV 45km line</li> </ul>
<b>2019</b>	<ul style="list-style-type: none"> <li>Mutundwe – Entebbe 132kV 23.5km line</li> <li>T-Mukono from Nalubaale - Namanve Transmission Line 132kV 8km line</li> <li>T- Iganga from Bujagali - Tororo Transmission Line 132kV 15km line</li> <li>Namanve - Namanve South 132kV 6km line</li> <li>Kawanda - Kasana 132kV 54km line</li> <li>Opuyo – Moroto 132kV 160km line</li> </ul>

Year	Description for the Planned Transmission lines as per GDP 2018 -2040
<b>2020</b>	<ul style="list-style-type: none"> <li>• Gulu – Agago 132kV 83km line</li> <li>• Lira – Gulu 132kV 90km line</li> <li>• Gulu – Nebbi (Via Olwiyo) 132kV 160km line</li> <li>• Nebbi – Arua 132kV 63km line</li> <li>• Buloba branch point – Buloba Substation 132kV 0.8km line</li> <li>• (New Mukono Substation – Mukono Substation) 132kV 0.3km line</li> <li>• New Mukono branch point – New Mukono Substation 220kV 4.2km line</li> <li>• New Mukono Substation – New Mukono branch point (Southern trunk line) 132kV 0.4km line</li> <li>• Mukono branch point (Northern trunk line) – Kampala North substation 132kV 25.4km line</li> <li>• Kampala North Substation – Mutundwe Substation 132kV 10.2km line</li> <li>• Kawaala branch point – Kawaala Substation 132kV 0.1km line</li> <li>• Buloba branch point – Buloba Substation 220kV 0.9km line</li> <li>• Mirama – Kabale 132kV 85km line</li> </ul>
<b>2021</b>	<ul style="list-style-type: none"> <li>• Masaka - Mbarara 400kV 134km line</li> <li>• Tororo SS – SGR Tororo Traction SS 132kV 11km line</li> <li>• Bujagali – Tororo T/L T-off to SGR Buwoola SS 132kV 64km line</li> <li>• Iganga SS – SGR Iganga Traction SS 132kV 3.5km line</li> <li>• Nalubaale – Lugogo T/L to SGR Nyenga SS 132kV 5km line</li> <li>• Namanve South – SGR Kampala East SS 132kV 3.7km line</li> <li>• Hoima - Kinyara 220kV 45km line</li> <li>• Kinyara – Kafu 220kV 47km line</li> <li>• Kingfisher – Kabale 132kV 50km line</li> <li>• Tilenga – Kabale 132kV 135km line</li> </ul>
<b>2022</b>	<ul style="list-style-type: none"> <li>• Wobulenzi – Kapeka 220kV 37km line</li> <li>• Kapeka - Kiboga - Hoima 220kV 142.9km line</li> <li>• Nakasongola – Kaweweta- Kapeka 132kV 160km line</li> <li>• Mbale – Bulambuli – Kween 132kV 76km line</li> <li>• Mirama – Nsongezi 132kV 37.3km line</li> <li>• Masaka – Mutukula 220kV 92km line</li> <li>• Bujagali – Tororo T off to Jinja 132kV 5km line</li> <li>• Mbarara Nkenda Toff to Ishaka 132kV 10km line</li> <li>• Masaka Kyaka Toff to Rakai 132kV 10km line</li> <li>• Nkonge – Mubende 132kV 30km line</li> <li>• Nkenda – Mpondwe 220kV 72.5km line</li> </ul>
<b>2023</b>	<ul style="list-style-type: none"> <li>• Oriang interconnection 400kV 10km line</li> <li>• Ayago interconnection 400kV 12km line</li> </ul>

**Table 7: Actual Added Transmission lines in the period 2018–2024**

Year	Description for the Added Transmission line in the period 2018 –2024
2018	<ul style="list-style-type: none"> <li>• Mbarara – Mirama - UG’RW border 220kV 66km line</li> <li>• Kawanda – Masaka 220kV 137km line and 132kV 300m Underground cable at Masaka West substation</li> <li>• Isimba – Bujagali 132kV 42km evacuation line</li> <li>• Nkenda – FortPortal – Hoima 220kV 226km line</li> <li>• 132kV 300m Underground cable at Masaka West substation</li> </ul>
2019	<ul style="list-style-type: none"> <li>• Mbarara – Nkenda 132kV 160km line</li> <li>• T-Mukono from Nalubaale - Namanve Transmission Line to create 1LILLO of 132kV 4.2km to Mukono substation</li> <li>• T- Iganga from Bujagali - Tororo to create 2LILLOs of 132kV 9.7km to Iganga substations</li> <li>• Kawanda – Kapeeka 132kV 52km single circuit line</li> </ul>
2020	<ul style="list-style-type: none"> <li>• Mbale-Opuyo-Lira 132kV 222.7km double circuit line</li> </ul>
2021	<ul style="list-style-type: none"> <li>• Namanve - Namanve South 132kV 5km line</li> <li>• Opuyo - Moroto 132kV 160.2km double circuit line</li> <li>• Karuma – Kawanda 400kV 248km double circuit line</li> </ul>
2022	<ul style="list-style-type: none"> <li>• Karuma – Olwiyo 400kV 54.2km double circuit line (operating at 132kV)</li> <li>• Karuma – Lira 132kV 75.5km double circuit line</li> </ul>
2023	<ul style="list-style-type: none"> <li>• Namanve South – Luzira 132kV 15km double circuit line</li> <li>• Mutundwe – Entebbe 132kV 23.8km double circuit line</li> <li>• Gulu – Agago 132kV 83km double circuit line</li> <li>• Kole – Gulu 132kV 67.25km double circuit line</li> </ul>
2024	<ul style="list-style-type: none"> <li>• Gulu - Olwiyo 132kV 57.08km double circuit line</li> <li>• Olwiyo - Nebbi 132kV 102.11km double circuit line</li> <li>• Nebbi - Arua 132kV 62.7km double circuit line</li> <li>• Mirama – Kabale 132kV 88.5km line</li> <li>• 132kV 0.2438km T-off line to Muzizi along FortPortal – Hoima Line</li> <li>• 132kV 0.94km T-off line to Xsabo solar along Kabulasoke – Nkonge line</li> </ul>

Table 8 below presents the transmission lines that were planned to be commissioned within the period of 2018–2024 as per the GDP 2018–2040 but were not achieved.

**Table 8: Un-achieved transmission lines in the period 2018–2024**

Planned Transmission lines that were not achieved in the period 2018 –2024
• Tororo - UG'KY border 220kV 127km line
• T Matuga Kapeka 132kV 45km line
• Kawanda - Kasana 132kV 54km line
• Buloba branch point – Buloba Substation 132kV 0.8km line
• (New Mukono Substation – Mukono Substation) 132kV 0.3km line
• New Mukono branch point – New Mukono Substation 220kV 4.2km line
• New Mukono Substation – New Mukono branch point (Southern trunk line) 132kV 0.4km line
• Mukono branch point (Northern trunk line) – Kampala North substation 132kV 25.4km line
• Kampala North Substation – Mutundwe Substation 132kV 10.2km line
• Kawaala branch point – Kawaala Substation 132kV 0.1km line
• Buloba branch point – Buloba Substation 220kV 0.9km line
• Masaka - Mbarara 400kV 134km line
• Tororo SS – SGR Tororo Traction SS 132kV 11km line
• Bujagali – Tororo T/L T-off to SGR Buwoola SS 132kV 64km line
• Iganga SS – SGR Iganga Traction SS 132kV 3.5km line
• Nalubaale – Lugogo T/L to SGR Nyenga SS 132kV 5km line
• Namanve South – SGR Kampala East SS 132kV 3.7km line
• Hoima - Kinyara 220kV 45km line
• Kinyara – Kafu 220kV 47km line
• Kingfisher – Kabale 132kV 50km line
• Tilenga - Kabale 132kV 135km line
• Wobulenzi – Kapeka 220kV 37km line
• Kapeka - Kiboga - Hoima 220kV 142.9km line
• Nakasongola – Kaweweta- Kapeka 132kV 160km line
• Mbale – Bulambuli - Kween 132kV 76km line
• Mirama – Nsongezi 132kV 37.3km line
• Masaka – Mutukula 220kV 82km line
• Bujagali – Tororo T off to Jinja 132kV 5km line
• Mbarara Nkenda Toff to Ishaka 132kV 10km line
• Masaka Kyaka Toff to Rakai 132kV 10km line
• Nkongge – Mubende 132kV 30km line
• Nkenda – Mpondwe 220kV 72.5km line
• Oriang interconnection 400kV 10km line
• Ayago interconnection 400kV 12km line

Table 9 below presents the transmission lines that were additionally constructed and commissioned within the period of 2018–2024.

**Table 9: Additional Transmission Lines constructed within the period of 2018–2024**

Year	Additional transmission lines
2019	132kV Kawanda-Kapeeka 52km single circuit wooden transmission line
2024	132kV 0.2438km T-off line to Muzizi along FortPortal - Hoima Line 132kV 0.94km T-off line to Xsabo Solar along Kabulasoke -Nkonge Line

A summary of the statistics for planned line circuit length as per the GDP 2018–2040, against actual line length achieved between the period of January 2018 to December 2024 is shown in Table 10 here under.

**Table 10: Planned against actual Circuit line length achieved between 2018–2024**

Line Voltage (kV)	Expected/Planned Line length Between 2018–2024	Actual Line length Commissioned between 2018 –2024	UnachievedLine Length between 2018–2024	Achieved line length Between 2018 –2024 (%)
66 kV	N/A	N/A	N/A	N/A
132 kV	3,446.00	2,424.96	1,021.04	70.37%
220 kV	1,873.20	858	1,014.96	45.80%
400 kV	909.40	606.00	303.4	66.64%
<b>Total (km)</b>	<b>6,228.60</b>	<b>3,888.96</b>	<b>2,339.4</b>	<b>62.44%</b>

A summary of the cumulative commissioned transmission line statistics between the period 2018–2024 are presented in Table 11 below.

**Table 11: Commissioned Transmission Line Statistics (2018–2024)**

Description	Total Circuit Length of Transmission lines as of Dec. 2024 (km)						
	2018	2019	2020	2021	2022	2023	2024
66 kV	35.2	35.2	35.2	35.2	35.2	35.2	35.2
132 kV	1,364.66	1,783.86	2,229.26	2,559.66	2,710.66	3,088.76	3,705.08
132kV Underground cable	0.9	0.9	0.9	0.9	0.9	0.9	1.1438
220 kV	1002	1002	1002	1002	1002	1002	1002
400 kV	0	0	0	496	606	606	606
Total circuit length (km)	2,402.76	2,821.96	3,267.36	4,093.76	4,354.76	4,732.86	5,349.42
Growth Rate (%)		17.45%	15.78%	25.29%	6.38%	8.68%	13.03%

### 1.2.1.2.2. TRANSMISSION SUBSTATIONS

The transmission expansion with respect to the planned and actualized added transmission substations, for the period 2018 to 2024 are presented in Table 12 and Table 13 respectively here under.

**Table 12: Planned transmission Substations achieved in the period 2018–2024**

Year	Description for the Planned Transmission substations as per GDP 2018–2040
2018	<ul style="list-style-type: none"> <li>• 1 x 15/20MVA 132/33kV Kapeeka substation</li> <li>• 1 x 20MVA 132/33kV Kawanda substation</li> <li>• 2 x 250MVA 220/132kV Kawanda substation</li> <li>• 2 x 650MVA 400/220kV Kawanda substation</li> <li>• 1 x 50MVA 132/33kV Mobile substation</li> <li>• 2 x 125MVA 220/132kV Masaka West substation</li> <li>• 1 x 40/60MVA 132/33kV Mabara South substation</li> <li>• 1 x 40/60MVA 220/132kV Mirama substation</li> <li>• 2 x 32/40MVA 132/33kV Hoima substation</li> <li>• 2 x 50/63MVA 132/10.5kV Sukulu Phosphate substation</li> <li>• 2 x 650MVA 400/132kV Karuma Substation</li> <li>• 2 x 20MVA 132/33kV Karuma substation</li> <li>• 2 x 15/20MVA 132/33kV Olwiyo substation</li> </ul>
2019	<ul style="list-style-type: none"> <li>• 3 x 40/63MVA 132/33kV Namanve South substation</li> <li>• 3 x 32/40MVA 132/33kV Luzira substation</li> <li>• 3 x 40/63MVA 132/33kV Mukono substation</li> <li>• 2 x 60/80MVA 132/33kV Entebbe substation</li> <li>• 1 x 15/20MVA 132/33kV Kasana Substation</li> <li>• 1 x 32/40MVA 132/33kV Kawanda substation</li> <li>• 1 x 32/40MVA 132/33kV Kampala North Substation</li> <li>• 1 x 60/80MVA 132/33kV Tororo substation</li> <li>• 2 x 32/40MVA 132/33kV Iganga substation</li> <li>• 2 x 32/40MVA 132/33kV Opuyo substation upgrade</li> <li>• 2 x 32/40MVA 132/33kV Moroto substation</li> </ul>
2020	<ul style="list-style-type: none"> <li>• 2 x 32/40MVA 132/33kV Kabale substation</li> <li>• 1 x 60/80MVA 132/33kV Mbale substation</li> <li>• 2 x 32/40MVA 132/33kV Gulu substation</li> <li>• 2 x 32/40MVA 132/33kV Nebbi substation</li> <li>• 2 x 32/40MVA 132/33kV Arua substation</li> <li>• 2 x 32/40MVA 132/33kV Agago substation</li> </ul>
2021	<ul style="list-style-type: none"> <li>• 2 x 250MVA 400/220/33kV Wobulenzi substation</li> <li>• 3 x 125MVA 220/132kV New Mukono substation</li> <li>• 2 x 125MVA 220/132kV Buloba substation</li> <li>• 2 x 32/40MVA 132/33kV Buloba substation</li> </ul>

Year	Description for the Planned Transmission substations as per GDP 2018–2040
2021	<ul style="list-style-type: none"> <li>• 1 x 20MVA 132/11kV Kawaala substation upgrade</li> <li>• 3 x 32/40MVA 132/33kV Kawaala substation upgrade</li> <li>• 1 x 20MVA 132/33kV Mobile substation</li> <li>• 2 x 10MVA 133/27.5kV Nyenge traction SS</li> <li>• 2 x 10MVA 133/27.5kV Kampala East traction SS</li> <li>• 2 x 250MVA 133/33kV Mbarara South substation upgrade</li> <li>• 2 x 40/60MVA 33/132/220kV Fort portal Substation</li> <li>• 1 x 60MVA 220/132kV Mirama Substation</li> <li>• 2 x 50/60MVA 133/33kV Mirama Substation</li> <li>• 2 x 250MVA 220/132/33kV Hoima substation</li> <li>• 2 x 250MVA 220/132/33kV Nkenda substation</li> <li>• 2 x 250MVA 400/220/33kV Kafu substation</li> <li>• 2 x 250MVA 220/132/33kV Kabaale substation</li> <li>• 2 x 32/40MVA 132/33kV Kingfisher substation</li> <li>• 3 x 32/40MVA 132/33kV Tilenga substation</li> <li>• 2 x 250MVA 220/132/33kV Muzizi substation</li> <li>• 2 x 40/60MVA 132/220kV Kinyara substation</li> <li>• 1 x 250MVA 220/132kV Bujagali substation</li> <li>• 2 x 250MVA 220/132kV Tororo substation</li> <li>• 2 x 10MVA 132/27.5kV Tororo traction SS</li> <li>• 2 x 10MVA 132/27.5kV Buwoola traction SS</li> <li>• 2 x 10MVA 132/27.5kV Iganga traction SS</li> </ul>
2022	<ul style="list-style-type: none"> <li>• 2 x 50/60MVA 132/33kV Mutundwe substation</li> <li>• 2 x 50/60MVA 132/11kV Mutundwe substation</li> <li>• 3 x 50/63MVA 132/33kV Kapeeka substation</li> <li>• 2 x 125MVA 220/33kV Kapeeka substation</li> <li>• 2 x 32/40MVA 132/33kV Nakasongola substation</li> <li>• 2 x 50/60MVA 132/33kV Lugogo substation</li> <li>• 2 x 50/60MVA 132/11kV Lugogo substation</li> <li>• 2 x 32/40MVA 132/33kV Kaweweta substation</li> <li>• 2 x 50/60MVA 132/33kV Masaka West substation</li> <li>• 2 x 50/63MVA 132/33kV Mbarara North substation upgrade</li> <li>• 2 x 60MVA 132/33kV Nkenda substation</li> <li>• 2 x 32/40MVA 132/33kV Nsongezi substation</li> <li>• 2 x 32/40MVA 132/33kV Nkonge substation</li> <li>• 2 x 32/40MVA 132/33kV Mubende substation</li> <li>• 2 x 32/40MVA 132/33kV Rakai substation</li> <li>• 2 x 32/40MVA 132/33kV Ishaka substation</li> <li>• 3 x 50/60MVA 132/33kV Jinja substation</li> <li>• 3 x 50/63MVA 132/33kV Tororo substation</li> </ul>

Year	Description for the Planned Transmission substations as per GDP 2018–2040
2022	<ul style="list-style-type: none"> <li>• 2 x 45/60MVA 132/33kV Kapterol substation</li> <li>• 2 x 60/80MVA 132/33kV Mbale substation</li> <li>• 2 x 50/63MVA 132/33kV Kole substation</li> </ul>

**Table 13: Actual Added Transmission substations in the period 2018–2024**

Year	Description for the Added Transmission substations in the period 2018–2024
2018	<ul style="list-style-type: none"> <li>• 2 x 250MVA 220/132kV Kawanda Substation</li> <li>• 2 x 250MVA 220/132kV Masaka Substation</li> <li>• 2 x 32/40MVA 132/33kV Hoima Substation</li> <li>• 1 x 40/60MVA 220/132kV Mbarara South Substation</li> <li>• 1 x 32/40MVA Nkenda substation upgrade</li> <li>• 2 x 32/40MVA 132/33kV Fort Portal substation</li> <li>• 1 x 50MVA 132/33/11kV Mbale Mobile substation</li> <li>• 2 x 125MVA 220/132kV Masaka West substation</li> </ul>
2019	<ul style="list-style-type: none"> <li>• 3 x 50/63MVA 132/33kV Mukono substation</li> <li>• 2 x 32/40MVA 132/33kV Iganga substation</li> <li>• 1 x 32/40MVA 132/33kV Kawanda substation</li> <li>• 2x220kV Bujagali bays</li> <li>• 1 x 20MVA 132/33kV Kapeeka substation</li> </ul>
2020	<ul style="list-style-type: none"> <li>• 1 x 32/40MVA 132/33kV Kampala North Transformer</li> <li>• 1 x 32/40MVA 132/33kV Opuyo substation upgrade</li> </ul>
2021	<ul style="list-style-type: none"> <li>• 1 x 32/40MVA 132/33kV Opuyo substation upgrade</li> <li>• 2 x 50/63MVA 132/33kV Namanve South substation</li> <li>• 2 x 650MVA 400/220kV Kawanda substation</li> <li>• 2 x 650MVA 400/132kV Karuma Substation</li> </ul>
2023	<ul style="list-style-type: none"> <li>• 2 x 40MVA 132/33kV Entebbe substation</li> <li>• 2 x 40MVA 132/33kV Gulu substation</li> <li>• 2 x 40MVA 132/33kV Kole substation</li> </ul>
2024	<ul style="list-style-type: none"> <li>• 2 x 20MVA 132/33kV Muzizi B substation</li> <li>• 2 x 32/40MVA 132/33kV Nebbi substation</li> <li>• 2 x 32/40MVA 132/33kV Arua substation</li> <li>• 1 x 50.4/60MVA 220/132kV Mirama substation</li> <li>• 2 x 32/40MVA 132/33kV Kabale substation</li> <li>• 1 x 25MVA 132/33kV Nkongge solar substation</li> </ul>

Table 14 below presents the transmission substations that were planned to be commissioned within the period of 2018–2024 as per the GDP 2018–2040 but were not achieved.

**Table 14: Un-achieved transmission substations in the period 2018–2024**

Planned Transmission substations that were not achieved in the period 2018–2024
• 2 x 80/80MVA 132/10.5kV Sukulu Phosphate substation
• 1 x 15/20MVA 132/33kV Kasana Substation
• 2 x 250MVA 400/220/33kV Wobulenzi substation
• 3 x 125MVA 220/132kV New Mukono substation
• 2 x 125MVA 220/132kV Buloba substation
• 2 x 32/40MVA 132/33kV Buloba substation
• 1 x 20MVA 132/11kV Kawaala substation upgrade
• 3 x 32/40MVA 132/33kV Kawaala substation upgrade
• 1 x 20MVA 132/33kV Mobile substation
• 2 x 10MVA 133/27.5kV Nyenga traction SS
• 2 x 10MVA 133/27.5kV Kampala East traction SS
• 2 x 250MVA 133/33kV Mbarara South substation upgrade
• 2 x 40/60MVA 33/132/220kV Fort portal Substation
• 2 x 50/60MVA 133/33kV Mirama Substation
• 2 x 60/80MVA 220/132kV Hoima substation
• 2 x 250MVA 220/132/33kV Nkenda substation
• 2 x 200/250MVA 400/220/33kV Kafu substation
• 2 x 250MVA 220/132/33kV Kabaale substation
• 2 x 32/40MVA 132/33kV Kingfisher substation
• 3 x 32/40MVA 132/33kV Tilenga substation
• 2 x 250MVA 220/132/33kV Muzizi substation
• 2 x 60/80MVA 132/220kV Kinyara substation
• 1 x 250MVA 220/132kV Bujagali substation
• 2 x 250MVA 220/132kV Tororo substation
• 2 x 10MVA 132/27.5kV Tororo traction SS
• 2 x 10MVA 132/27.5kV Buwoola traction SS
• 2 x 10MVA 132/27.5kV Iganga traction SS
• 2 x 50/60MVA 132/33kV Mutundwe substation
• 2 x 50/60MVA 132/11kV Mutundwe substation
• 2 x 125MVA 220/33kV Kapeeka substation
• 2 x 32/40MVA 132/33kV Nakasongola substation
• 2 x 50/60MVA 132/33kV Lugogo substation
• 2 x 50/60MVA 132/11kV Lugogo substation
• 2 x 32/40MVA 132/33kV Kaweweta substation
• 2 x 50/60MVA 132/33kV Masaka West substation
• 2 x 50/63MVA 132/33kV Mbarara North substation upgrade
• 2 x 60MVA 132/33kV Nkenda substation
• 2 x 32/40MVA 132/33kV Nsongezi substation
• 2 x 32/40MVA 132/33kV Nkonge substation
• 2 x 32/40MVA 132/33kV Mubende substation
• 2 x 32/40MVA 132/33kV Rakai substation

**Planned Transmission substations that were not achieved in the period 2018–2024**

- 2 x 32/40MVA 132/33kV Ishaka substation
- 3 x 50/60MVA 132/33kV Jinja substation
- 3 x 50/63MVA 132/33kV Tororo substation
- 2 x 45/60MVA 132/33kV Kapterol substation
- 2 x 60/80MVA 132/33kV Mbale substation
- 2 x 50/63MVA 132/33kV Kole substation

A summary of the statistics for the planned transformation capacity as per the GDP 2018-2040, against the actual transformation capacity achieved between the period of January 2018 to December 2024 is shown in Table 15 below.

**Table 15: Planned against actual Transformation capacity achieved between 2018–2024**

Transformer	Planned (MVA) Between 2018 –2024	Achieved (MVA) Between 2018 –2024	Unachieved (MVA) Between 2018 –2024	Achieved (%)
400/200kV	2,300	1,302	998	56.61%
400/132kV	1,300	630	670	48.46%
220/132kV	4,665	1,620	3,045	34.73%
220/33 kV	250	0	250	0.00%
132/33 kV	4,978	1,494	3,484	30.01%
132/33/11 kV	0	50	N/A	N/A
132/27.5 kV	100	0	100	0.00%
132/11kV	260	0	260	0.00%
132/10.5kV	126	0	126	0.00%
Total Transformation (MVA)	13,979	5,096	8,883	36.45%
Number of substations/ switching stations	55	28	27	50.91%

A summary of the statistics for substations commissioned between the period 2018 – 2024 is presented in Table 16 below.

**Table 16: Commissioned Substations Statistics (2018–2024)**

Transformers	Total MVA By Dec. 2018	Total MVA By Dec. 2024
400/132kV	0	630.00
400/220/33kV	0	1,302.00
220/132/33 kV	2,060	2,120.00
132/33 kV	1,446.5	2,795.50
132/11 kV	220	220
66/11 kV	28	28
Mobile Transformer 132/33/11 kV	50	50
Total (MVA)	3,754.50	7,145.50
Capacitor Banks (MVAR)	98	205.864
Reactors (MVAR)	0	455
Number of substations and Switching stations	19	43

### 1.2.1.3. ACHIEVEMENTS (2018–2024) – INVESTMENTS

The achieved investments from GDP 2018–2024 are presented below.

**Table 17: Achieved investments from GDP 2018–2024**

Achievement	Project and Financing Details	Status
Financing was secured for the following projects.	Masaka-Mbarara 400kV Transmission line and associated substations AFD loan signed on 27th April 2018 and KfW loan was signed on 21st June 2018.	Loan extension from KfW and AFD is awaited for commencement of works.
	Kampala Metropolitan Project (Buloba, Kawaala, Mukono, Bujagali substations)	JICA loan was signed on 26th April 2018.
	Mukono-Kampala North-Lugogo and Kampala North-Mutundwe transmission line restructuring	JICA loan was signed on 26th April 2018.
	Gulu – Agago 132kV transmission line and associated substations project	KfW loan signed on 30th October 2019.
	Uganda-Tanzania feasibility, ESIA and Resettlement Policy Framework (RPF) Study	Balance from Grid Expansion and Reinforcement Project (GERP) was used
	Uganda-DRC feasibility, ESIA and RAP study.	Funded by AfDB under NELSAP coordination.
	Uganda-South Sudan feasibility, ESIA and RAP study.	Funding secured from AfDB under MEMD savings from the AfDB funded Uganda Rural Electricity Access Project (UREP).
	Matugga-Kasana, Nkenda and Mbarara	ERA Approved Capex
EPC and supervision consultancy procurement was concluded for the following projects.	Kole-Gulu-Nebbi-Arua 132kV transmission line and associated substation	Commissioned in July 2024
	Masaka-Mbarara 400kV transmission line and associated substations	Procurement is at contract award stage
	Gulu-Agago 132kV transmission line and associated substations	Commissioned on 21st February 2024
	Mirama-Kabale 132kV transmission line and associated substations	Commissioned on 12th February 2025
	220kV underground and associated substations	At implementation stage. COD expected in December 2025
	Kampala Metropolitan 220kV and 132kV transmission system improvement project	At implementation stage. COD expected in 2026

The status of the EPC contracts undertaken within the period 2018–2024 are presented below.

**Table 18: Remarks on signed EPC Contracts**

EPC Contract Signed	Remark
Kole-Gulu-Nebbi-Arua 132kV transmission line and associated substation	Commissioned in 2024
Electrification of Industrial Parks phase II and trade free zones comprising of Sukulu, Mbale, Wobulenzi, Kapeeka, Kaweweta and Nakasongola substations and associated transmission lines	Procurement of supervision consultant is ongoing
SCADA Upgrade	Complete
Mirama-Kabale 132kV transmission line and associated substations	Commissioned in 2024
Mirama-Kikagati-Nshongezi transmission line and associated substations	Update of feasibility studies is being undertaken by a new developer (China National Electric Engineering Company Ltd.)
Mbarara North 32/40MVA Transformer Upgrade	Energized on 14th June 2025
Nkenda 60/80MVA Transformer Upgrade	Energized on 19th May 2025
40MVAR 132kV FortPortal Reactor	Implementation is ongoing
Kampala Metropolitan 220kV and 132kV Transmission system improvement project.	EPC implementation ongoing.
220kV underground cable and associated Kabalega substation.	At implementation stage
50MVA Multi-ratio Mbale Mobile station	EPC Commercial contract signed pending conclusion of pre-financing agreement between Tangshan Mbale Industrial Park Ltd and MoFPED

### 1.2.2. ACHIEVEMENTS OF THE NDPIII SCENARIO (FY2020/21 –FY2024/25)

The National Development Plan (NDPIII) was the third in a series of six NDPs that would guide the nation in delivering the aspirations articulated in Uganda Vision 2040.

The NDPIII (FY2020/21–FY2024/25) was anchored on the progress made, challenges encountered, and lessons learnt from previous planning and implementation of NDPI and NDPII; and came into effect at the time when the country and the World are battling the COVID-19 pandemic that has posed social and economic impacts.

The goal of the NDP III plan was to increase house incomes and improve quality of life of Ugandans through sustainable industrialization for inclusive growth, employment and sustainable wealth creation.

In light of the plan, some of key results set to be achieved over five years from 2020/21 to 2024/25 as highlighted here under in Table 19.

**Table 19: NDP III targets<sup>1</sup>**

Description	2017/18 Baseline Year	2020/21	2021/22	2022/23	2023/24	2024/25
Increase in Energy Generation Capacity (MW)	984	1,884	1,990.4	2,493.6	2,996.8	3,500
Consumption Per Capita (kWh)	100	150	200	300	400	578
Population <sup>2</sup> projection in Millions	40	42.9	44.2	45.6	46.9	48.3
Population with Access to Electricity (%)	21	40	45	50	55	60
Computed Consumption (GWh) <sup>3</sup>	840	2,574	3,978	6,840	10,318	16,750
Computed Demand (MW) <sup>4</sup>	96	294	454	781	1,178	1,912
Increase in length for High voltage <sup>5</sup> lines (km)	2,354	2,600	3,000	3,400	3,800	4,354
Increase in grid Reliability (%)			90	90	90	90

The NDP III targets in terms of increased energy generation capacity, demand, increase in length of transmission lines, increase in per capita consumption and increase in grid reliability, were compared with the realized outcomes of implementing the GDP by FY2024/25, to determine the extent of progress made towards achieving the goals. The results are indicated in Table 20 below.

**Table 20: Comparison between the NDP III targets and realized outputs by 2024/25**

Description	Planned Target Between 2017/18 -2024/25	Achieved Between 2017/18 -2024/25	Achieved Between 2017/18 -2024/25 (%)
Increase in Energy Generation Capacity (MW)	2,516	1,066	42.4%
Demand (MW)	1,816	825	45.4%
Increase in length for High voltage lines (km)	2,000	2,994	123%
Increase in Per Capita Consumption	478	118	24.7%
Increase in grid reliability (%)	90	986	109%

<sup>1</sup> Source of the targets: NDP III

<sup>2</sup> Source for projected population: UBOS

<sup>3</sup> The computed consumption was not listed among the NDP III targets. It was only computed based on the targets

<sup>4</sup> The demand was not listed among the NDP III targets. It was only computed based on the targets.

<sup>5</sup> The High voltages referred to range from 132kV – 400kV as cited in the NDP III document

<sup>6</sup> The cited 98% grid reliability was measured based on the availability of the transmission network.

### 1.3. CHALLENGES FACED IN IMPLEMENTING THE GDP 2018–2040

The Challenges faced in implementing the GDP 2018–2040 and the proposed mitigation measures are presented in the table below

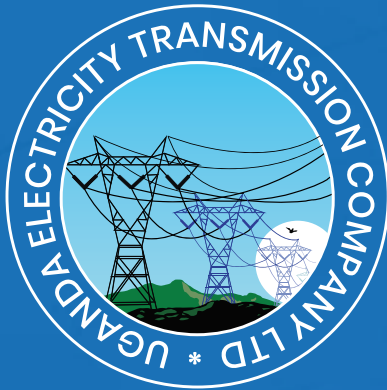
**Table 21: Challenges faced during implementation of the GDP 2018–2040 and the proposed mitigation measures**

CHALLENGES	MITIGATION MEASURES
<ul style="list-style-type: none"> <li>Acquisition of way leaves for construction of transmission lines continues to be a challenge.</li> </ul>	<ul style="list-style-type: none"> <li>Strengthening stakeholder engagement and community sensitization to explain the benefits of the project and address their concerns; while ensuring they are fairly compensated for the land used, to ease the acquisition process.</li> </ul>
<ul style="list-style-type: none"> <li>Securing funding for new investments</li> </ul>	<ul style="list-style-type: none"> <li>Exploring public-private partnerships (PPPs) and engaging various development partners to secure funding.</li> </ul>
<ul style="list-style-type: none"> <li>Rampant vandalism, which is a threat to the integrity of the transmission infrastructure and increases significantly the Operations and Maintenance (O&amp;M) budget of UETCL.</li> </ul>	<ul style="list-style-type: none"> <li>Intensifying security by regularly patrolling the transmission lines, working with the police and other security teams, and encouraging local communities to help protect the infrastructure through awareness campaigns</li> </ul>
<ul style="list-style-type: none"> <li>Pinpointing the cause of the increasing losses and subsequent mitigation measures has been a challenge</li> </ul>	<ul style="list-style-type: none"> <li>Conducting detailed technical audits and energy loss studies aimed at segregating technical and non-technical losses in order to develop and implement targeted loss-reduction strategies.</li> </ul>
<ul style="list-style-type: none"> <li>Challenges in operations due to high voltages as a result of commissioned projects.</li> </ul>	<ul style="list-style-type: none"> <li>Installation of reactive power compensation equipment to address the voltage regulation</li> </ul>
<ul style="list-style-type: none"> <li>Delayed release of counterpart funds from GoU.</li> </ul>	<ul style="list-style-type: none"> <li>Improving coordination with MoFPED and fast-tracking disbursement processes to minimize delays in securing funds. Including contingency measures in project planning</li> </ul>
<ul style="list-style-type: none"> <li>Delays in establishment of a regulatory and legal framework for private investment in transmission.</li> </ul>	<ul style="list-style-type: none"> <li>The Electricity Regulatory Authority (ERA) introduced the Independent Power Transmission (IPT) framework model in 2023, aimed at encouraging private investment in a bid to enhance competition within the transmission sector.</li> </ul>
<ul style="list-style-type: none"> <li>Project time overruns due to unforeseen circumstances like the COVID 19 pandemic.</li> </ul>	<ul style="list-style-type: none"> <li>Including risk buffers in project schedules and budgets, as well as enabling contract flexibility to cater for unforeseen.</li> </ul>
<ul style="list-style-type: none"> <li>Different reporting timelines between GOU and ERA continue to be a challenge.</li> </ul>	<ul style="list-style-type: none"> <li>Harmonizing reporting requirements through joint planning sessions and standardized templates.</li> </ul>
<ul style="list-style-type: none"> <li>The grid is not yet completely N-1 compliant.</li> </ul>	<ul style="list-style-type: none"> <li>Prioritizing critical investments in grid reinforcement and redundancy through long-term system expansion planning.</li> </ul>

## 1.4. LESSONS learnt FROM IMPLEMENTING GDP 2018–2040

The following lessons were learnt from implementing the GDP 2018–2040.

- Pandemics like the Covid – 19 led to project delays and reduction in observed demand growth rate.
- Political instability in other countries can result in significant variations in planned Project costs such as the Russia - Ukraine war.
- The transformation capacity in industrial parks has not been fully utilized due to low consumption. UETCL should engage MEMD to further engage Ministry of Trade, Industry and Cooperatives to ensure that the new industries are located within the existing industrial parks with reliable supply.
- Securing of financing takes a longer time due to the new project financing approaches introduced like EPC+F
- Technically compliant but lowest priced bidder does not always guarantee quality works and services.



# **THE GRID DEVELOPMENT PLAN PROCESS**

## 2. THE GRID DEVELOPMENT PLAN PROCESS

### 2.1. OBJECTIVES OF THE GRID DEVELOPMENT PLAN

The main objectives of the Grid Development Plan are:

- To give an outlook of the future power system of Uganda.
- To present the High Voltage Transmission Grid's (HVTG) investment requirements to meet forecasted demand.
- To detail the new power generation development projects over the planning horizon and their associated evacuation infrastructure.
- Identify power transmission investment requirements to mitigate anticipated system constraints.
- To form a basis for the company's financial projections, multi-year tariff and multi-year budget.

### 2.2. METHODOLOGY

A scenario-based approach has been adopted for the 2025–2040 Grid Development Plan Update. Four scenarios have been considered as follows:

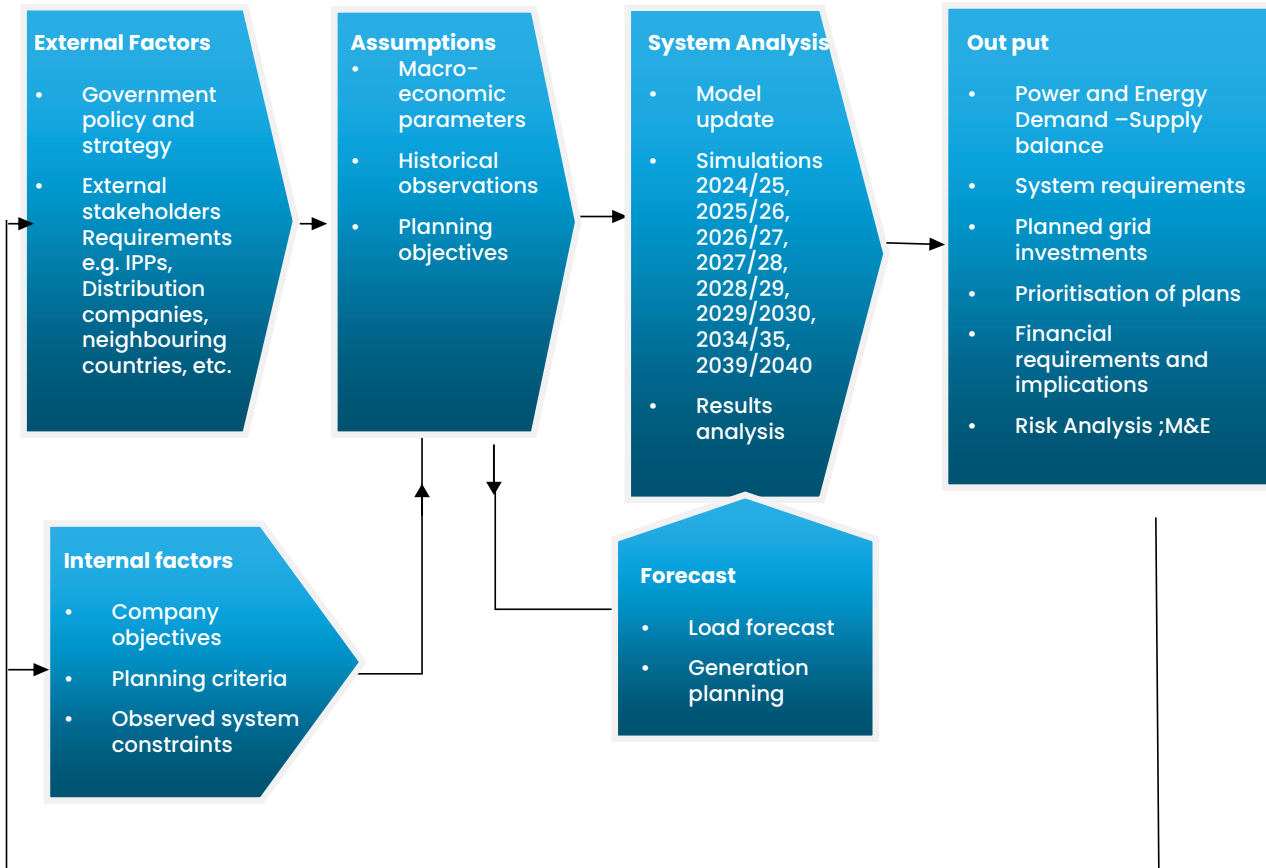
- **The Business-as-usual (BAU) 2040 Scenario (base case):** This scenario involves observing historical demand growth trends, growth projections of the Gross Domestic Product, distribution connection strategies and regional power trade projections, implementation of loss reduction strategies and the need to address constraints that have created suppressed demand in the past.
- **NDPIV 2030 Scenario (FY2025/26–FY2029/30):** This scenario aims at strengthening Uganda's competitiveness through sustainable industrialization for inclusive growth, employment and wealth creation, with set targets to be implemented within 5 years.
- **The Tenfold 2040 Scenario:** This scenario assumes a tenfold growth of existing installed generation capacity from 2,050MW to 22GW by 2040.
- **Vision 2040 scenario (updated by the Energy Policy 2023):** This scenario is anchored by Uganda's Vision 2040 which provides development paths and strategies to operationalize Uganda's Vision statement which is "A Transformed Ugandan Society from a Peasant to a Modern and Prosperous Country". It aims at transforming Uganda from a predominantly peasant and low-income country to a competitive upper middle-income country.

The Vision 2040 is conceptualized around strengthening the fundamentals of the economy to harness the abundant opportunities around the country. The identified opportunities include oil and gas, tourism, minerals, ICT business, abundant labour force, geographical location and trade, water resources, industrialization and agriculture among others that are to date considerably under-exploited. Achieving the transformational goal will thus depend on the country's capacity to strengthen the fundamentals including: infrastructure (energy, transport, water, oil and gas, and ICT); Science, Technology, Engineering and Innovation (STEI); land use and management; urbanization; human resource; and peace, security and defence and that's where UETCL comes in to expand the transmission network to deliver bulk, quality and reliable power.

To achieve the Vision 2040, one of the key targets was to increase Uganda’s installed generation capacity to 41,738MW by 2040. However, following the launch of the Energy Policy 2023 in September 2023 which envisions an installed generation capacity of 52GW by 2040, the Vision 2040 target was subsequently updated from 41GW to 52GW to align with the new ambition.

### 2.2.1 THE GRID DEVELOPMENT PLAN PROCESS

The process used for formulating the GDP is illustrated in Figure 2 below.



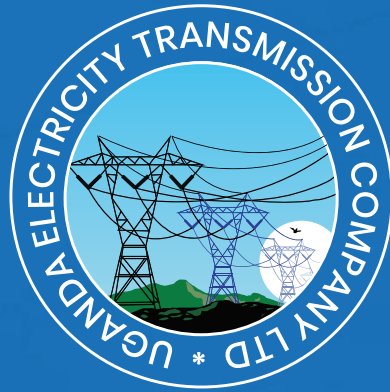
**Figure 2: The Grid Development Plan process**

From the above figure, it can be observed that the inputs to the GDP process include both external and internal factors, which are then used in the analyses for load forecast and power system to yield results which are further analysed to come-up with the outputs.

The load forecast conducted for the Business as usual, NDPIV 2030, Tenfold 2040 and the Energy Policy 2023-Vision 2040 scenarios for the period 2024/25–2039/40 was based on the respective assumptions for each scenario as detailed in the respective sections. Power system constraints as observed in the day-to-day operation of the network were considered in the power system analysis. These include quality of supply, equipment loading, system reliability and availability.

Generation expansion planning was based on the implementation timelines for power plants under construction and those planned (Licensed, with or without executed Power Purchase Agreements). The demand-supply balance analysis for each respective scenario recommended the timing of additional required generation capacities.

Power system studies and analysis were carried out on eight system models. The results formed the basis for determining the updated Grid Investment Plan that details the identified project concepts with their respective cost estimates and timing.



# **PLANNING CRITERIA**

### 3. PLANNING CRITERIA

#### 3.1. TRANSMISSION PLANNING CRITERIA

The transmission planning criteria provides a framework for system design in order to operate the power grid in a manner that satisfies the grid code and the regional interconnection requirements. This section describes the criteria utilized when analysing Uganda's transmission system and serves as a guide for determining future transmission infrastructure investments.

The Planning criteria are utilized to ensure the following objectives are met:

- Provide a transmission system that can adequately serve the system loads.
- Provide a robust transmission system that can withstand system disturbances arising from faults and / or switching.
- Provide a transmission system that contributes to overall system integrity and supports effective competition in a power pool.
- Provide a transmission system whose revenue requirement, capital and operating costs are minimized while being consistent with the above goals.

##### 3.1.1. SYSTEM VOLTAGE

Under steady state and post contingency conditions, all system voltages from 66kV and above (i.e. 132kV, 220kV, and 400kV) should be within the limits set as shown below.

**Table 22: Voltage Limits.**

Description	Normal condition <sup>7</sup>		Contingency condition	
	Minimum Value/ %	Maximum Value/ %	Minimum Value/ %	Maximum Value/ %
400 kV Transmission Substation Bus Voltage	380 (95%)	420 (105%)	360 (90%)	440 (110%)
220 kV Transmission Substation Bus Voltage	209 (95%)	231 (105%)	198 (90%)	242 (110%)
132 kV Transmission Substation Bus Voltage	125.4 (95%)	138.6 (105%)	118.8 (90%)	145 (110%)
66 kV Transmission Substation Bus Voltage	62.7 (95%)	69.3 (105%)	59.4 (90%)	72.6 (110%)

Under normal operations, the system voltages at various levels at the tail end of the lines shall be as close to the nominal voltage as possible. The transformer tap positions may be increased or decreased at peak load or off load conditions as need arises.

The system should withstand outage of any two circuits of 220kV lines or any one circuit of 400 kV line with voltage and frequency levels remaining within prescribed limits.

##### 3.1.2. SYNCHRONISM

The system shall remain in synchronism even in the event of a single line to ground fault or three phase fault and upon successful clearance of fault by the protective devices. Adequate margin shall be available, in terms of voltage and steady state oscillating stability. The voltage angles between consecutive substations should be in the region of 30 degrees.

<sup>7</sup> The Uganda grid code stipulates the operating voltage limits of +/- 10%. UETCL has adopted a planning criterion from the East African Power Pool Interconnection code which stipulates operating voltage range of +/- 5% during normal operating conditions.

### 3.1.3. EQUIPMENT LOADING

Under normal conditions all transmission equipment can be loaded up to 100% of the continuous rating. Under contingency conditions, this will be allowed to increase to 120% of continuous rating for a limited period depending on the age and physical condition of the equipment.

### 3.1.4. REACTIVE POWER COMPENSATION

Reactive resources should be planned and designed such that adequate reactive power compensation is provided in the form of dynamic reserves at synchronous generators and Static Var Compensators (SVCs) before, during and after system disturbances. Reactive loads should be served by fixed and mechanically switched or variable shunt compensation to the extent practical. Reactive power dynamic reserves at generators and SVCs should help minimize the impact of system disturbances and unusual operating conditions.

### 3.1.5. VOLTAGE SELECTION

Voltage selection shall consider cases where existing voltages are found inadequate and will also consider new power transmission lines, catering for all power plants to be developed and power to be evacuated from that particular region. This aims at optimizing transmission capacity, optimizing wayleaves, reducing technical losses and operation & maintenance costs.

### 3.1.6. RELIABILITY CRITERIA

The future transmission system is planned to operate satisfactorily under the condition of a single element contingency, N-1. Modifications and enhancements shall be made to the system to improve reliability when needed. Criteria such as contingency, load growth, load density was used in the analysis of reliability.

### 3.1.7. OPERATING RESERVE

Operating reserves consist of spinning reserves and non-spinning reserves. Spinning reserves constitute the additional output from generating plant that must be realizable in real time in order to arrest a drop of system frequency due to a loss of generation or a loss of external interconnector or mismatch between generation and demand.

Non-spinning reserves constitute the output available from standby generating units that can be synchronized and loaded up within 5 minutes for a hydro and 30 minutes for a thermal plant to respond to abnormal demand increase or further generating units breakdown.

### 3.1.8. GENERATION MIX

For peak load conditions, optimal generation mix comprising of various energy resources taking into consideration the marginal cost of production for the different plants is recommended to be used. For the minimum load conditions, the must run power plants shall be used in conjunction with the most economical generation.

### 3.1.9. FAULT CURRENT CRITERIA

Three phase and single phase to ground fault current values associated with transmission system buses are reviewed to check equipment rating adequacy. Transmission facilities are rechecked as needed to determine that all equipment can withstand available fault duty. Maximum fault levels should not exceed 80% of the rated fault interrupting capacity of the circuit breaker.

**Table 23: Switchgear rated fault current interrupting capacity**

Rated Voltage (kV)	Switchgear Rating (kA)
400	63
220	40
132	31.5
66	31.5
33	31.5*
11	25*

\* Due to the distribution grid configuration adopted and the proximity of generation sources to the medium voltage buses, it has necessitated the installation of higher rated circuit breakers in some cases. This is considered on a case-by-case basis.

### 3.1.10. SYSTEM FREQUENCY

The operating frequency of the system should be maintained within  $\pm 1\%$  of 50Hz. This is a grid code requirement. Sufficient means to carry out active load balancing with active power generation shall be put in place to ensure that the frequency is within the set limits.

Under frequency load shedding is carried out in the stages below: -

Stage 1 – at 49.2Hz

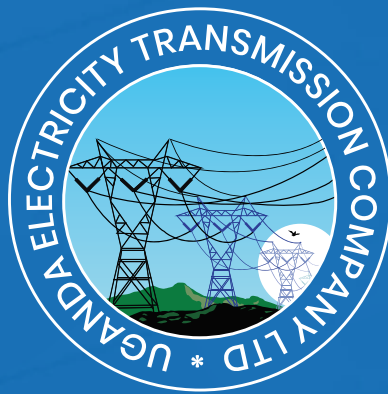
Stage 2 – at 48.9Hz

Stage 3 – at 48.6Hz

Stage 4/ decoupling – at 48.0Hz

### 3.1.11. INFORMATION AND COMMUNICATION TECHNOLOGY

As new transmission infrastructure is planned, consideration shall be made of the fact that sufficient communication facilities are incorporated to cater for present and future needs of the company and other potential external users.



# **BUSINESS AS USUAL (2040)**

# **BAU SCENARIO**

## 4.1 LOAD AND GENERATION PROGNOSIS FOR THE BAU 2040 SCENARIO

The national load forecast was prepared using regression analysis based on econometric parameters. The indicators considered include Gross Domestic Product and population growth. Other parameters used include historical energy purchases, energy sales, system peak demand, regional power trade obligations and additional industrial load requirements. The tool used for load forecasting is EViews, an Excel based econometrics model. The assumptions, methodology applied are elaborated and the results are presented in form of tables and charts along with corresponding narrative.

### Load Forecasting Strategy

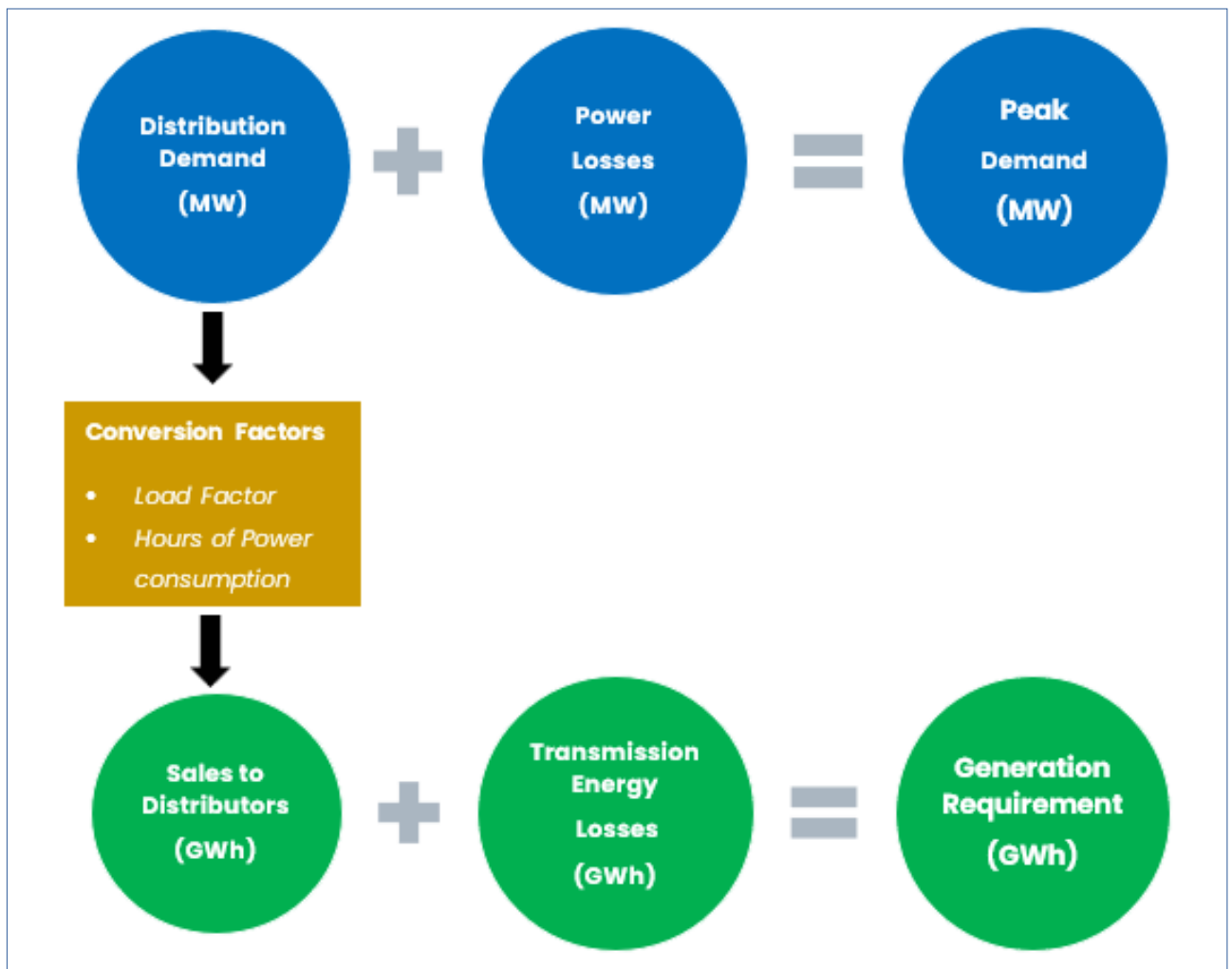
This is an approach used to forecast and estimate the future electrical energy needs to meet both system and domestic demand. The forecasted amounts not only reflect what can be supplied but also what is required to meet the energy needs.

Historically, the real Gross Domestic Product figures were used in the forecast and although the figures exhibited growth, it was mostly under certain constraints. With the removal of the constraints to economic growth (e.g. more investment in the power sector, lowering of tariffs, etc) it is anticipated that the Gross Domestic Product will grow at a rate faster than previously observed. Further more, the population growth is expected to follow the trend observed in the UBOS report of 2024.

These two factors i.e. population growth and historical real Gross Domestic Product were considered to be the independent variables and the correlation between them with the historical energy consumption was determined in order to establish the forecast. The correlation between real Gross Domestic Product and energy consumption was found stronger therefore population data was not considered while preparing the load forecast.

### Approach and Methodology for the Forecasts

To determine the national energy needs and demand forecast, the approach shown in Figure 3 here under.



**Figure 3: Approach and Methodology for the forecasts**

The power demand indicated in the approach above was forecast using e-views. To obtain the corresponding peak demand, power losses were also put into consideration.

To forecast the electrical energy (sales to distributors), conversion factors such as the load factor and hours of power consumption were applied to the power demand.

The sales to distributors indicated in the approach above include both distribution and embedded generator losses.

In estimating the generation requirement to meet the distributors' energy needs, transmission energy losses were also put into consideration.

#### 4.1.1. ASSUMPTIONS AND DATA FOR DEMAND – SUPPLY PROGNOSIS

##### 4.1.1.1. HISTORICAL DEMAND TRENDS

The growth in the historical power and energy consumption data for the period FY2018/19–FY2023/24 as presented in Table 24 here under was used in the analysis.

The data in Table 24 here under was sourced from the UETCL Statistics reports.

The value of the domestic peak demand recorded in Table 24 below was the highest domestic peak demand registered within the year.

The average growth rates of the system peak demand, domestic demand, system energy sales and domestic energy sales for the past five financial years (FY2018/19 to FY2023/24) are shown in Table 25 here under.

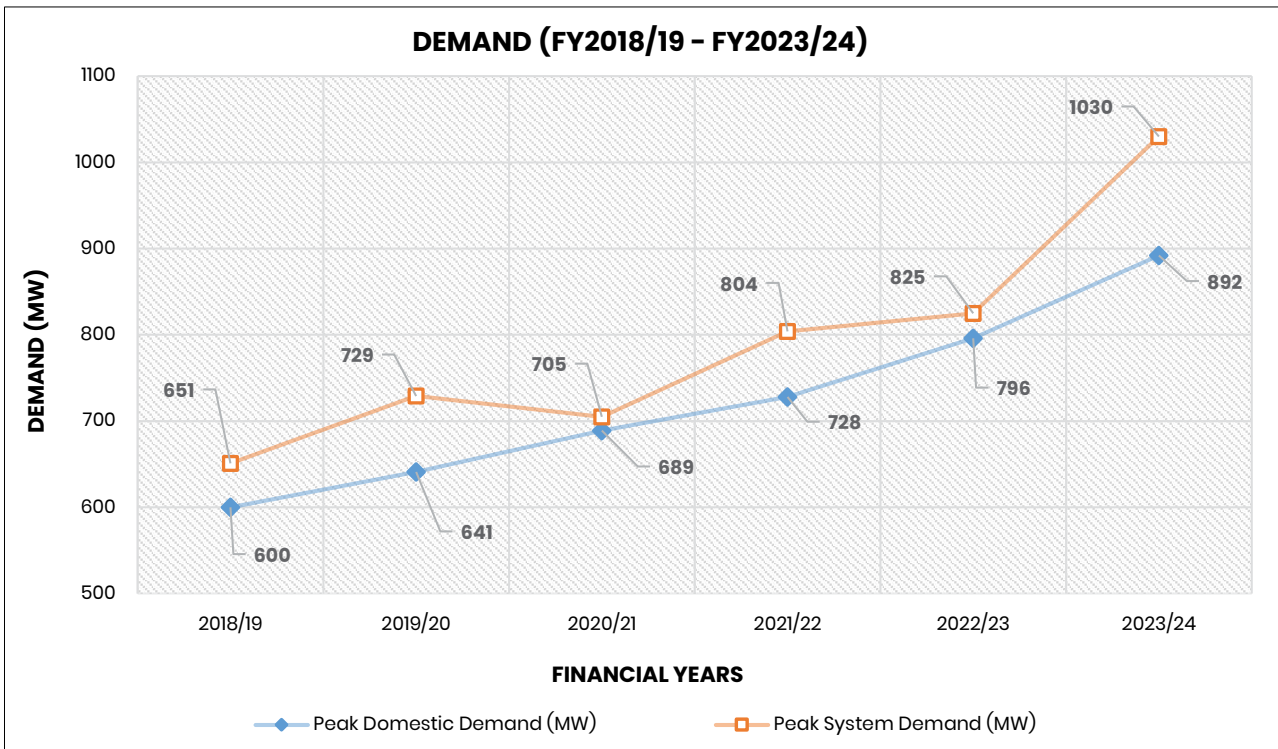
**Table 24: Historical Trend of Power peak demand and Energy sales**

Financial Year	Domestic Peak Demand (MW)	Growth Rate (%)	Peak System demand (MW)	Growth Rate (%)	Domestic Energy Sales to Distribution (GWh)	Growth Rate (%)	Domestic Energy Sales + Export Sales (GWh)	Growth Rate (%)
2018/19	600		651		4,102		4,371	
2019/20	641	6.76%	729	11.85%	4,171	1.68%	4,449	1.81%
2020/21	689	7.55%	705	-3.25%	4,536	8.75%	4,706	5.76%
2021/22	728	5.63%	804	14.07%	5,055	11.44%	5,508	17.05%
2022/23	796	9.33%	825	2.62%	5,410	7.02%	5,823	5.72%
2023/24	892	12.08%	1,030	24.81%	5,537	2.35%	6,031	3.57%

**Table 25: Average growth rates for demand and energy sales over the period of FY2018/19– FY2023/24**

Description	Average growth (FY2018/19 – FY2023/24)
System peak demand (MW)	10.02%
Domestic demand (MW)	8.27%
System Energy Sales (GWh)	6.78%
Domestic Energy (GWh)	6.25%

The historical trend of the National (Uganda’s) peak demand (for both domestic and system demand) is illustrated in Figure 4 below.

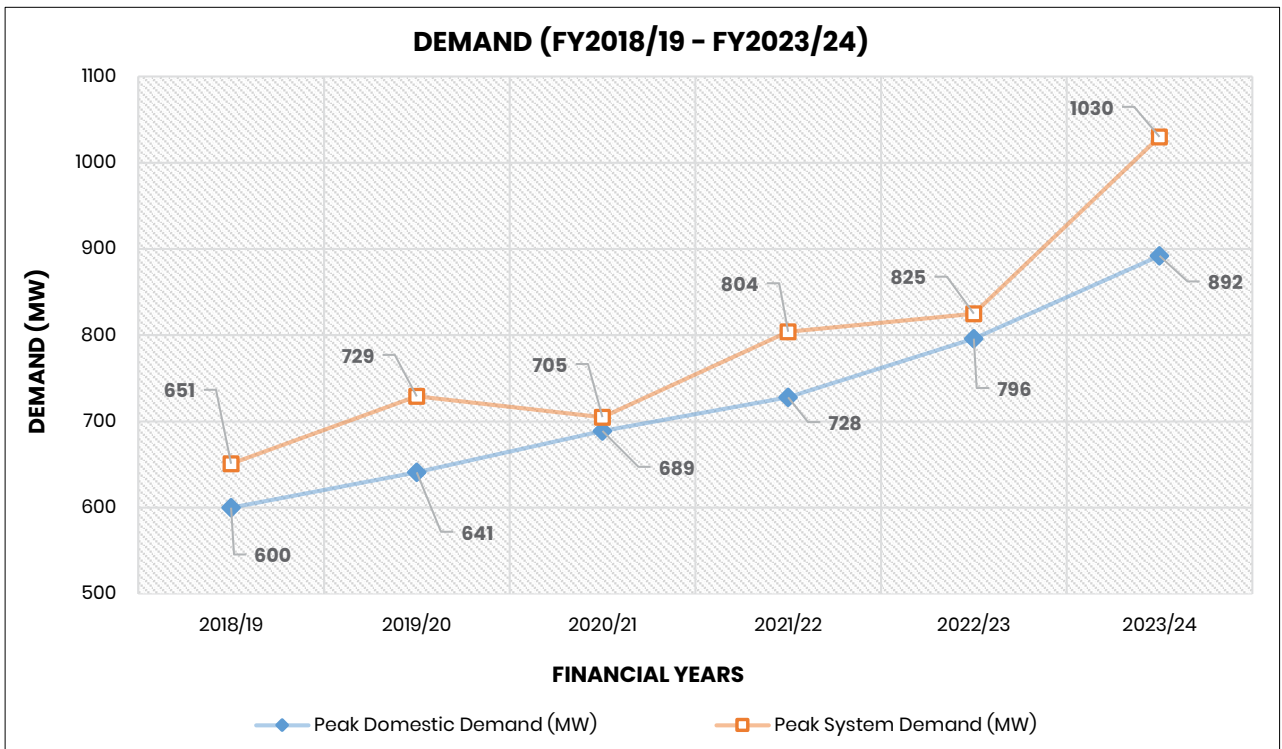


**Figure 4: Trend of National electricity peak demand (FY2018/19–FY2023/24)**

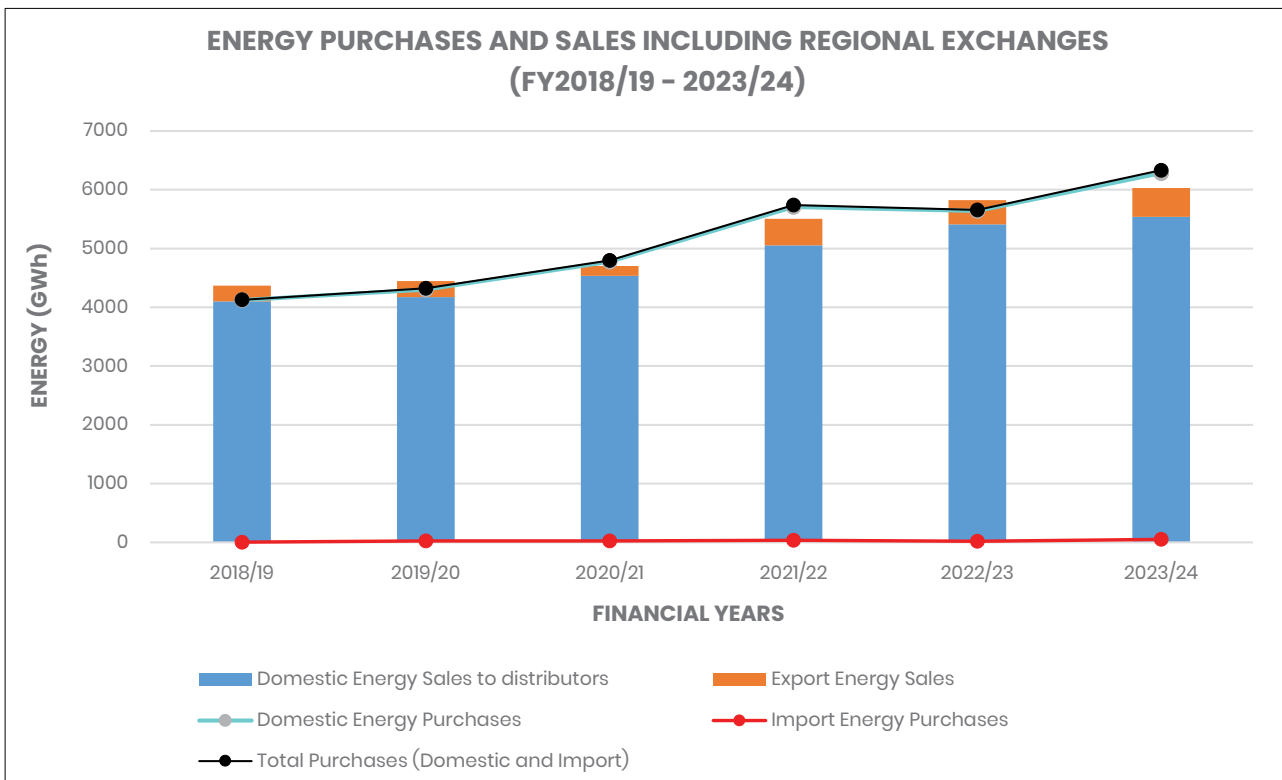
The historical energy purchases and sales (including regional exchanges) in the period of FY2018/19–FY2023/24 were also taken into consideration as presented in Table 26 and illustrated in Figure 5 & Figure 6 shown here under.

**Table 26: Energy Sales and Purchases in the period FY2018/19–FY2023/24**

Financial Years	Domestic Energy Sales to Distributors (GWh)	Export Energy Sales (GWh)	Domestic Energy Purchases (GWh)	Import Energy Purchases (GWh)
2018/19	4,102	268.55	4,122	4
2019/20	4,171	278.47	4,299	22
2020/21	4,536	169.90	4,778	22
2021/22	5,055	453.14	5,704	34
2022/23	5,410	413.21	5,642	16
2023/24	5,537	493.99	6,284	51



**Figure 5: Trend of the national domestic energy exchanges (FY2018/19–FY2023/24)**



**Figure 6: Trend of Energy exchanges inclusive of regional exchanges**

**Observations**

- The energy demand was observed to grow despite the interruption to the economy owing to the covid -19 pandemic in 2020 and 2022.
- The peak demand including exports on the Uganda power system increased from year to year. However, a reduction in system demand was observed in the FY 2020/2021 due to reduced exports during the hour of consideration (hour of the highest domestic demand in December 2020).

- On the contrary, the energy sales growth rate significantly increased in the same financial year 2020/2021.

#### 4.1.1.2. GROSS DOMESTIC PRODUCT

The historical real Gross Domestic Product figures and corresponding growth rates used in the load forecast are presented in Table 27 below.

It was established that there is a strong correlation between electricity energy consumption and Gross Domestic Product.

**Table 27: Historical Gross Domestic Product values and computed growth rates**

YEAR	2018/ 19	2019/ 20	2020/ 21	2021/ 22	2022/ 23	2023/ 24
Real Gross Domestic Product 8 (Bn UGX)	128,694	138,283	148,278	162,123	184,895	212,541
Growth Rate (%)		7.5%	7.2%	9.3%	14.0%	14.95%

The Gross Domestic Product was forecast as presented in Table 28 here under were using projections obtained from UBOS, National Development Plan IV and Vision 2040 report.

**Table 28: Gross Domestic Product projections**

FINANCIAL YEAR	2024/2025	2029/30	2034/35	2039/40
Forecasted Gross Domestic Product growth rate (%)	6.4% <sup>9</sup>	10.6% <sup>10</sup>	8.07%	7.83% <sup>11</sup>

#### 4.1.1.3. POPULATION GROWTH

The 2024 national census indicated that Uganda's population is estimated at 45.9million<sup>12</sup>, showing that the country's population has grown by 11.3million from 34.6million since the last census in 2014. At an average annual growth rate of 2.9%, Uganda's population is projected to increase from 45.9million in 2024 to 72.5million in 2040.

Our analysis revealed that the correlation between Population and energy consumption, and that of a combination of population and Gross Domestic Product were lower than Gross Domestic Product alone. Population data was therefore not used while preparing the load forecast.

#### 4.1.1.4. SYSTEM LOSSES

No matter how carefully the system is designed, losses are present. In the transmission system, losses are a summation of losses due the heating of conductors, heating of transformers, corona discharge, amongst other factors.

The historical transmission losses as reported in UETCL's System Annual Operations reports are presented in Table 29 below.

8 Source for Real Gross Domestic Product values: Uganda Bureau of Statistics (UBOS)  
 9 Source of projected Gross Domestic Product value for FY2024/25: UBOS  
 10 Source: of projected Gross Domestic Product value for FY2029/30: NDP IV (2025/26 – 2029/30)  
 11 Source of projected Gross Domestic Product value for FY2031/32 – FY2039/40: Vision 2040  
 12 Source of population values: National Population and Housing Census 2024 preliminary report (UBOS)

**Table 29: Historical Transmission system losses (FY2018/19–FY2023/24)**

Financial Year	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
Historical Transmission Losses <sup>13</sup> (%)	3.53%	3.67%	3.93%	4.53%	5.03%	4.79%

The corresponding transmission loss targets as set by the Electricity Regulatory Authority (ERA) are also presented in Table 30 below to provide a comparison between the actual and targeted transmission losses

**Table 30: ERA set targets for Transmission losses for the period 2018–2024**

Year	2018	2019	2020	2021	2022	2023	2024
Target Transmission Losses <sup>14</sup> (%)	3.37%	3.38%	3.35%	3.29%	3.03%	4.65%	4.60

Given the envisaged generation addition onto the grid, demand forecast and the envisaged network topology, the projected system loss trajectory for the period FY2024/25 – FY2039/2040 for the UETCL grid is computed as shown in the Table 31 below.

**Table 31: Transmission energy loss projections**

Year	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30 2033/34	2034/35 2038/39	2039/ 40
Transmission Losses without industries (%)	4.80%	4.91%	5.17%	5.09%	5.07%	4.31%	3.54%	4.14%
Transmission Losses with industries (%)	5.06%	4.84%	4.81%	4.75%	4.71%	4.15%	4.06%	5.52%

#### 4.1.1.5. EXPORT POTENTIAL

Uganda has five neighbouring countries and with each is either export, import or energy exchange agreement through both interconnectors and as cross boundary transactions.

The table below details the maximum power exports<sup>15</sup> for the period FY2018/19 to FY2023/2024.

**Table 32: Past Maximum exports (2018/2019–2023/2024)**

Financial Years	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
Kenya	91.64	95.38	87.54	96.51	97.95	116.90
Tanzania	19.47	17.0	19.77	24.28	29.52	32.30
Rwanda					57.87	55.01
D.R Congo	0.35	0.37	0.21	0.30	0.36	0.30
S. Sudan			0	0	0	0

<sup>13</sup> Source for historical Transmission system losses: UETCL System Annual Operations Report

<sup>14</sup> Source for Target Transmission losses: ERA set targets

<sup>15</sup> Source for maximum power exports: UETCL System Annual Operations Reports

## Observations

- Uganda – Kenya: Although Kenya indicated a need to import 50MW from Uganda, it imported up to 117MW in the period 2018/19 – 2023/24.
- Uganda –Tanzania: Uganda exported up to 32MW to Tanzania (Maximum 27.16MW to Northern Tanzania and 5.14MW to Murongo).
- Uganda–Rwanda: Uganda exported up to about 58MW to Rwanda and reduced Rwanda’s import requests to 40MW following the transformer constraints at Mbarara South as well as the instability caused to Rwanda due to transformer tripping on overload.
- Uganda–DRC: Uganda exported up to about 0.4MW to DRC.

With an exception of power supply to Northern Tanzania which is considered part of the Ugandan domestic demand for the planning period, power export and import from or to Kenya and Rwanda as well as power export to DRC are on a need versus power availability basis.

In this edition of the GDP, the approach that has been adopted is to forecast the demand considering two cases:

- Forecasting Demand for Uganda (National demand) including Northern Tanzania exports only to be considered as the domestic peak demand. This has been compared to the expected available generation capacity which further determines available Surplus in forecasted years.
- Forecasting Demand considering the adopted domestic demand (the national demand including Northern Tanzania exports), as well as additional exports to neighbouring countries. Exports to Kenya, Rwanda, DRC, Tanzania through Murongo and South Sudan will be on availability basis in the absence of committed power exchange amounts. This shall also take into consideration the emerging request for power under the new regulations of direct Supply to big consumers

The assumptions used to forecast exports are briefly explained below, with the exports presented in Table 33 here under.

- Exports to Northern Tanzania only (through Kyaka), assumed to range up to 40MW for the entire planning horizon
- Exports to Kenya were assumed to range from 4MW to 100MW in the planning horizon. The maximum exports of 100 MW are based on historical trade patterns via the existing Uganda–Kenya interconnection.
- Exports of up to 60MW to Rwanda were assumed in order not to destabilize the Rwanda grid.
- Exports to the DR.Congo were assumed to range from 20MW to 100MW in the planning horizon. The maximum exports of 100 MW were assumed as a conservative approach informed by demand patterns observed on the Uganda–Kenya 400 kV interconnector and applied to the proposed Uganda–DRC 400 kV interconnector.
- Exports to South Sudan were projected to range from 45.7 MW to 261.3 MW over the planning horizon, based on findings obtained from the Uganda–South Sudan feasibility study.
- Additional exports to Tanzania (Murongo) across the planned 400kV interconnector were assumed at range from 4MW to 140MW, in the planning horizon.

**Table 33: Projected Exports to neighbouring countries**

Financial Years	Kenya Exports (MW)	Rwanda Exports (MW)	DRC Exports (MW)	South Sudan Exports (MW)	Northern Tanzania Exports (MW)	Additional Tanzania Exports (MW)	Total Additional Exports (MW)
2024/25	100	60	0	0	40	0	200
2025/26	100	60	0	0	40	0	200
2026/27	100	60	0	0	40	0	200
2027/28	100	60	0	0	40	0	200
2028/29	100	60	0	45.7	40	4	249.7
2029/30	4	60	20	69.4	40	4	197.4
2030/31	4	60	20	95.2	40	4	223.2
2031/32	4	60	20	124.5	40	4	252.5
2032/33	4	60	50	154.3	40	4	312.3
2033/34	4	60	50	144.3	40	4	302.3
2034/35	100	60	50	45.7	40	140	435.7
2035/36	100	60	100	45.7	40	140	485.7
2036/37	100	60	100	45.7	40	110	455.7
2037/38	100	60	100	115.2	40	110	525.2
2038/39	100	60	100	85.8	40	110	495.8
2039/40	100	60	100	261.3	40	110	671.3

The exports shown in the above table, indicate that tie line capacities are envisaged to Kenya and Tanzania upon commissioning of the respective 400kV transmission lines due to the upcoming competitive EAPP power trade. During this period, Kenya and Tanzania are expected to utilize power from their planned generation plants such as the planned construction of a 1GW nuclear generation plant in Kenya and an import agreement between Kenya and Ethiopia in addition to available power on the EAPP market.

It is further envisaged that upon commissioning of the additional large power plants, Uganda would have a more competitive tariff that will once again increase exports to Kenya and Tanzania. The indicative Projected Exports for the period FY2024/25 – FY2039/40 along with the planned projects intended to enable achievement of the export levels are summarized below.

**Table 34: The indicative projected exports to neighbouring countries**

Description	2024/25	2025/26–2039/40	Planned projects	Expected commissioning timeline
Kenya	100	4-100MW	400kV Karuma – Tororo T-Line	2029/30
Tanzania	40	40 – 18016MW	400kV Masaka – Mutukula T-Line	2028/29
Rwanda	60	60MW	400kV New Mbarara – Rwanda T-Line	2039/40
D.R Congo		20 – 100MW	400kV Mbarara South – Kasese – DRC T-Line	2031/32
			132kV Arua – Arue T-line	2030/31
S. Sudan		45 – 260MW	400kV Olwiyo – Bibia – South Sudan T-Line	2028/29

#### 4.1.1.6. LOAD FACTOR

A review of the 2018 to 2024 System Annual Operations reports by the UETCL System Control Centre revealed the system Load Factor as per Table 35 below.

Considering the average load will always be less than the maximum demand, a high value of Load Factor implies the load is using electrical energy on the system more efficiently.

The load factor is assumed to increase to maximum of 80% by the end of the planning period as indicated in Table 36, due to growth in the base load which is due to increased industrial loads, lowering tariffs, and improved welfare of population. These will result into better utilization of the generation resources on the grid.

**Table 35: Historical load factor**

Financial Year	2018	2019	2020	2021	2022	2023
National Load Factor (%)	72%	74%	73%	72%	77%	70%
System Load Factor (%)	75%	78%	77%	72%	79%	75%

**Table 36: Load factor projection**

Year	2024/25–2029/30	2030/31–2036/37	2037/38–2039/40
Load Factor (%)	78%	79%	80%

#### 4.1.2. ASSUMPTIONS FOR GENERATION PLAN

The assumptions for the generation plan are briefly highlighted below.

1. For the generation plants along the Nile River, the average flow considered is 1000 cumecs
2. Spinning Reserve –the additional output from generating plant that must be realizable in real time to arrest a drop of system frequency due to a loss of generation or a loss of external interconnector or mismatch between generation and demand. The spinning reserve considered the largest unit on the grid.

3. Plant factor for large hydros considered is:
  - Nalubaale & Kira – 0.66
  - Bujagali – 0.72
  - Karuma, Isimba, Ayago, Oriang, Kiba & Uhuru – 0.67
  
4. Dispatch of Bujagali HPP will follow the discharge from Kiira and Nalubaale thus limiting its capacity to 1.237 times the combined dispatch of Nalubaale and Kiira and is estimated as below;
  - Peak: 235 –250MW
  - Shoulder: 185 – 217MW
  - Off peak: 100 –169MW –The exact dispatch will depend on the coincident maximum demand requirements for the different periods.
  
5. Mini hydros have been dispatched with a plant factor between 40% and 82%. All the mini-hydro Power Plants are dispatched as base plants.

The following plant factors shown in Table 37 have been observed and are assumed to hold for the future: –

**Table 37: Plant factor for the mini-hydro plants**

Plant name/ Plant Factor	Plant name/ Plant Factor
• Mobuku 1(KML) 0.52	• Siti II 0.49
• Mobuku 3(KCCL) 0.78	• Nyamwamba I 0.48
• EPUL (Ishasha) 0.4	• Nyamwamba II 0.48
• Nyagaka 3 0.57	• Achwa I 0.41
• TPL(Bugoye) 0.77	• Achwa II 0.41
• EMS (Mpanga) 0.52	• Sindila 0.57
• Hydromaxx (Buseruka) 0.48	• Ndugutu 0.52
• Kikagati 0.76	• Kakaka 0.58
• Atari 0.77	• Kyambura 0.5
• Rwimi 0.56	• Mahoma 0.5
• Muzizi 0.57	• Nkusi 0.59
• Muvumbe 0.55	• Nyamagasani II 0.59
• Siti I 0.57	• Nyamagasani I 0.49
• Waki 0.59	• Bukinda 0.49
• Lubilia 0.57	• Nyagak 3 0.57
• Nyamwamba III 0.48	• Muyembe 0.49
• Agago/Achwa III & IV 0.41	• Nyabuhuka –Mujunju (Rwenkuba) 0.56
• Sironko 0.49	• Kabeywa I & II 0.77
• Nyamabuye 0.59	• Bukwa 0.59

Plant name/ Plant Factor	Plant name/ Plant Factor
• Keere 0.59	• Ngoryomwo 0.59
• Mazima 0.82	• Nengo Bridge 0.66
• Kigwabya 0.59	• Nsongi HPP 0.77
• Ngenge 0.59	• Mukoki 0.5
• Lwakhakha 0.59	• Bukurungo 0.5
• Nyagak 1 0.5	• Nshongezi 0.72
• Kiraboha 0.56	• Hoimo 0.588
• Rushaya 0.56	• Igassa 0.588
• Kanyampara 0.5	• Kabasanja 0.588
• Sisi 0.5	• Tokwe 0.56
• Simu 0.5	• Nsongya 0.5
• Latoro 0.41	• Nchwera 0.56
• Haisesoro 0.5	• Katooke 0.5
• Rwembya 0.48	• Rushobe 0.5
• Okollo 0.64	• Kinsonko 0.5
• Awere HPP 0.41	• Warugo 0.5
• Lower Achwa (Gidro-Sila) HPP 0.41	• Bugongo 0.59
• Esha SHPP 0.56	• Sebei HPP 0.59
• Nyakinengo SHPP 0.4	• Rwimi II HPP 0.56
• Rubabo HPP 0.5	• Buwangani HPP 0.59
• Mitaano - Kashegu (Pago) HPP 0.5	• Birara HPP 0.5

#### 6. Thermal Power Plants:

- Namanve 50MW HFO Thermal Plant: The thermal power plant shall be dispatched according to merit order dispatch of up to 50MW but with a minimum dispatch of 7MW. It has a plant factor of 97%.
- Electromaxx (50MW): The thermal power plant shall be dispatched according to merit order dispatch of up to 50MW but with a minimum dispatch of 7MW. It has a plant factor of 97%.
- Gas to Power Tilenga (200MW): The thermal plant shall be dispatched according to merit order dispatch up to 200MW. It has a plant factor of 97%.
- Gas to Power Kingfisher (39.1MW): The thermal plant shall be dispatched according to merit order dispatch up to 39.1MW. It has a plant factor of 97%.

#### 7. Cogeneration Plants

- 51MW Kakira with up to 32MW sold to the grid
- 19.5MW Kinyara majorly for own use with a planned upgrade to 40MW in 2027/28; selling up to 25MW to the grid
- 11.9MW SAIL with up to 6.9MW sold to the grid

- 25MW SCOUL with up to 19MW sold to the grid
  - 32.2MW Mayuge Sugar with 17MW sold to the grid.
  - 16MW Victoria sugar with 10MW sold to the grid
  - 20MW Biogas power plant Masindi with a plant factor of 65%.
  - 20MW Pece Biomass with a plant factor of 65%.
  - 9MW Kyankwanzi Bagasse with a plant factor of 82%
  - 15MW Kamuli sugar with a plant factor of 82%
  - 30MW Bugiri sugar with 20MW sold to the grid. It has a plant factor of 82%.
  - 5MW Modern Laminates with a plant factor of 82%
  - 10MW GM Sugar Ltd with a plant factor of 82%
  - 5MW Vidul Biomass with a plant factor of 65%
  - 32MW NLS Waste to Power with 29.5MW sold to the grid. It has a plant factor of 65%.
  - 10.2MW Premium Distillers Ltd with 6MW sold to the grid. It has a plant factor of 82%
8. Solar Power Plants
- Access Solar 10MWp dispatched during the shoulder band
  - Tororo Solar North 10MWp dispatched during the shoulder band
  - Xsabo Solar Kabulasoke 20MWp dispatched during the shoulder band
  - Bufulubi Solar 10MWp dispatched during the shoulder band
  - Tororo PV Solar 10MWp dispatched during the shoulder band
  - Nkonge Xsabo solar 20MWp dispatche during the shoulder band.
  - Busitema PV Solar 4MWp dispatched during the shoulder band
9. Solar/Wind
- Future solar plants have been planned to operate with a plant factor between 0.2 – 0.25
  - Wind power plants have been planned to operate at a plant factor of 0.34
10. All plants are scheduled according to timelines as per the PPAs or feasibility study reports

#### 4.1.3. GENERATION EXPANSION PLAN

The objective of generation expansion planning is to determine the generation capacity and energy requirements to meet forecasted demand during the planning period. It informs the need to optimize the generation resources as well as timing for new power plants.

The new power plants, their capacity and expected commissioning years are presented in Table 38 below.

Previously, the generation expansion plan projected the commissioning of large hydro power plants as follows, Kiba 400MW power plant would be commissioned by 2028/29, Oriang 392MW power plant by 2029/30, Ayago 840MW power plant by 2031/32, and the nuclear power plant; Buyende 1400MW by 2029/30 respectively.

These plants were expected to be integrated at full capacity, aligned with the anticipated demand growth. However, following the mentioned timelines would lead to excessive generation in comparison with the forecasted demand, and lead to high associated deemed energy costs.

As a result, installed capacity of the additional large hydro power plants and nuclear power plants were adjusted to follow a staggered approach and adjusted timeline as indicated in Table 38 here under.

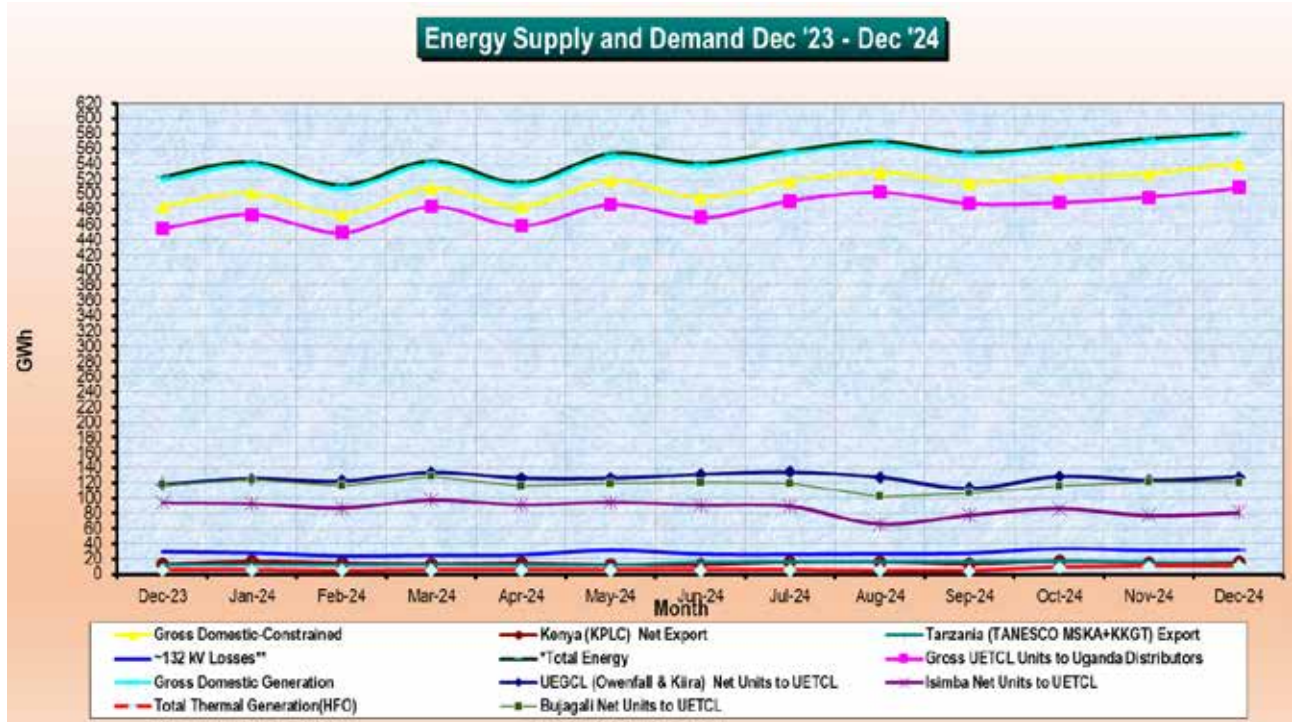
**Table 38: Curtailing of additional generation power plants and proposed commissioning year**

Year	Additional Generation Power Plants
2024/25	Nyagak I 3.5MW, Nyagak III HPP 6.6MW, Kigwabya HPP 4.2MW, Nkongwe Xsabo solar 20MW, Victoria Sugar 16MW, Kikagati – Additional 2MW, Ituka West Nile Solar PV 20MW
2025/26	Nyabuhuka–Mujunju HPP 3.2MW, Hoimo HPP 3.3MW, Igassa HPP 0.3MW, Kabasanja HPP 0.4MW, Tokwe HPP 0.3MW, Nsongya HPP 0.7MW, Nchwera HPP 0.5MW, Katooke HPP 0.3MW, Rushobe HPP 0.234MW, Kinsonko HPP 0.693MW
2026/27	Maziba HPP 1.18MW, Nengo Bridge HPP 7.5MW, Kiraboha HPP 5MW, Rushaya HPP 4.2MW, Sisi HPP 7.1MW, Simu HPP 9.5MW, Mitaano–Kashegu HPP 13.6MW, Nshongi HPP 7MW, Senok Wind 20MW, Kingfisher(Gas to power) 39.1MW, Tilenga (Gas to power) 200MW
2027/28	Sironko HPP 7MW, Nyamabuye HPP 7MW, Keere Small HPP 6.3MW, Ngoryomwo HPP 2MW, Haisesoru HPP 1.1MW, Rwembya HPP 0.4MW, Nyakinengo HPP 5.2MW, Rubabo HPP 1.8MW, Buwangani HPP 7MW, Birara HPP 1MW, Mukooki HPP 3.4MW, Bukurungo HPP 0.05MW, Warugo HPP 0.5MW, Bugongo HPP 6.5MW, Panyimur Geothermal power plant 10MW, SUNFarming Food and Energy solar 30MW, Total Energies (Iganga and Tororo) Solar plant 40MW, Machame solar plant 20MW, Biogas power plant Masindi 20MW, Pece Biomass 20MW, Kyankwazi bagasse 9MW, Bugiri Sugar bagasse 30MW, Kamuli Sugar bagasse plant 15MW, Modern Laminates bagasse plant 5MW, GM Sugar Limited bagasse plant 10MW, MMP Agro Industries Ltd Bagasse plant 20MW, Birara (1MW), Mukoki (3.4MW), Bukurungo (0.05MW), Warugo (0.5MW); Bugongo (6.5MW)
2028/29	Atari HPP 3.25MW, Agago/Achwa III & IV HPP 17.57MW, Kabeywa I&II HPP 8.5MW, Awere HPP 18MW, Lower Achwa HPP 17.8MW, Esha SHPP 4.2MW, Sebei HPP 9.5MW, Rwimi II HPP 5MW, Kabale Peat 33MW, Kabale Energy Ltd 80MW, AAAS Energy BV Solar plant 25MW, Vidul Biomass 5MW, NLS Waste to Power 32MW, Premium Distillers Ltd. 10.2MW
2029/30	Muzizi HPP 44.7MW, Nyamwamba III HPP 4.5MW, Bukwa HPP 9MW, Ngenge HPP 13.8MW, Kanyampara HPP 1.6MW, Latoro HPP 4.2MW, Okollo HPP 5MW, Panyimur Geothermal plant – additional 50MW, Floating solar 10MW, Bulambuli Solar 150MW
2030/31	–
2031/32	Nshongezi HPP 11.7MW, Panyimur Geothermal plant-additional 70MW
2032/33	Kiba HPP 300MW (Adjusted timeline with staggered installed capacity)
2033/34	Kiba HPP – additional 100MW, Oriang HPP 200MW (Adjusted timeline with staggered installed capacity)
2034/35	Oriang HPP – additional 192MW
2035/36	Ayago HPP 300MW (Adjusted timeline with staggered installed capacity), Buyende Nuclear power plant 1,400 MW (Adjusted timeline), Panyimur Geothermal plant – additional 20MW
2036/37	Ayago HPP – additional 200MW
2037/38	Ayago HPP – additional 100MW
2038/39	Ayago HPP – additional 100MW
2039/40	Uhuru17 HPP 100MW(with staggered installed capacity), Ayago HPP – additional 140MW

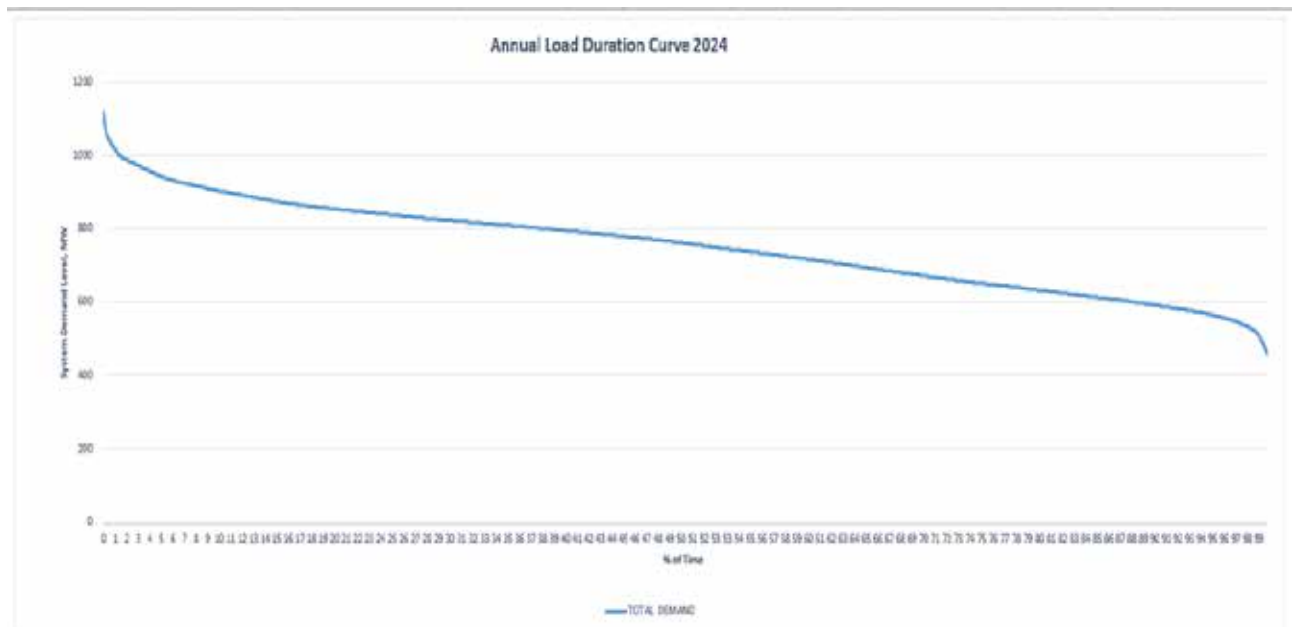
<sup>17</sup> In line with minimizing excessive generation with respect to demand, Uhuru HPP 400MW will be commissioned following a staggered approach, with the first 100MW unit schedule for commissioning in FY2039/40. The remaining units (300MW) will be installed beyond the current planning horizon

#### 4.1.4. PRESENT DEMAND–SUPPLY STATUS

The graph illustrated in Figure 7 below shows the energy demand<sup>18</sup> and supply as recorded for the period December 2023 – December 2024. An analysis shows an annual growth in energy demand. This shows that the electricity supply needs to be maintained at this rate or higher to avoid running into a deficit situation.



**Figure 7: Energy supply and demand for the period of Dec. 2023 to Dec. 2024**



**Figure 8:Load duration curve December 2024**

The Load Duration graph above shows the annual load duration for 2024. It illustrates the relationship between generating capacity requirements and capacity utilization. The curve further shows that the base load of the Ugandan grid is about 450MW and the peak load on the Uganda national

<sup>18</sup> Source: UETCL Control Center Monthly Reports

grid is about 1,000 MW that is observed to occur for approximately a period of less than 2% of the time. Therefore, there is need to improve Demand Side Management measures to reduce the peak demand to avoid investment in expensive peak generation facilities.

To meet the power and energy requirements, the generation plants in Table 39 below need to be optimally utilized.

**Table 39: Installed Generation Capacity**

GENERATOR PLANT CATEGORIZED ACCORDING BY TECHNOLOGY TYPES	
<b>LARGE HYDROS</b>	
Generator Plant Name	Installed Capacity (MW)
Nalubaale (EUL)	180
Kiira (EUL)	200
Bujagali	250
Isimba	183
Karuma	600
<b>MINI HYDROS</b>	
Generator Plant Name	Installed Capacity (MW)
Mpanga	18
Bugoye	13
Kilembe Mines	5
Kasese Cobalt	9.9
Ishasha	6.4
Buseruka	9
Rwimi	5.54
Muvumbe	6.5
Siti I	5
Siti II	16.5
Lubilia	5.4
Nyamwamba I	9.2
Nyamwamba II	7.8
Nkusi	9.6
Mahoma	2.7
Waki	4.8
Sindila	5.25
Kyambura	7.6
Ndugutu	5.9
Agago/Achwa II	41
Agago/Achwa I	42
Bukinda	6.5

GENERATOR PLANT CATEGORIZED ACCORDING BY TECHNOLOGY TYPES	
Nyamagasani 1	15
Nyamagasani 2	6.1
Kakaka	4.5
PA TECHNICAL - Kigwabya	4.2
Nyagak 1	3.5
Kikagati	14
SM Hydro	6.9
CO-GENERATION	
Generator Plant Name	Installed Capacity (MW)
Kakira Sugar Works	51
Kinyara Sugar Works	19.5
Sugar Corporation Uganda Ltd	26
SAIL Sugar Works	11.9
Mayuge Sugar	32.2
Victoria Sugar	16
THERMAL	
Generator Plant Name	Installed Capacity (MW)
Jacobsen Uganda Limited (Namanve HFO)	50
Electromaxx (HFO)	50
SOLAR	
Generator Plant Name	Installed Capacity (MW)
Access Uganda Solar	10
Tororo Solar North Limited	10
Kabulasoke Xsabo Solar	20
Bufulubi	10
Tororo Solar PV	10
Busitema	4
NKonge Xsabo Solar	20
<b>Total Installed Generation Capacity</b>	<b>2,050.39</b>

#### 4.1.5 DEMAND FORECAST

The demand prognosis was prepared using 2023/24 as the base year. For the Business-as-usual scenario demand forecast, the assumptions in section 4.1.1 above were used. A correlation factor between electricity consumption and the Gross Domestic Product was determined using historical values.

The average annual growth rate obtained for the planning period is 6.70% and 7.26% for domestic peak demand and energy respectively.

A summary of the load forecast results is shown in the proceeding tables below: -

**Table 40: Power Demand forecast for the period FY2024/25-FY2039/40**

Years	National Demand (MW)	Northern Tanzania Exports (MW)	Additional Exports (MW)	IND Load with Data Centers (MW)	Total Domestic (National demand+ Northern Tanzania exports) (MW)	Total Domestic + Additional Exports (MW)	National Demand + IND (MW)	Total Domestic + IND (MW)	Total Domestic + IND + Additional Exports (MW)
2024/25	960.2	40	160	68.6	1,000.2	1,160.2	1,028.9	1,068.9	1,228.9
2025/26	1,022.0	40	160	163.5	1,062.0	1,222.0	1,185.5	1,225.5	1,385.5
2026/27	1,088.8	40	160	168.9	1,128.8	1,288.8	1,257.7	1,297.7	1,457.7
2027/28	1,161.2	40	160	328.8	1,201.2	1,361.2	1,489.9	1,529.9	1,689.9
2028/29	1,239.5	40	209.7	340.6	1,279.5	1,489.2	1,580.1	1,620.1	1,829.8
2029/30	1,324.2	40	157.4	353.7	1,364.2	1,521.6	1,677.9	1,717.9	1,875.3
2030/31	1,414.2	40	183.2	368.1	1,454.2	1,637.4	1,782.3	1,822.3	2,005.5
2031/32	1,511.5	40	212.5	383.9	1,551.5	1,764.0	1,895.4	1,935.4	2,147.9
2032/33	1,616.6	40	272.3	401.3	1,656.6	1,928.9	2,017.9	2,057.9	2,330.2
2033/34	1,730.3	40	262.3	420.4	1,770.3	2,032.6	2,150.6	2,190.6	2,452.9
2034/35	1,853.1	40	395.7	551.4	1,893.1	2,288.8	2,404.5	2,444.5	2,840.2
2035/36	1,981.8	40	445.7	704.6	2,021.8	2,467.5	2,686.4	2,726.4	3,172.1
2036/37	2,120.6	40	415.7	730.0	2,160.6	2,576.3	2,850.6	2,890.6	3,306.3
2037/38	2,270.3	40	485.2	758.0	2,310.3	2,795.5	3,028.4	3,068.4	3,553.6
2038/39	2,431.8	40	455.8	788.8	2,471.8	2,927.6	3,220.6	3,260.6	3,716.4
2039/40	2,605.8	40	631.3	822.7	2,645.8	3,277.1	3,428.5	3,468.5	4,099.8

**Table 41: Energy Demand forecast for the period FY2024/25–FY2039/40**

Years	National Demand (GWh)	Northern Tanzania Exports (GWh)	Additional Exports (GWh)	IND Load with Data Centers (GWh)	Total Domestic (National demand + Northern Tanzania exports) (GWh)	Total Domestic + Additional Exports (GWh)	National Demand + IND (GWh)	Total Domestic + IND (GWh)	Total Domestic + IND + Additional Exports (GWh)
2024/25	6,837.0	273.3	1,093.2	469.1	7,110.3	7,927.6	7,030.1	7,579.4	8,396.6
2025/26	7,334.0	273.3	1,093.2	1,117.3	7,607.3	8,349.7	8,100.4	8,724.6	9,466.9
2026/27	7,872.0	273.3	1,093.2	1,153.8	8,145.3	8,806.4	8,593.7	9,299.1	9,960.3
2027/28	8,454.0	273.3	1,093.2	2,246.3	8,727.3	9,300.7	10,180.5	10,973.6	11,547.0
2028/29	9,083.0	273.3	1,432.8	2,327.4	9,356.3	10,175.3	10,796.6	11,683.8	12,502.7
2029/30	9,765.0	273.3	1,075.5	2,416.7	10,038.3	10,396.9	11,464.8	12,455.0	12,813.6
2030/31	10,489.0	276.8	1,267.8	2,547.1	10,765.8	11,331.7	12,334.2	13,312.9	13,878.8
2031/32	11,271.0	276.8	1,470.6	2,656.5	11,547.8	12,207.7	13,116.8	14,204.3	14,864.2
2032/33	12,117.0	276.8	1,884.4	2,776.8	12,393.8	13,349.1	13,964.7	15,170.6	16,125.9
2033/34	13,031.0	276.8	1,815.2	2,909.2	13,307.8	14,066.2	14,883.3	16,217.0	16,975.4
2034/35	14,018.0	276.8	2,738.4	3,816.0	14,294.8	15,839.1	16,639.9	18,110.8	19,655.1
2035/36	15,054.0	276.8	3,084.4	4,875.8	15,330.8	17,076.1	18,590.7	20,206.6	21,951.9
2036/37	16,170.0	276.8	2,876.8	5,052.0	16,446.8	17,829.3	19,727.6	21,498.8	22,881.3
2037/38	17,374.0	280.3	3,400.3	5,312.2	17,654.3	19,591.1	21,222.7	22,966.5	24,903.3
2038/39	18,673.0	280.3	3,194.2	5,528.0	18,953.3	20,516.4	22,569.8	24,481.3	26,044.4
2039/40	20,073.0	280.3	4,424.2	5,765.4	20,353.3	22,966.1	24,027.1	26,118.8	28,731.6

**Table 42: Average Growth Rates for both Power and Energy Demand for the period FY2024/25-FY2039/40**

Description	Average Growth Rate (%) (FY2024/25 –FY2039/40)
National Demand (MW)	6.88%
National Demand + IND19 with Data Centers (MW)	8.42%
Domestic Demand (i.e., National Demand + Northern Tanzania Exports) (MW)	6.70%
Domestic Demand + IND with Data centers (MW)	8.22%
Domestic Demand + Additional Exports (MW)	7.20%
Domestic Demand + Additional Exports + IND with Data centers (MW)	8.44%
National Demand (GWh)	7.44%
National Demand + IND with Data Centers (GWh)	8.60%
Domestic Demand (i.e., National Demand + Northern Tanzania Exports) (GWh)	7.26%
Domestic Demand + IND with Data centers (GWh)	8.65%
Domestic Demand + Additional Exports (GWh)	7.39%
Domestic Demand + Additional Exports + IND with Data centers (GWh)	8.62%

<sup>19</sup> Industrial load projections considered anticipated industries as well as emerging data centres. Some of the key industrial loads and data centres envisaged to contribute to the future load include.

- Katikelle Klinker factory (industrial load) initially estimated at 30MW, and anticipated to scale up to 80MW
- Taifa Data centre; initially estimated at 50MW, with projected growth up to 100MW by the end of the planning horizon
- Nuhive Data centre; starting at 20MW, anticipated to scale up to 100MW
- Carefree and Zhurong Data centres; combined initial demand of 40MW, anticipated to reach 150MW.
- Bridger Solutions, Synetics and Green Hydrogen, collectively projected to grow up to 100MW

#### 4.1.6. FORECASTED GENERATION MIX

The generation expansion plan has been presented in Table 38 above. A deeper look into the generation mix reveals that the Uganda system will continue to rely heavily on green sources of electrical energy.

The system is initially dominated by hydropower, contributing approximately 83% in the early years of the planning horizon. However, with the planned diversification of the generation mix to introduce nuclear, hydropower's share is projected to decline to 58% by the end of the planning horizon, while nuclear is expected to contribute 21%.

The graphs in Figure 9 here under show the installed capacity of the generation mix in the various years of FY2024/25, FY2029/30, FY2034/35 and FY2039/40 respectively.

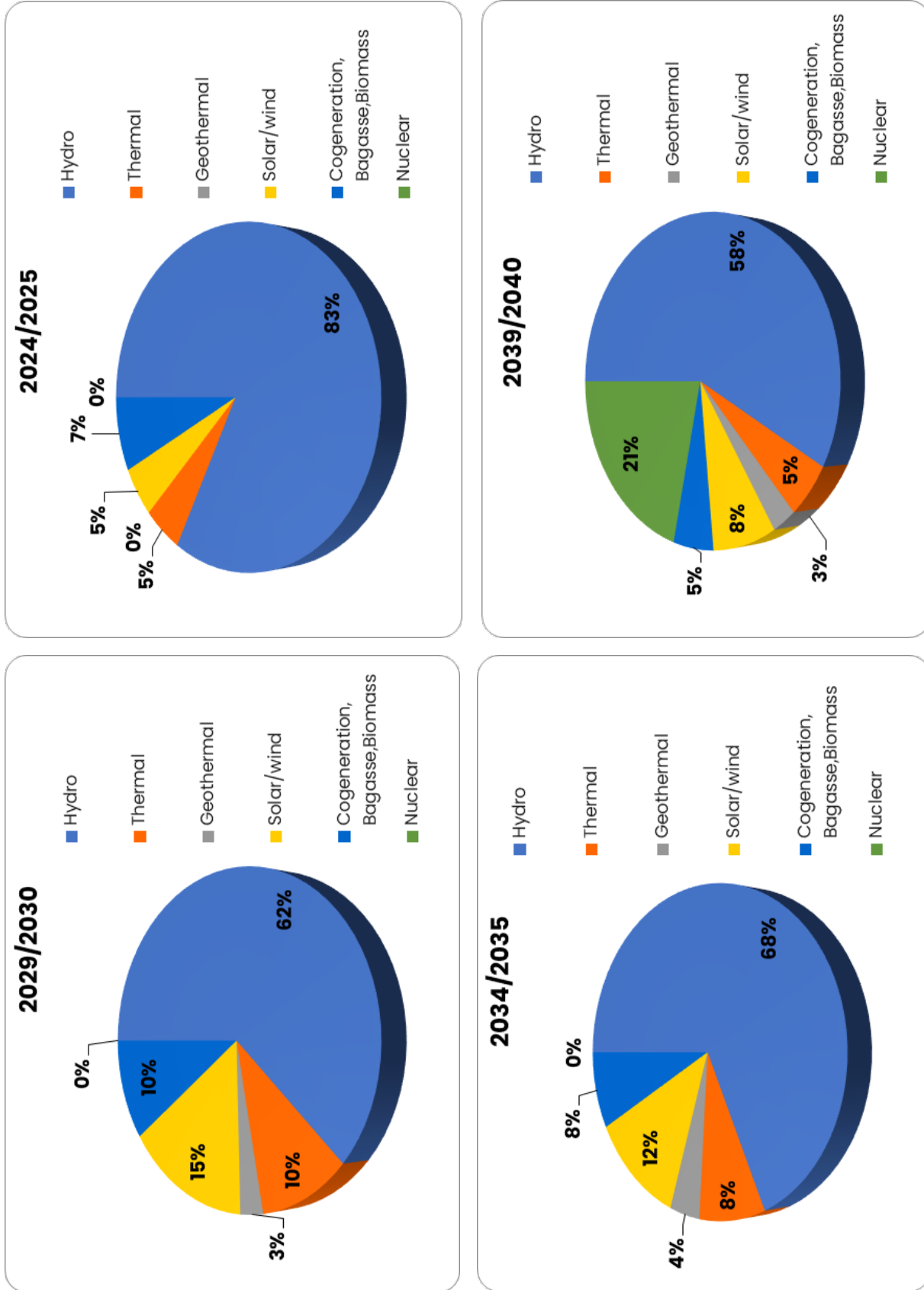
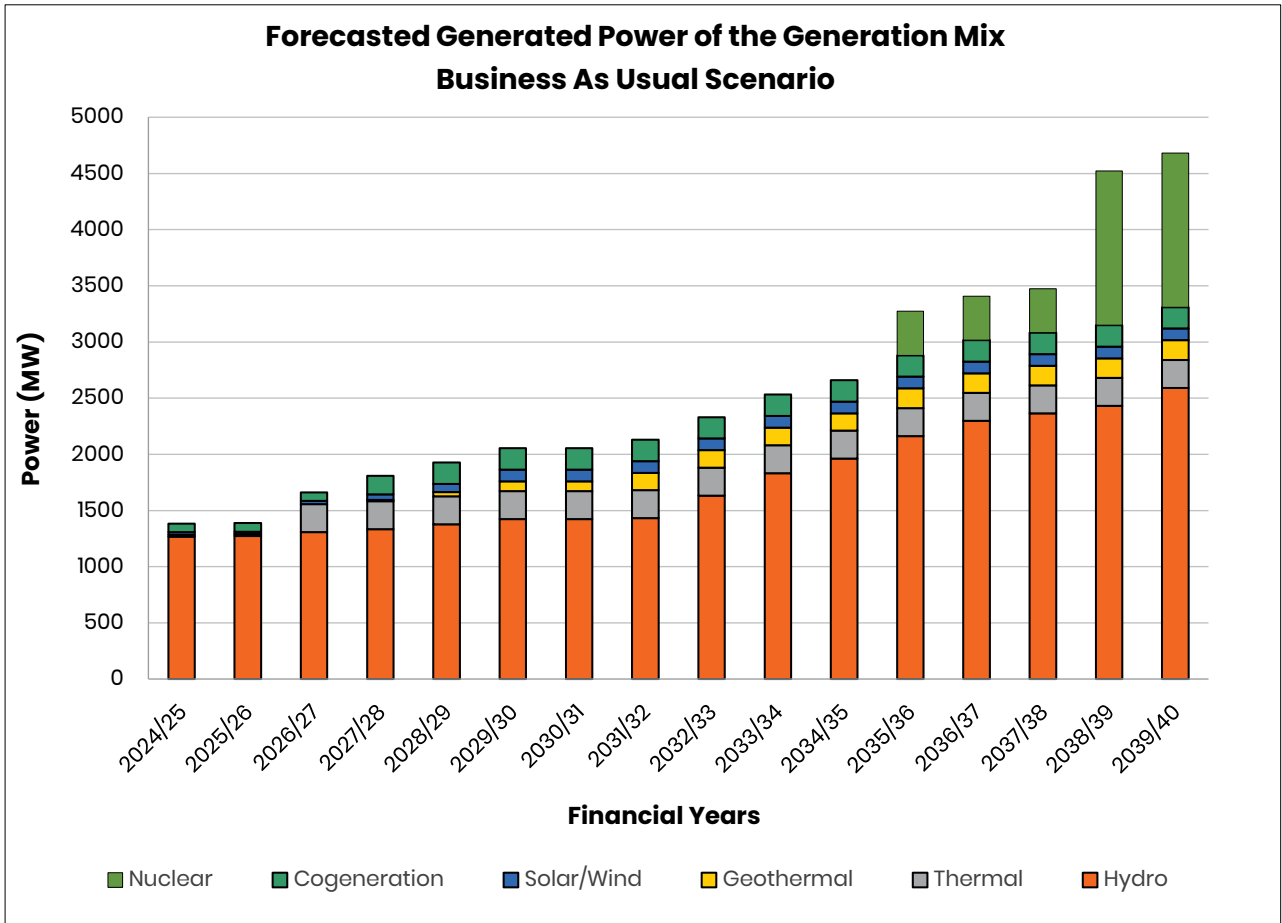


Figure 9: Forecast Generation Mix for the business as usual scenario

Figure 10 below shows the forecast generated power of the generation mix for the planning horizon



**Figure 10: Forecasted generated power of the generation mix for planning period FY2024/25–FY2039/40**

**4.1.7. DEMAND–SUPPLY BALANCE FINDINGS**

A Demand–Supply balance was conducted to ascertain whether the generation capacity meets the projected demand and envisaged additional loads including the export requirements and required spinning reserve.

The Demand–Supply Power and Energy balance detailed results that considered domestic demand (i.e., Uganda’s national demand including Northern Tanzania exports), industrial loads with data centers and Additional Exports are summarized as shown here under in Table 43 and Table 44 respectively and illustrated in Figure 11 and Figure 12 respectively.

The excess/deficit power and energy supply are illustrated in Figure 13 and Figure 14 respectively.

**Table 43: Demand-Supply Power Balance showing Excess/Deficit supply FY2024/25-FY2039/40 for BAU Scenario**

Financial Years	Installed Capacity (MW)	Available Generation (minus spinning reserve) (MW)	Total Domestic Demand (National demand + Northern Tanzania exports) (MW)	Excess/Deficit for Domestic Demand (MW)	Total Domestic demand + Additional Exports (MW)	Excess/Deficit for Domestic Demand + Additional Exports (MW)	Total Domestic demand + Additional Exports (MW)	Excess/Deficit for Domestic Demand + Additional Exports (MW)	Total Domestic demand + Additional Exports (MW)	Excess/Deficit for Domestic Demand + Additional Exports (MW)
2024/25	2,078.0	1,260.0	1,000.2	259.8	1,160.2	99.8	1,068.9	191.1	1,228.9	31.1
2025/26	2,087.9	1,265.5	1,062.0	203.5	1,222.0	43.5	1,225.5	40.0	1,385.5	-120.0
2026/27	2,407.0	1,532.8	1,128.8	404.0	1,288.8	244.0	1,297.7	235.1	1,457.7	75.1
2027/28	2,705.7	1,656.0	1,201.2	454.8	1,361.2	294.8	1,529.9	126.0	1,689.9	-34.0
2028/29	2,971.8	1,754.0	1,279.5	474.6	1,489.2	264.9	1,620.1	133.9	1,829.8	-75.8
2029/30	3,264.6	1,849.3	1,364.2	485.1	1,521.6	327.7	1,717.9	131.4	1,875.3	-26.0
2030/31	3,264.6	1,849.3	1,454.2	395.1	1,637.4	211.9	1,822.3	27.0	2,005.5	-156.2
2031/32	3,346.2	1,925.6	1,551.5	374.1	1,764.0	161.6	1,935.4	-9.8	2,147.9	-222.3
2032/33	3,646.2	2,126.6	1,656.6	469.9	1,928.9	197.6	2,057.9	68.7	2,330.2	-203.6
2033/34	3,946.2	2,327.6	1,770.3	557.3	2,032.6	295.0	2,190.6	136.9	2,452.9	-125.4
2034/35	4,138.2	2,456.2	1,893.1	563.2	2,288.8	167.5	2,444.5	11.8	2,840.2	-383.9
2035/36	5,858.2	3,068.6	2,021.8	1,046.8	2,467.5	601.1	2,726.4	342.3	3,172.1	-103.4
2036/37	6,058.2	3,202.6	2,160.6	1,042.0	2,576.3	626.3	2,890.6	312.0	3,306.3	-103.7
2037/38	6,158.2	3,269.6	2,310.3	959.3	2,795.5	474.1	3,068.4	201.3	3,553.6	-283.9
2038/39	6,258.2	4,316.6	2,471.8	1,844.9	2,927.6	1,389.1	3,260.6	1,056.1	3,716.4	600.3
2039/40	6,498.2	4,477.4	2,645.8	1,831.6	3,277.1	1,200.3	3,468.5	1,008.9	4,099.8	377.6

**Table 44: Demand-Supply Energy Balance showing Excess/Deficit supply FY2024/25–FY2039/40 for BAU scenario**

Financial Years	Available Generation (minus spinning reserve) (GWh)	Total Domestic Demand (National Demand + Northern Tanzania exports) (GWh)	Excess/Deficit for Domestic Demand (GWh)	Total Domestic Demand + Additional Exports (GWh)	Excess/Deficit for Domestic Demand + Additional Exports (GWh)	Total Domestic Demand + Additional Exports (GWh)	Excess/Deficit for Domestic Demand + Additional Exports (GWh)	Total Domestic Demand + Additional Exports (GWh)	Excess/Deficit for Domestic Demand + Additional Exports (GWh)
2024/25	9,553.6	7,110.3	2,102.0	7,927.6	1,245.5	7,579.4	1,590.7	8,396.6	732.1
2025/26	9,599.9	7,607.3	1,619.1	8,349.7	840.3	8,724.6	453.1	9,466.9	-325.2
2026/27	11,905.0	8,145.3	3,338.6	8,806.4	2,643.3	9,299.1	2,158.6	9,960.3	1,465.7
2027/28	13,125.7	8,727.3	4,058.5	9,300.7	3,351.6	10,973.6	1,630.9	11,547.0	1,030.2
2028/29	14,127.1	9,356.3	4,400.7	10,175.3	3,436.0	11,683.8	1,893.1	12,502.7	1,035.5
2029/30	15,197.2	10,038.3	4,830.6	10,396.9	4,352.3	12,455.0	2,225.3	12,813.6	1,851.9
2030/31	15,197.2	10,765.8	4,071.7	11,331.7	3,377.2	13,312.9	1,331.8	13,878.8	742.5
2031/32	15,838.9	11,547.8	3,897.6	12,207.7	3,105.1	14,204.3	1,045.1	14,864.2	357.8
2032/33	17,546.8	12,393.8	4,723.1	13,349.1	3,622.4	15,170.6	1,746.6	16,125.9	751.7
2033/34	19,254.8	13,307.8	5,477.7	14,066.2	4,582.3	16,217.0	2,364.8	16,975.4	1,574.9
2034/35	20,347.8	14,294.8	5,651.3	15,839.1	3,948.0	18,110.8	1,501.7	19,655.1	-105.3
2035/36	25,549.8	15,330.8	9,780.6	17,076.1	7,869.2	20,206.6	4,522.8	21,951.9	2,706.6
2036/37	26,688.5	16,446.8	9,763.7	17,829.3	8,228.0	21,498.8	4,316.8	22,881.3	2,878.2
2037/38	27,257.8	17,654.3	9,082.8	19,591.1	6,973.1	22,966.5	3,358.9	24,903.3	1,343.4
2038/39	36,154.3	18,953.3	16,634.3	20,516.4	14,911.7	24,481.3	10,679.1	26,044.4	9,052.6
2039/40	37,520.7	20,353.3	16,429.0	22,966.1	13,603.8	26,118.8	9,960.2	28,731.6	7,203.1

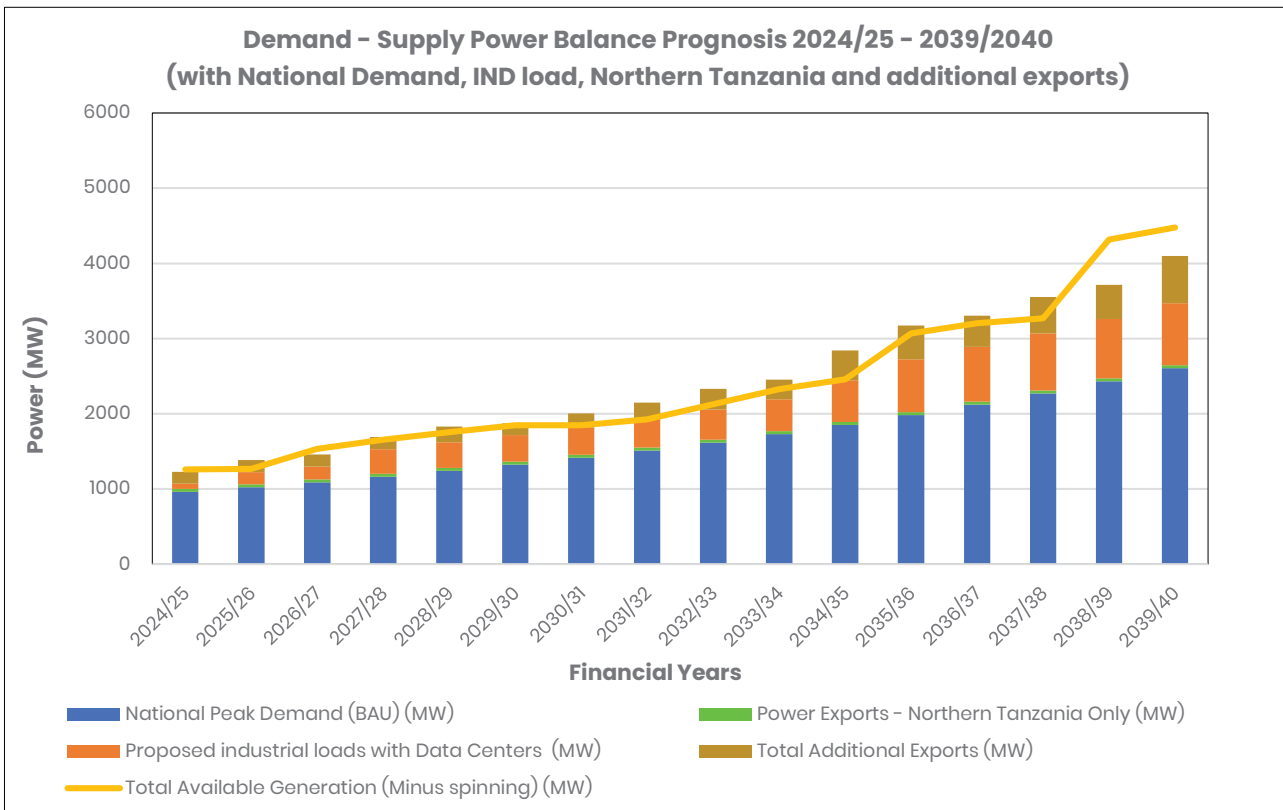


Figure 11: Demand-Supply power balance of BAU Scenario

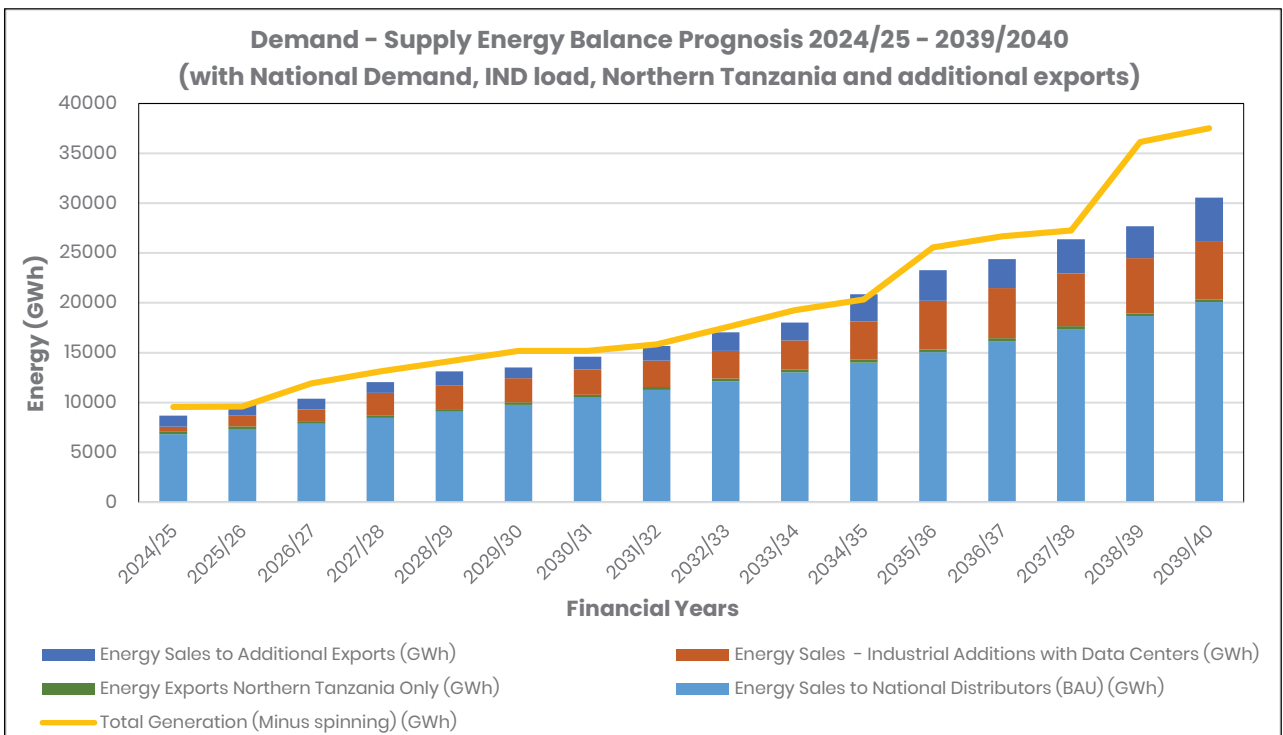


Figure 12: Demand-Supply Energy balance of BAU scenario

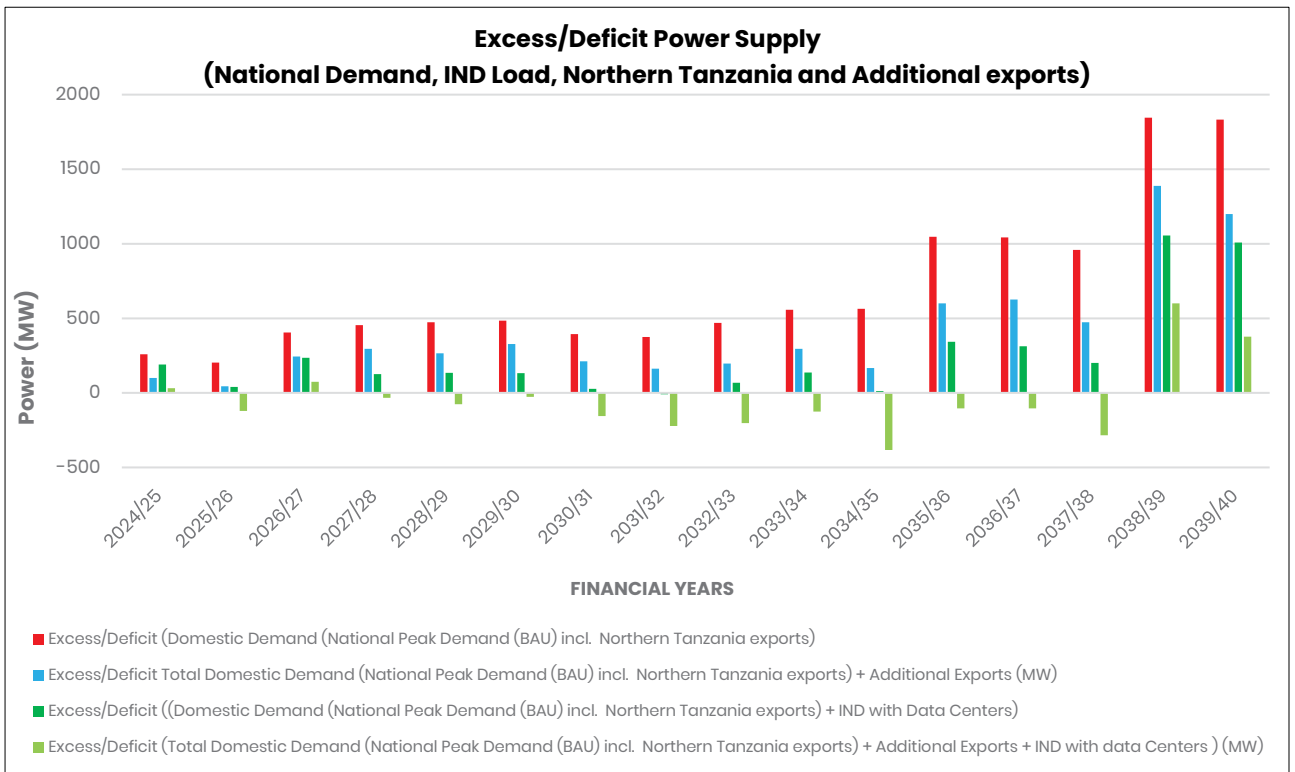


Figure 13: Excess/Deficit Power supply for BAU scenario

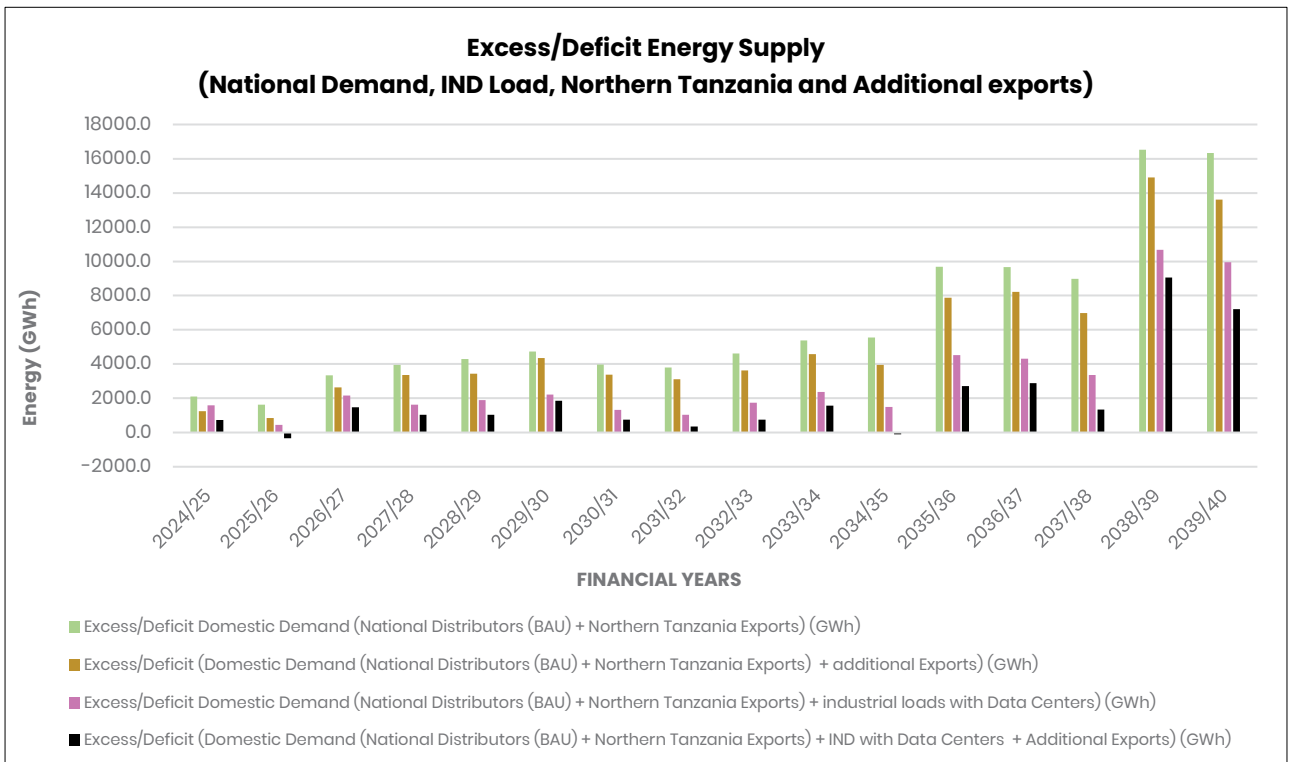


Figure 14: Excess/Deficit Energy for BAU scenario

#### 4.1.7.1. OBSERVATIONS FROM DEMAND SUPPLY BALANCE

##### Observations

For the Demand-Supply Power Balance

- The surplus generation capacity to meet any additional demand, after accounting for domestic demand ranges from 203.5MW in 2025/26 to 1,844.9MW in 2038/39.
- With the consideration of envisaged additional industrial loads and emerging data centers, the surplus generation capacity after meeting domestic demand and industrial loads is projected to range from 11.8MW in 2034/35 to 1,056.1MW in 2038/39 to meet additional demand.
- However, a deficit is observed of 9.8MW in 2031/32, indicating that the available generation may be inadequate to fully support significant additional loads and data centers
- Surplus generation capacity sufficient to support additional demand after accounting for domestic demand and Additional exports is projected to range from 43.5 MW in FY2025/26 to 1,389.1 MW in FY2038/39.
- Similarly, excess generation ranging between 31.1MW in FY2024/25 and 600.3 MW in FY2038/39 suggests the potential to accommodate additional demand after accounting for domestic demand, exports, new industrial loads and emerging data centers demand.
- However, deficits are observed ranging from 26.0 MW in FY2029/30 to 383.9 MW in FY2034/35, indicating that the available generation may be inadequate to fully support significant additional loads and data centers.

For the Demand-Supply Energy Balance

- The surplus generated energy to meet any additional energy needs after domestic demand energy needs ranges from 1,619.1GWh in 2025/26 to 16,530.1GWh in 2038/39.
- With the consideration of envisaged additional industrial loads and emerging data centers, the surplus generated energy after meeting domestic demand, and industrial load demand energy needs ranges from 453.1GWh in 2025/26 to 10,679.1GWh in 2038/39.
- Surplus generated energy after supporting domestic demand and Additional exports energy needs is projected to range from 840.3GWh in FY2025/26 to 14,911.7GWh in FY2038/39.
- Similarly, excess generated energy ranging between 357.8GWh in FY2031/32 and 9,052.6GWh in FY2038/39 suggests the potential to accommodate additional domestic demand, exports, new industrial loads and emerging data centers demand energy needs
- However, deficits are observed ranging from 103.5GWh in FY2034/35 to 325.2GWh in FY2025/26, indicating that the available generated energy may be inadequate to fully support significant additional loads and data centers.

#### 4.1.7.2. RECOMMENDATIONS

- Demand Growth opportunities need to be explored to realize demand that matches the generation capacity development for cases of surplus generation. Considering that the magnitude of available generation capacity varies widely over continuous period, it is advantageous for the country to harness the benefits of being part of the power pool which would allow for power exchange as required.

It should be noted that data centers could draw power from the grid at a higher tariff than that for excess power. The tariff proposed for power that could be drawn from the grid is the Bulk Supplier Tariff for Big Consumers as guided under the Supply of Electricity in Bulk to Specified Consumers Regulations, 2022.

Furthermore, it should be noted that there is currently no legal framework for the sale of excess power. The excess power is subject to availability as declared by the System Operator.

## 4.2. POWER SYSTEM ANALYSIS

### 4.2.1. PRESENT POWER SYSTEM

The current transmission lines and substations are presented in appendix A.1 and A.2 detailing the capacities of the components. The present 2025 power system network is illustrated in appendix A.3.1. The grid consists of:

- **The hydro power plants:** Karuma (600MW), Owen-Falls complex (Nalubaale and Kiira HPPs) whose installed capacity is 380MW, Bujagali (250MW), Isimba (183MW), Tibet Hima mining Co Ltd formerly Kilembe mines (5MW), Ishasha (6.4MW), Mpanga (18MW) Bugoye (13MW), Buseruka (9MW), Kasese Cobalt company Ltd (9.9MW), Muvumbe (6.5MW), Rwimi (5.54MW), Nkusi (9.6MW), Siti I (5MW), Siti II (16.5MW), Nyamwamba I (9.2MW), Nyamwamba II (7.8MW), Lubilia (5.4MW), Nyamagasani I (15MW), Nyamagasani II (6.1MW), Mahoma (2.7MW), Ndugutu (5.9MW), Sindila (5.25MW), Waki (4.8MW), Achwa I (4.2MW), Achwa II (4.1MW), Kyambura (7.6MW), Bukinda (6.5MW), Kakaka (4.5MW), Kikagati (14MW), Muyembe (6.9MW), Kigwabya (4.2MW), Nyagak I (3.5MW), SM Hydro (6.9MW)
- **The thermal power plants:** Namanve (50MW) and Electromaxx (50MW) plants
- **Co-generation, Bagasse plants:** Kakira Sugar works (51MW) plant, Kinyara sugar works 19.5MW plant, SCOUL (26MW) and Sail plant (11.9MW), Mayuge Sugar (32.2MW), Victoria Sugar (16MW)
- **Solar plants:** Access solar TSK 10MW, Tororo solar north 10MW, Kabulasoke Xsabo solar 20MW, Bufulubi 10MW, Tororo PV (10MW), Busitema Solar (4MW), Nkongwe Xsabo solar 20MW
- **The transmission grid:** Presently, the transmission grid comprises 606km of 400kV, 1,002.24km of 220kV, 3,314.1km of 132kV overhead line, 35.2km of 66kV high voltage, 0.9km of 132kV Underground cable transmission lines and 43 substations (including Isimba & Nalubaale switching stations and as well as the mobile substation).

### 4.2.2. POWER SYSTEM MODELS

The power system analysis was carried out using the status of the network of May 2025 as the base year scenario. Power system models were developed to enable analysis of present and future power systems. An Engineering software, PSS/E (Power System Simulation for Engineers), was used to develop the models.

Eight models were developed to analyze the present and future grids. The eight models include the 2024/2025 model, 2025/2026 model, 2026/2027 model, 2027/2028 model, 2028/2029 model, 2029/2030 model, 2034/2035 model and 2039/2040 model.

The above grid models were established and analyzed to determine whether the grid shall behave within agreed voltage and thermal limits. The power system studies included: load flow and fault analysis.

The results were analyzed to pre-determine the following:

- Network reliability in terms of transmission line and power transformer loading (N-1 Criteria being fulfilled)
- Power supply quality in terms of voltage limits
- Technical losses and Optimum utilization of transmission lines and substations

#### 4.2.2.1. MODEL INPUTS AND OUTPUTS

##### Input Data

The input data for power system modelling is:

- Plant and Generator data
- Transformer data
- Substation loads
- Line parameters for Existing transmission lines
- Line parameters for planned transmission lines
- Reactive power compensation data

##### Output Results

The output results for power system modelling are:

##### a. Power flow result in terms of:

- Voltage profile to guard against insulation failure and maintain quality of supply
- Line and transformer loading
- Power flow and
- Losses

##### b. Fault calculation results in terms of:

- Fault levels to confirm switchgear safe breaking capability  
The technical analysis derived from power system studies formed a basis for determining technical viability and timing of the projects.

The technical analysis was conducted by studying two major scenarios, each with two sub scenarios as outlined below:

1. Business as Usual case, where projects are commissioned within the anticipated timelines.
2. Sensitivity analysis case, where projects are delayed and commissioned one year later than initially planned, specifically for FY 2028/29 and FY2029/30.

Under each major scenario, two demand sub scenarios were considered.

1. Base case, where Demand is exclusive of the envisaged industrial load.
2. High case, where Demand is inclusive of the envisaged industrial load

The results of the studies are presented below.

#### 4.2.2.2. FY 2024/25 MODEL: MAY – PEAK SYSTEM

##### Key Events

- Power plants commissioned:
  - Karuma (600MW) fully commissioned
  - Nyagak I (3.5MW) connected to the grid
  - Nkongge Xsabo solar (20MW)
  - Kigwabya (4.2MW) connected to the grid
  - Nyagak III (6.6MW)
  - Ituka West Nile Solar PV (20MW)
  - Victoria Sugar (16MW)
  - Kikagati (additional 2MW)
- Projects commissioned:
  - 132kV Kole-Gulu-Nebbi-Arua Project (Substations: 2X32/40MVA 132/33kV Gulu SS, 2X32/40MVA 132/33kV Nebbi SS & 2X32/40MVA 132/33kV Arua SS; Transmission Lines: 75.1km 132kV Kole SS - Gulu SS, 159.4km 132kV Gulu SS - Nebbi SS & 60km 132kV Nebbi SS - Arua SS), Kole Swich-yard upgrade to 2x40MVA 132/33kV substation, 4x132kV Line bays at Olwiyo substation.
  - 85km 132kV Mirama - Kabale Transmission Line (2X32/40MVA 132/33kV Kabale SS)
  - 132kV Gulu – Agago 83km double circuit and associated substation (2x32/40MVA).
  - 23.5km 132kV double circuit Mutundwe – Entebbe transmission line (2x60/80MVA 132/33kV Entebbe substation)

##### 4.2.2.2.1. FY2024/25 MODEL ANALYSIS OF BASE CASE (WITHOUT ENVISAGED INDUSTRIAL LOAD)

The demand and generation capacity modeled are: -

- Peak Demand : 1,176.22MW
- Transmission losses (loss factor) : 59.5MW (4.80%)
- Required Generation : 1,240.3MW

##### 4.2.2.2.2. FY2024/25 MODEL ANALYSIS OF HIGH CASE (WITH ENVISAGED INDUSTRIAL LOAD)

The demand and generation capacity modeled are: -

- Peak Demand : 1,160.2MW
- Industrial +Data centers Demand : 68.65MW
- Total system Demand : 1,228.82MW
- Transmission losses (loss factor) : 65.7MW (5.06%)
- Required Generation : 1,299.1MW

##### Findings

- **Voltage Violations**
  - No violations

- **N – 1 Loading violations observed at:**
  - Substations: Kawanda 132/33kV (101.9%), Mutundwe 132/33kV (82.6%), Mutundwe 132/11kV (89.2%), Kawaala 132/11kV (85.5%)
- **Fault level violations**
  - No observed fault level violations
- **Mitigation Measures**
  - Reticulate the 33kV network of Bombo area to be supplied from Kasana substation to relieve Kawanda substation.
  - Expedite the procurement of new transformers for Kawanda 2x60/80MVA 132/33kV and Mutundwe 2x32/40 132/11kV substations to increase transformation capacities at the respective substations

#### 4.2.2.3. FY 2025/26 MODEL

#### Key Events

- Power plants commissioned:
 

➤ Hoimo (3.3MW)	➤ Nchwera (0.5MW)
➤ Igassa (0.3MW)	➤ Katooke (0.3MW)
➤ Kabasanja (0.4MW)	➤ Rushobe (0.234)
➤ Tokwe (0.3MW)	➤ Kinsonko (0.693MW)
➤ Nsongya (0.7MW).	➤ Nyabuhuka-Mujunju (Rwenkuba) (3.2MW)
- Projects commissioned:
  - 132kV Kabaale Industrial Park Substation Phase 1 (132/33kV 3x60/80MVA Kabaale SS); 6km Underground Cable LILO from Hoima - Fort Portal transmission line to Kabaale Industrial Park SS
  - 141.2km 132kV Tororo - Opuyo Transmission Line Project
  - 42.5 km 132kV Matugga - Kasana T/L , 132kV Switching Station at Matugga and 1X20MVA, 132/33kV Substation Phase 1.
  - Mbarara North Power transformer Upgrade 1x15MVA to 32/40MVA.
  - Nkenda Power transformer Upgrade 1x20MVA to 60/80MVA
  - 1 x 40MVAR Reactor at Fort Portal Substation
  - 1km 132kV LILO from Tororo - Lessos transmission line to Sukulu Phosphate SS(2X60/80MVA 132/33kV Power Transformers -Phase 1)

#### 4.2.2.3.1. FY2025/26 MODEL ANALYSIS OF BASE CASE (WITHOUT ENVISAGED INDUSTRIAL LOAD)

The demand and generation capacity modeled are: -

- Peak Demand : 1,222MW
- Transmission losses (loss factor) : 64.9MW (5.01%)
- Required Generation : 1,295.2MW

#### Findings

- **Voltage Violations**
  - No violations were observed
- **Loading violations**
  - Nkonge 132/33kV (128.3%)
- **N – 1 Loading violations observed at;** ➤ Masaka West 132/33kV (91.3%), Namanve 132/33kV (82.5%), Lugogo 132/33kV (78%), Kawaala 132/11kV (76.2%)
- **Fault level violations** ➤ No violations were observed.

#### 4.2.2.3.2. FY2025/2026 MODEL ANALYSIS OF HIGH CASE (WITH ENVISAGED INDUSTRIAL LOAD)

The demand and generation capacity modeled are: -

- Peak Demand : 1,222MW
- Industrial +Data centers Demand : 163.51MW
- Total system Demand : 1,385.51MW
- Transmission losses (loss factor) : 67.7MW (4.62%)
- Required Generation : 1,465.3MW

#### Findings

- **Violations**
  - No violations were observed
- **Loading violations**
  - Nkonge 132/33kV (135.5%)
- ➤ Masaka West 132/33kV (96.4%), Namanve 132/33kV (86.6%), Lugogo 132/33kV (80.4%), Kawaala 132/11kV (78.6%)
- ➤ Mutundwe 11kV (20.1kA)

#### Mitigation Measures

- Expedite the procurement of the third transformer at Namanve substation

- Exchange transformers of Masaka West with transformers from Agago.
- Expedite upgrade of the 11kV distribution system in the Kawaala environs to a 33kV system to fully utilize the newly commission 132/33kV Kawaala substation
- Upgrade of all 25kA rated 11kV circuit breakers at Mutundwe to ones with a 31.5kA short circuit withstand capacity or installation of current limiting reactors.

#### 4.2.2.4. FY 2026/2027 MODEL

##### Key Events

- Power plants commissioned:
  - Maziba (1.18MW)
  - Nengo Bridge HPP (7.5MW)
  - Kiraboha (5MW)
  - Rushaya (4.2MW)
  - Sisi (9.5MW)
  - Simu (7.1MW)
  - Mitaano – Kashegu (Pago) (13.6MW)
  - Nsongi (11.9MW)
  - Gas to Power – Tilenga (200MW)
  - Gas to Power – Kingfisher (39.1MW)
  - Senok Wind (20MW)
- Projects commissioned:
  - Kampala Metropolitan Area Improvement Project (Transmission Lines; 25.4km 132kV 1 cct Mukono branch point (Northern trunk line) – Kampala North Substation, 10.2km 2cct Kampala North Substation – Mutundwe Substation, 5.3km 132kV 2 cct Kampala North Substation – Lugogo Substation, 0.1km 132kV 2 cct Kawaala branch point – Kawaala Substation, 0.3km 132kV 2 cct (New Mukono Substation – Mukono Substation), 4.2km 220kV 4 cct New Mukono branch point – New Mukono Substation, 0.4km 132km 2 cct New Mukono Substation – New Mukono branch point (Southern trunk line), 0.8km 132kV 2 cct Buloba branch point – Buloba Substation, 0.9km 220kV 4 cct Buloba branch point – Buloba Substation; Substations (2X 125MVA 220/132kV Buloba SS, 2X40MVA 132/33kV Buloba SS, 3X200MVA 220/132/33kV Mukono SS, 3X40MVA 132/33kV Kawaala SS, 1X20MVA 132/11kV Kawaala SS, 1X250MVA 220/132/33kV Bujagali SS, 1X20MVA 132/33kV Mobile SS)
  - 50MVA Mbale Mobile Substation (assuming financing is confirmed by May 2025)
  - Mirama Substation Upgrade (Relocation of 2X20MVA, 132/33kV Transformers from Mbarara North and Nkenda Substations)
  - Kasana Substation Power Transformer Upgrade (1x32/40MVA, 132/33kV)
  - 220kV NELSAP (Bujagali – Tororo & Mbarara – Mirama): Residual work at Mirama and Tororo SSs; Transmission Lines: 131.2km 220kV Bujagali – Tororo- UG/KY Border

##### 4.2.2.4.1. FY2026/2027 MODEL ANALYSIS OF BASE CASE (WITHOUT ENVISAGED INDUSTRIAL LOAD)

The demand and generation capacity modeled are: -

- Peak Demand : 1,288.8MW
- Transmission losses (loss factor) : 74.6MW (5.43%)
- Required Generation : 1,372.2MW

## Findings

- - Kawaala 132kV (0.94p.u), Kampala North 132kV (0.94p.u), Mutundwe 132kV (0.94p.u), Tororo (0.93p.u), Namanve South 132kV (0.94p.u), Kawanda (0.94p.u), Lugogo 132kV (0.94p.u), Kapeeka 132kV (0.93p.u), Clock Tower (0.94p.u).
- **Loading violations observed at:**
  - Masaka 132/33kV (97.6%), Nkongge 132/33kV (137.4%)
- **N – 1 Loading violations observed at:**
  - Lugogo 132/33kV (81.4%), Kawaala 132/11kV (81%)
- **Fault level violations**
  - No violations were observed.

### 4.2.2.4.2. FY2026/2027 MODEL ANALYSIS OF HIGH CASE (WITH ENVISAGED INDUSTRIAL LOAD)

The demand and generation capacity modeled are: -

- Peak Demand : 1,288.8MW
- Industrial +Data centers Demand : 168.87MW
- Total system Demand : 1,457.711MW
- Transmission losses (loss factor) : 73.9MW (4.78%)
- Required Generation : 1,540.5MW

## Findings

- **Voltage Violations observed at:**
  - Kawaala 132kV (0.9p.u), Kampala North 132kV (0.92p.u), Mutundwe 132kV (0.92p.u), Tororo (0.91p.u), Namanve South 132kV (0.93p.u), Luzira (0.93p.u), Kawanda (0.93p.u), Lugogo 132kV (0.92p.u), Kapeeka 132kV (0.92p.u), Clock Tower (0.92p.u), Entebbe 132kV (0.92p.u), Kawanda 132kV (0.93p.u), Mukono 132kV (0.93p.u)
- **Loading violations observed at:**
  - Masaka 132/33kV (103%), Nkongge 132/33kV (145.5%)
- **N – 1 Loading violations observed at:**
  - Lugogo 132/33kV (86.5%), Kawaala 132/11kV (83.5%)
- ➤ Mutundwe 11kV (20.2kA)

## Mitigation Measures

- Expedite the implementation of Western Transmission system Upgrade
- Upgrade of all 25kA rated 11kV circuit breakers at Mutundwe to ones with a 31.5kA short circuit withstand capacity or installation of current limiting reactors.

#### 4.2.2.5. FY 2027/2028 MODEL

##### Key Events

- Power plants commissioned:
  - Sironko (7MW)
  - Nyamabuye (7MW)
  - Keere Small HPP (6.3MW)
  - Ngoryomwo (2MW)
  - Haisesoro (1.1MW)
  - Rwembya (0.4MW)
  - Nyakinengo (5.2MW)
  - Rubaabo (1.8MW)
  - Buwagani (7MW)
  - MMP Agro Industries Ltd (20MW)
  - Pece Biomass (20MW)
  - Kamuli Sugar (15MW)
  - Modern Laminates (5MW)
  - Birara (1MW),
  - Mukoki (3.4MW),
  - Bukurungo (0.05MW)
  - Warugo (0.5MW)
  - Bugongo (6.5MW)
  - Panyimur Geothermal Plant (10MW).
  - SUN Farming Food and Energy Solar (30MW)
  - Total Energies (Iganga and Tororo) (40MW)
  - Machame Solar (20MW)
  - Biogas power (20MW)
  - Kyankwanzi Bagasse (9MW)
  - Bugiri Sugar (30MW)
  - GM Sugar (10MW)
- Projects commissioned:
  - Kawanda Substation Upgrade 2x60/80MVA 132/33kV
  - 1km 132kV LILO from Owen Falls - Mukono transmission line to Njeru SS (Phase 1: 1x40MVA 132/33kV Njeru SS)
  - Kapeeka 1x32/40MVA, 132/33kV Power Transformer
  - Namanve 1x32/40MVA, 132/33kV Power Transformer Replacement
  - Mutundwe Upgrade 2x40MVA 132/11kV
  - Tororo Substation Upgrade (1x60/80MVA,132/33kV Power Transformer)
  - Mirama Substation Upgrade (Reallocation of 1x60MVA 220/132/33kV Transformer from Mbarara South to Mirama Substation)
  - 2x125MVA 220/132kV Tororo substation Interbus Transformers
  - Mbarara North Substation Upgrade (1x32/40 MVA,132/33kV Power Transformers).
  - Nkenda Substation 132/33kV Upgrade (1x60/80MVA 132/33kV Transformers).
  - 2x125MVA 220/132kV Tororo Interbus Transformers
  - 2x125MVA 220/132kV Mbarara South Interbus Transformers
  - 118km 132kV Bujagali-Iganga-Tororo Double circuit Line Re-conductoring
  - 1x20MVAr Reactor at Kabale Substation
  - Mirama 1x40MVA Power Transformer
  - 134km 400kV Masaka - Mbarara Transmission Line and associated substation
  - 29.2km 132kV Moroto - Katikekile transmission line and related substation (2x40MVA

Katikekile Substation)

- 92km 220kV Hoima-Kinyara-Kafu. (2x80MVA 220/33kV and 40MVAR(220kV)) at Kinyara SS, (2x250MVA, 400/220/33kV, 2x40MVA 220/33kV and 40MVAR(400kV), 20MVAR(220kV) ) at Kafu SS, 2x80MVA 220/132kV and 20MVAR(220kV) ) at Hoima SS
- Electrification of industrial parks and free trade zones including project scope: Sukulu Phosphate Transmission Line Project phase 2-(1km 220kV LILLO from Tororo – Lessos transmission line to Osukulu substation with associated 3x80MVA, 220/33kV Power Transformers at Osukulu substation), 2x80 MVA 220/132kV Kapeeka Substation,apeeka Industrial Park Project (3X50/63MVA 132/33kV Kapeeka SS,Mbale Industrial Park substation and associated transmission 3x80MVA 132/33kV Substation

#### 4.2.2.5.1. FY2027/2028 MODEL ANALYSIS OF BASE CASE (WITHOUT ENVISAGED INDUSTRIAL LOAD)

The demand and generation capacity modeled are: -

- Peak Demand : 1,361.2MW
- Transmission losses (loss factor) : 72.3MW (5.01%)
- Required Generation : 1,596.1MW

#### Findings

- - No voltage violations
- - Nkonge (150.7%), Masaka West (106.8%)
- - Lugogo 132/33kV (89.5%), Lugogo 132/11kV (77.6%), Kawaala 132/11kV (88.4%), Namanve 132/33kV (63.5%), Kampala North 132/11kV Kawanda 132/33kV (59.6%)
- - No violations were observed.

#### 4.2.2.5.2. FY2027/2028 MODEL ANALYSIS OF HIGH CASE (WITH ENVISAGED INDUSTRIAL LOAD)

The demand and generation capacity modeled are: -

- Peak Demand : 1,361.2MW
- Industrial + Data centers Demand : 328.75MW
- Total system Demand : 1,689.9MW
- Transmission losses (loss factor) : 83.5MW (4.68%)
- Required Generation : 1,782.4MW

## Findings

- - No voltage violations
- - Nkongwe (159.5%), Masaka West (112.9%)
- - Lugogo 132/33kV (95.0%), Lugogo 132/11kV (82.6%), Kawaala 132/11kV (90.4%), Namanve 132/33kV (65.7%), Kampala North 132/11kV (82.4%), Kawanda 132/33kV (63%), Queensway (66.5%), Njeru 132/33kV (69.8%)
- - Mutundwe 33kV (20.44kA), Tororo 33kV (22.7kA), Kampala North 11kV (28.95kA), Mutundwe 11kV (32.5kA)

## Mitigation Measures

- Upgrade circuit breakers in respective substations to circuit breakers with higher rated short circuit withstand capacity or installation of series current limiting reactors.
- Expedite implementation of Matugga substation to relieve Kawanda substation.
- Add transformation capacity at Njeru substation

### 4.2.2.6.FY 2028/2029 MODEL

The FY2028/2029 model was analyzed using the two sub-scenarios of business as usual case and sensitivity analysis for each major scenario of the base case (demand without envisaged industrial load) and high case (demand with envisaged industrial load) as detailed below.

## Key Events

- Power plants commissioned:
 

<ul style="list-style-type: none"> <li>➤ Atari (3.25MW)</li> <li>➤ Achwa III &amp; IV (17.57MW)</li> <li>➤ Kabeywa I &amp; II (8.5MW)</li> <li>➤ Awere (18MW)</li> <li>➤ Lower Achwa (Gidro-Sila) (17.8MW)</li> <li>➤ Esha SHPP (4.2MW)</li> <li>➤ Sebei HPP (9.5MW)</li> </ul>	<ul style="list-style-type: none"> <li>➤ Rwimi II HPP (5MW)</li> <li>➤ Kabale Peat (30MW)</li> <li>➤ Kabale Energy Limited (80MW)</li> <li>➤ AAAS Energy BV Solar (25MW)</li> <li>➤ Vidul Biomass (5MW)</li> <li>➤ NLS Waste to Power (32MW)</li> <li>➤ Premium Distillers Ltd. (10.2MW)</li> </ul>
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- Projects commissioned:
  - Mutundwe 132kV 150MVar Capacitor Bank
  - 37.3km 132kV Mirama- Nshongezi Transmission Line and Associated Nshongezi 2x32/40MVA 132/33kV Substation
  - Upgrade of Mutundwe – Buloba – Kabulasoke – Masaka and Kabulasoke – Nkongwe –

- Rugonjo – Nkenda 359km 132kV Transmission Line and Associated substation works (2X40MVA 132/33kV Kabulasoke SS, 2X40MVA 132/33kV Nkonge).
- Masaka west Power Transformer Upgrades (2x60/80MVA, 132/33kV)
  - 150km 400kV Olwiyo – Bibia – Juba (Sudan) Transmission Line, Olwiyo 2x250MVA 400/132kV interbus transformers, Bibia 1x100MVA 400/132kV, 2x40MVA 132/33kV substation – (Uganda’s part)
  - 92km 400kV Masaka – Mutukula – Mwanza Transmission Line, 151km Wobulenzi – Masaka and associated substations (2X250MVA 400/220kV New Masaka substation)
  - Standard Gauge Railway Transmission Line Project
  - 47km 132kV Kabale–Nyakagyeme Transmission Line and associated substations (2X132kV line bays at Kabale SS and 1X40MVA 132/33kV Nyakagyeme substation)
  - Electrification of industrial parks and free trade zones including project scope: 123km 132kV double circuit Nakasongola, Kaweweta Kapeka transmission line, 37km 220kV Wobulenzi – Kapeeka Transmission Line and Wobulezi 400/220kV 2x250MVA

The Business as usual case analysis considers projects to be commissioned with in the anticipated timelines, with demand excluding the envisaged industrial load.

The demand and generation capacity modeled are: -

- Peak Demand : 1,489.2MW
- Transmission losses (loss factor) : 54.5MW (3.52%)
- Required Generation : 1,549.1MW

#### **028/2029 MODEL OF BASE CASE WITH SENSITIVITY ANALYSIS**

The Sensitivity analysis considers a one-year delay in the commissioning of all transmission projects relative to the anticipated timelines, with demand excluding the envisaged industrial load.

The demand and generation capacity modeled are: -

- Peak Demand : 1,443.520MW
- Transmission losses (loss factor) : 77.3MW (5.05%)
- Required Generation : 1,529.4MW

#### **Findings**

- - No voltage violations
- - No loading violations
- - Lugogo 132/33kV (90.5%), Lugogo 132/11kV (79.6%), Kawaala 132/11kV (99.4%), Namanve 132/33kV (65.5%), Kampala North 132/11kV (62.6%)
- - No violations were observed.

20 Exports to South Sudan (45.7MW) were not considered due to delayed commissioning of the respective interconnectors

#### 4.2.2.6.2. FY2028/2029 MODEL ANALYSIS OF HIGH CASE (WITH ENVISAGED INDUSTRIAL LOAD)

##### 4.2.2.6.2.1. FY2028/2029 MODEL OF HIGH CASE WITH- BUSINESS AS USUAL CASE

The Business as usual case analysis considers projects to be commissioned within the anticipated timelines, with the envisaged industrial load inclusive of demand.

The demand and generation capacity modeled are: -

- Peak Demand : 1,489.2MW
- Industrial + Data centers Demand : 249.7MW
- Total system Demand : 1,829.81MW
- Transmission losses (loss factor) : 67.6MW (3.55%)
- Required Generation : 1,903.8MW

##### 4.2.2.6.2.2. FY2028/2029 MODEL ANALYSIS OF HIGH CASE WITH SENSITIVITY ANALYSIS

The Sensitivity analysis considers a one-year delay in the commissioning of all transmission projects relative to the anticipated timelines, with the envisaged industrial load inclusive of demand.

The demand and generation capacity modeled are: -

- Peak Demand : 1,784.1121MW
- Transmission losses (loss factor) : 88.1MW (4.67%)
- Required Generation : 1,884.6MW

### Findings

- - No voltage violations
- - No loading violations
- - Lugogo 132/33kV (96.0%), Lugogo 132/11kV (84.6%), Kawaala 132/11kV (90.4%), Namanve 132/33kV (66.7%), Kampala North 132/11kV (82.4%), Kawanda 132/33kV (64%), Queensway (66.5%), Njeru 132/33kV (70.8%)
- - Mutundwe 33kV (20.85kA), Mutundwe 11kV (32.62kA), Tororo 33kV (22.9kA), Kampala North 11kV (29.95kA)

### Mitigation Measures

- Upgrade circuit breakers in respective substations to circuit breakers with higher rated short

21 Exports to South Sudan (45.7MW) & Increased exports to Tanzania (140MW) were not considered due to delayed commissioning of their respective interconnectors.

circuit withstand capacity or installation of series current limiting reactors.

- Expedite implementation of Matugga substation to relieve Kawanda substation.
- Add transformation capacity at Njeru substation

#### 4.2.2.7. FY 2029/2030 MODEL

The FY2029/2030 model was similarly analysed using the two sub-scenarios of business-as-usual case and sensitivity analysis for each major scenario of the base case (demand without envisaged industrial load) and high case (demand with envisaged industrial load) as detailed below.

#### Key Events

- Power plants commissioned:
  - Muzizi (44.7MW)
  - Nyamwamba III (4.5MW)
  - Bukwa (9MW)
  - Ngenge (13.8MW)
  - Kanyampara (1.6MW)
  - Latoro HPP (4.5MW)
  - Okollo (5MW)
  - Panyimur Geothermal (Additional 50MW)
  - Floating Solar (10MW).
  - Bulambuli solar (150MW)
- Projects commissioned:
  - Kawanda 132kV 150MVA Capacitor Bank
  - Nkenda 220kV 60MVA Bus Reactor
  - 76km 132kV Mbale – Bulambuli – Kween Transmission Line; 1X 60/80MVA 132/33kV Mbale SS, 2X60MVA 132/33kV Kween SS and 2X80MVA Bulambuli SS)
  - 78km 132kV Nakasongola – Kasana Transmission Line and 2x40MVA Kasana Substation
  - 150km 132kV Adjumani – Arua Transmission Line (2X32/40MVA 132/33kV Adjumani SS)
  - 72.5km 400kV (initially operated at 220kV) Nkenda- Mpondwe (D.R.Congo) Transmission line (2X220kV bays at 220/132kV Nkenda SS)
  - 70km 132kV Arua – Oraba Transmission Line (2X40MVA 132/33kV Oraba SS)
  - 345km 400kV Karuma – Tororo Transmission Line (2X250MVA 400/220kV Boarder SS in Tororo District, 2X400kV line bays at Karuma SS) and Ntinda 2x40MVA 132/33kV Substation and Associated 2km 132kV Transmission Line
  - Electrification of industrial parks and free trade zones including project scope – Nakasongola SS, 2X32/40MVA and 132/33kV Kaweweeta SS
  - Upgrade of Nkenda – Fort Portal – Hoima to 220kV (Nkenda 2X250MVA 220/132kV Interbus transformers, Fort Portal 2X80MVA 220/132 Substation, Kabaale 2x250 MVA 220/132kV, 3x80MVA 132/33kV Substation, Lyanda/Muzizi 2x80MVA 220/132kV, 1x40MVA 132/33kV Substation
  - 132kV Buloba – Entebbe – Gaba-Luzira (2x32/40MVA 132/33kV Gaba SS; 40km 132kV Buloba – Entebbe Transmission Line, 45km 132kV Entebbe – Gaba Transmission Line and 8km 132kV Ggaba – LuziraTransmission Line)

#### 4.2.2.7.1. FY2029/2030 MODEL ANALYSIS OF BASE CASE (WITHOUT ENVISAGED INDUSTRIAL LOAD)

#### 4.2.2.7.1.1. FY2029/2030 MODEL ANALYSIS OF BASE CASE WITH BUSINESS AS USUAL CASE

The Business as usual case analysis considers projects to be commissioned with in the anticipated timelines, with demand excluding the envisaged industrial load.

The demand and generation capacity modeled are: -

- Peak Demand : 1,521.6MW
- Transmission losses (loss factor) : 52.9MW (3.34%)
- Required Generation : 1,582.7MW

#### 4.2.2.7.1.2. FY2029/2030 MODEL ANALYSIS OF BASE CASE WITH SENSITIVITY ANALYSIS

The Sensitivity analysis considers a one-year delay in the commissioning of all transmission projects relative to the anticipated timelines, with demand excluding the envisaged industrial load.

The demand and generation capacity modeled are: -

- Peak Demand : 1,501.622MW
- Transmission losses (loss factor) : 55.5MW (3.55%)
- Required Generation : 1,562.7MW

### Findings

- ➤ Mpondwe 220kV (1.13p.u), Nkenda 220kV (1.12p.u), Nkenda 132kV (1.08p.u) Ishaka 132kV (1.06p.u), Kahugye 132kV (1.08p.u), Nkongwe 132kV (1.06p.u).
- ➤ No loading violations
- ➤ No violations were observed.
- ➤ No violations were observed.

#### 4.2.2.7.2.1. FY2029/2030 MODEL ANALYSIS OF HIGH CASE WITH BUSINESS AS USUAL CASE

The Business as usual case analysis considers projects to be commissioned within the anticipated timelines, with the envisaged industrial load inclusive of demand.

The demand and generation capacity modeled are: -

22 Exports to DRC (20MW) were not considered due to delayed commissioning of the respective interconnectors.

- Peak Demand : 1,521.6MW
- Industrial + Data centers Demand : 353.69MW
- Total system Demand : 1,875.30MW
- Transmission losses (loss factor) : 58.8MW (3.03%)
- Required Generation : 1,942.4MW

#### 4.2.2.7.2.2. FY2029/2030 MODEL ANALYSIS OF HIGH CASE WITH SENSITIVITY ANALYSIS

The Sensitivity analysis considers a one-year delay in the commissioning of all transmission projects relative to the anticipated timelines, with the envisaged industrial load inclusive of demand.

The demand and generation capacity modeled are: -

- Peak Demand : 1,855.323MW
- Transmission losses (loss factor) : 69.2MW (3.58%)
- Required Generation : 1,930.9MW

23 Exports to DRC (100MW) were not considered due to delayed commissioning of their respective interconnectors.

## Findings

- - Entebbe 132kV (0.93p.u), Kawanda 132kV (0.93p.u), Lugogo 132kV (0.93p.u), Namanve 132kV (0.93p.u), Clock Tower 132kV (0.92p.u), Luzira 132kV (0.93p.u), Kawaala 132kV (0.93p.u), Kampala 132kV (0.92p.u), Mutundwe 132kV (0.93p.u), Namanve South 132kV (0.93p.u).
- - No loading violations
- - No N-1 Loading violations
- - Mutundwe 33kV (21.9kA), Mutundwe 11kV (33.8kA), Tororo 33kV (24.91kA), Kampala North 11kV (30.1kA), Nkenda 33kV (21.04kA), Mukono 33kV (21.1kA)

## Mitigation Measures

- Install a 220kV 60MVar variable bus reactor at both Nkenda and Mpondwe
- Install a 132kV 150MVar Capacitor bank at Kawanda
- Upgrade of circuit breakers/switchgear to ones with high short circuit withstand capacity or installation of series current limiting reactors.

It is important to note that the further the planning period extends from the current grid status, the greater the uncertainty in predicting future grid conditions due to multiple unknown factors.

The key events in the financial years FY2030/31 to FY2033/34 as highlighted below were observed to have insignificant impact on the grid performance in terms of voltage violations, loading violations, N – 1 loading violations, fault level violations and transmission losses.

As a result, the grid performance from FY2029/30 through to FY2033/34 is assumed to remain constant

## Key events in FY2030/31

- Power plants commissioned: **None**
- Projects commissioned:
  - 10km 132kV LILO from Bujagali – Iganga transmission line to Masese SS (2x80MVA 132/33kV Masese Substation)
  - Njeru SS (2x80MVA 132/33kV Njeru Substation) Permanent Solution
  - 20km 220kV LILO from Bujagali – Kawanda transmission line to Busiika substation (Busiika 2x80MVA 220/33kV Substation)
  - 15km 132kV Arua (Uganda) – Aru – Duruba (DRC) Transmission Line Project – Uganda Part (2X32/40MVA 132/33kV Arua SS Upgrade)

### Key events in FY2031/32

- Power plants commissioned:
  - Nshongezi HPP (11.7MW)
  - Panyimur Geothermal plant (additional 70MW)
- Projects commissioned:
  - 160km 400kV New Mbarara – Kasese – D.R.Congo Uganda’s side Kasese Industrial Park SS ( 2x250MVA 400/220/33kV substation) and (2X250MVA, 400/220/33kV transformers at New Mbarara SS)
  - Ayago Interconnection Project (includes Nile HPP 400kV Switching station, 2km 400kV Ayago – Nile HPPs Switching Station Underground Cable, 10km Nile HPPs Switching Station – T- Ayago 400kV Underground Cable and T-Ayago 400kV Switching station)
  - Tororo 1x60/80MVA, 132/33kV Upgrade
  - 2km 132kV LILO from Masaka – Mbarara transmission line to Akageti substation (Akageti 2x40MVA 132/33kV Substation)

### Key events in FY2032/33

- Power plants commissioned:
  - Kiba (300MW)
- Projects commissioned:
  - 0.5km 132kV LILO from Mbarara – Nkenda transmission line to Kasese Industrial Park SS (2x80MVA 132/33kV Kasese Industrial Park Substation)
  - 2km 220kV LILO from Bujagali–Tororo transmission line to Jinja Industrial Park SS (2x80MVA 220/33kV Jinja Industrial Park Substation)
  - 5km 132kV LILO from Mbarara – Nkenda transmission line to Ishaka Industrial Park SS (2x80MVA 132/33kV Ishaka Industrial Park Substation)
  - 400kV Kiba Interconnection Project (10km 400kV Kiba – Nile HPPs Switching Station Underground Cable)

### Key events in FY2033/34

- Power plants commissioned:
  - Kiba (Fully Commissioned with the Additional 100MW)
  - Oriang (200MW)
- Projects commissioned:
  - 400kV Oriang Interconnection project (10km 400kV Oriang – Nile HPPs Switching Station Underground Cable)

#### 4.2.2.8 FY 2034/2035 MODEL

##### Key Events

- Power plants commissioned:
  - Oriang (Fully commissioned with the Additional 192MW)
- Projects commissioned:
  - Kasese Industrial Park 400kV 100MVAr Bus Reactor
  - Grid strengthening project including: Reinforcement of the proposed Lira Substation (2x40MVA, 132/33kV Power transformer), 132kV, 211km Double circuit Nkongwe – 211km Mubende – Kiboga – Kapeeka 132kV Transmission Line, New Mubende Substation and interconnection (2x40MVA, 132/33kV Power transformer), New Kiboga Substation and interconnection (2x40MVA, 132/33kV Power transformer), Kapeeka substation extension (2x132kV Line bays), Nkongwe substation extension (2x132kV Line bays), 132kV,13km LILLO to Rakai SS and new Rakai Substation (2x80MVA, 132/33kV Power transformer), 132kV, 2km LILLO to Lugazi Substation and upgrade of Lugazi substation (2x40MVA, 132/33kV Power transformer), Mutundwe SS Upgrade (2x80MVA, 132/33kV Power transformer), Lugogo SS Upgrade (2x80MVA, 132/11kV Power transformer)
  - 160km, 132kV Agago/Achwa – Kitgum – Bibia East Transmission Line and Associated Substations Project (2X32/40MVA 132/33kV Kitgum SS)

##### 4.2.2.8.1. FY2034/2035 MODEL ANALYSIS OF BASE CASE (WITHOUT ENVISAGED INDUSTRIAL LOAD)

The demand and generation capacity modeled are: -

- Peak Demand : 2,288.8MW
- Transmission losses (loss factor) : 65.9MW (2.77%)
- Required Generation : 2,379MW

##### Findings

- - Kasese Industrial 400kV (1.07p.u), Mpondwe (1.07p.u), Masaka 220kV (1.06p.u), Mbarara 220kV (1.07p.u), Kiboga 132kV (1.06p.u), Mbarara North 132kV (1.06p.u), Mirama (1.06p.u).
- ➤ No loading violations
- ➤ No N-1 Loading violations
- ➤ No violations observed

##### 4.2.2.8.2. FY2034/2035 MODEL ANALYSIS OF HIGH CASE (WITH ENVISAGED INDUSTRIAL LOAD)

The demand and generation capacity modeled are: -

- Peak Demand : 1,853.1MW

- Industrial + Data centers Demand : 551.41MW
- Total system Demand : 2,840.17MW
- Transmission losses (loss factor) : 118.13MW (3.98%)
- Required Generation : 2,968.1MW

### Findings

- ➤ Masaka 400kV (1.06p.u), Kasese Industrial 400kV (1.07p.u), Mbarara 220kV (1.07p.u), Masaka 220kV (1.07p.u), Mirama 132kV (1.06p.u), Mbarara South 132kV (1.07p.u), Mutukula 400kV (1.06p.u), Mpondwe 400kV (1.07p.u), Mirama 220kV (1.07p.u), Mbarara North 132kV (1.06p.u), Masaka West 132kV (1.06p.u), Kiboga 132kV (1.06p.u).
- ➤ No loading violations
- ➤ No N-1 Loading violations
- ➤ Mutundwe 33kV (23.22kA), Tororo 33kV (26.4kA), Olwiyo 33kV (29.65kA), Nkenda 33kV (21.34kA), Mbale 33kV (21.79kA), Mukono 33kV (23.1kA), Namanve South 33kV (20.6kA), Kampala North 11kV (30.5kA), Mutundwe 11kV (55.2kA), Kawaala 11kV (29.7kA), Sukulu 33kV (59.2kA)

### Mitigation Measures

- Install a 400kV 1x100MVAR variable bus reactor at Kasese Industrial S/S and 400kV 1x100MVAR at Mpondwe DR Congo side.
- Upgrade of Circuit breakers/switchgear to ones with higher short circuit withstand capacity or installation of series current limiting reactors where fault level violations have been observed.

Similar to the events that are anticipated between the financial years FY2030/31 to FY2033/34, the key developments projected in the financial years FY2035/36 to FY2038/39 as highlighted below were observed to have insignificant impact on the grid performance in terms of voltage violations, loading violations, N – 1 loading violations, fault level violations and transmission losses. As a result, the grid performance from FY2034/35 through to FY2038/39 is assumed to remain constant.

### Key events in FY2035/36

- Power plants commissioned:
  - Ayago (300MW)
  - Panyimur Geothermal plant (additional 20MW)
  - Buyende Nuclear (1,400MW)
- Projects commissioned:
  - Evacuation of power from the proposed Nuclear Power Plant at Buyende through 400kV lines from, Buyende to Jinja Industrial, Buyende to Nakasongola, Buyende to Opuyo & Buyende to Tororo

### Key events in FY2036/37

- Power plants commissioned:

- Ayago (Additional 200MW)
- Projects commissioned: **None**

#### Key events in FY2037/38

- Power plants commissioned:
  - Ayago (Additional 100MW)
- Projects commissioned:
  - 60km 132kV Kabale – Kisoro Transmission Line (2 x 32/40MVA 132/33kV Kisoro Substation)

#### Key events in FY2038/39

- Power plants commissioned:
  - Ayago (Additional 100MW)
- Projects commissioned:
  - 95km 132kV Kabale – Ishaka Transmission Line Project

#### 4.2.2.9 FY 2039/2040 MODEL

##### Key Events

- Power plants commissioned:
  - Ayago (Additional 140MW)
  - Uhuru (100MW)
- Projects commissioned:
  - Mbale 132kV 140MVA Capacitor Bank
  - 400kV Uhuru Falls Interconnection Project (38km 400kV Uhuru – Olwiyo Underground Cable)
  - 130km 132kV Bulambuli – Moroto Transmission Line (2x132kV Line bays at Bulambuli SS)
  - 220km 132kV Moroto – Kitgum Transmission Line
  - 50km 132kV Bibia – Adjumani Transmission Line Project
  - 70km 400kV New Mbarara South – Shango Double Circuit Transmission line and associated substations (5.5km 220kV Double Circuit Transmission Line from 220/132kV Mbarara SS to 400/220kV Mbarara SS)
  - 150km 220kV Kapeeka- Kiboga – Hoima Transmission Line (2x125MVA 220/132kV Kiboga substation interbus transformers)

#### 4.2.2.9.1. FY2039/2040 MODEL ANALYSIS OF BASE CASE (WITHOUT ENVISAGED INDUSTRIAL LOAD)

The demand and generation capacity modeled are: -

- Peak Demand : 3,277.1MW
- Transmission losses (loss factor) : 162.3MW (4.74%)
- Required Generation : 3,424.7MW

### Findings

- - Tororo 132kV (0.92p.u), Sukulu 132kV (0.93p.u), Buwoola SGR 132kV (0.91p.u), Kampala SGR (0.93p.u), Masese 132kV (0.91p.u), Opuyo 132kV (0.94p.u), Kasana 132kV(0.91pu), Kaweweta (0.94p.u), Entebbe 132kV (0.92p.u), Kampala North 132kV (0.93p.u), Mutundwe 132kV(0.94p.u), Opuyo 132kV (0.94p.u), Mbale 132kV(0.91p.u), Clock Tower 132kV(0.93p.u), Mukono 132kV (0.94p.u), Iganga 132kV (0.91p.u), Ntinda 132kV (0.93p.u), Kawaala (0.94p.u), Lugogo 132kV (0.93p.u), Namanve 132kV (0.93p.u), Kapeeka 132kV (0.94p.u), Lugazi 132kV (0.94p.u), Namanve South (0.93p.u), Luzira 132kV (0.93p.u), Gaba 132kV(0.93.p.u), Tororo SGR (0.92p.u), Iganga 132kV(0.91p.u).
- - No loading violations
- - No N-1 Loading violations
- - No violations observed

#### 4.2.2.9.2. FY2039/2040 MODEL ANALYSIS OF HIGH CASE (WITH ENVISAGED INDUSTRIAL LOAD)

The demand and generation capacity modeled are: -

- Peak Demand : 3,277.1MW
- Industrial + Data centers Demand : 822.7MW
- Total system Demand : 4,099.82MW
- Transmission losses (loss factor) : 303.26MW (6.98%)
- Required Generation : 4,344.7MW

### Findings

- - Kaweweta 132kV(0.88p.u), Ntinda 132kV(0.81p.u), Bujagali 220kV (0.90p.u), Buloba 132kV(0.91p.u), Sukulu 132kV (0.91p.u), Kapeeka (0.93p.u), Entebbe 132kV 0.8p.u, Kawanda 132kV 0.81p.u, Namanve 132kV (0.80p.u), Bujagali 132kV (0.92p.u), Opuyo 132kV (0.91p.u), Moroto 132kV (0.93p.u), Masaka West 132kV (0.93p.u), Kapeeka 132kV (0.89p.u), Lugazi 132kV(0.85p.u), Namanve South 132kV (0.8p.u), Luzira 132kV (0.79p.u), Gaba 132kV (0.79p.u),

Rakai 132kV (0.90p.u), Buwoola SGR 132kV (0.87p.u), Nyega (0.88p.u), Mubende 132kV (0.94p.u), Masese 132kV (0.87p.u), Masese 132kV(0.87p.u), Nakasongola 132kV (0.88p.u), Bulambuli 132kV(0.94p.u), Kawanda 220kV (0.92p.u), Tororo 220kV (0.92p.u), Mukono 220kV (0.89p.u), Jinja Industrial 220kV (0.9p.u), Kawala 132kV (0.81p.u), Kampala North 132kV (0.81p.u), Mutundwe 132kV (0.83p.u), Nkonge 132kV (0.94p.u), Nalubale 132kV (0.90p.u), Tororo 132kV(0.89p.u), Kabulasoke 132kV (0.91p.u). Mbale 132kV (0.88p.u), Clock Tower (0.81p.u), Mukono 132kV (0.85p.u), Iganga 132kV(0.87p.u), Buloba 132kV(0.86p.u), Tororo SGR 132kV (0.87p.u).

- - 132kV Mutundwe-Buloba transmission line (134.7%)
  - 132kV Bujagali-Nalubaale (122.8%)
- - Kaweweeta 132/33kV (85.1%)
  - Masaka West 132/33kV (81.2%)
  - Mbale 132/33kV (76.8%)
- - Njeru 33kV (24.1kA), Kawanda 33kV (22.01kA), Mutundwe 33kV (24.6kA), Tororo 33kV (27.9kA), Mbale 33kV (22.6kA), Mukono 33kV (23.7kA), Namanve South (21.5kA), Kampala North 11kV (31.75kA), Mutundwe 11kV (57.2kA), Kawanda 11kV (30.6kA), Olwiyo 33kV (31.6kA)

### Mitigation Measures

- 132kV 140MVAR Capacitor bank at Mbale Substation
- 90MVAR Capacitor bank at Kapeeka
- 250MVAR capacitor at Mutundwe
- Add a fourth transformer of 132/33kV 60/80MVA at Mbale
- Upgrade the Masaka West 2x15/20MVA transformers to 32/40MVA
- Upgrade of Circuit breakers/switchgear to ones with higher short circuit withstand capacity or installation of series current limiting reactors.

Further to the above results, we are cognizant that the simulated losses are at the end of the respective years and yet the investments will not materialize on the first day of the year. In effect, the losses are expected to relatively lessen through the year as the investments come online. For this reason, the adopted losses per year are an average of the year's simulated losses and the previous year's loss.

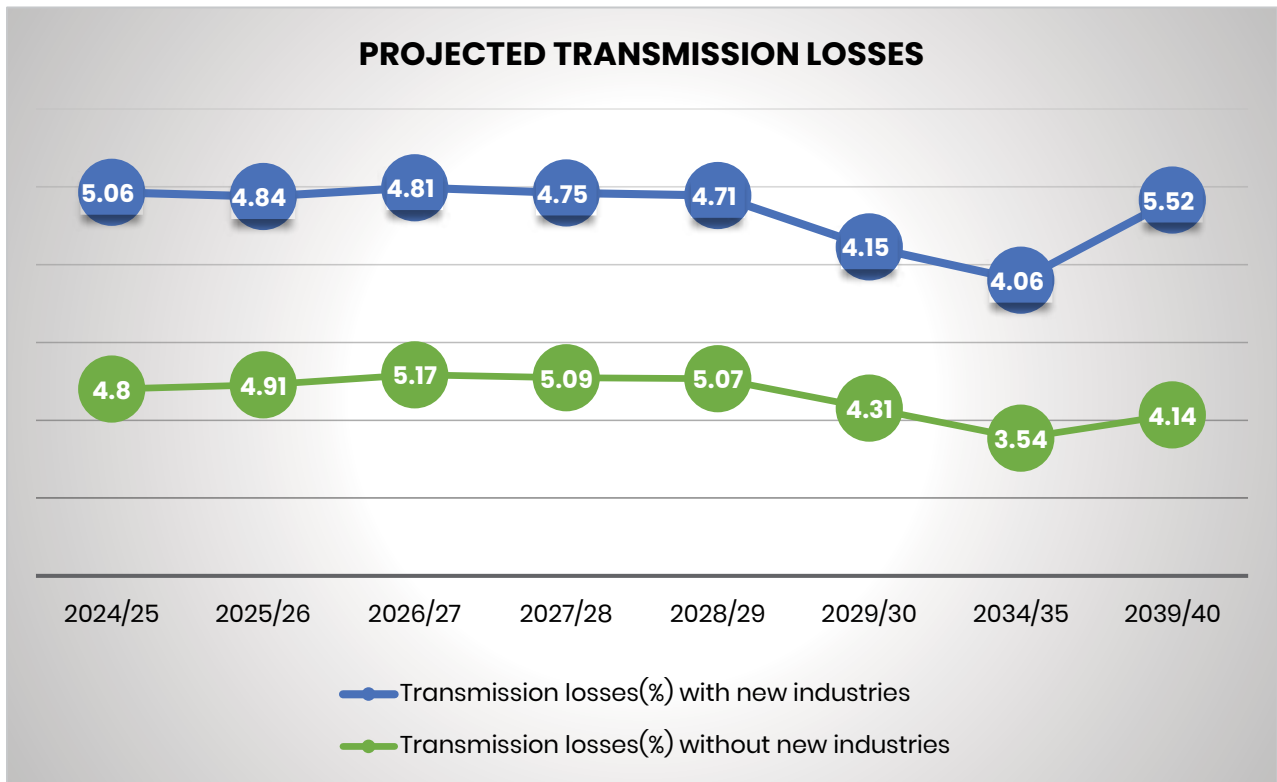
The detailed and summarized transmission loss trajectory are presented in Table 45 and Table 46 here under, and illustrated in Figure 15.

**Table 45: Detailed Transmission loss trajectory**

TRANSMISSION LOSSES TRAJECTORY PER FINANCIAL YEAR (%)										
Description	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30 -2033/34	2034/35 -2037/38	2039/40		
Simulated without new Industries	4.80%	5.01%	5.43%	5.01%	3.52%	3.34%	2.77%	4.74%		
Previous year Adopted losses		4.80%	4.91%	5.17%	5.09%	5.07%	4.31%	3.54%		
Adopted losses without industries (%)	4.80%	4.91%	5.17%	5.09%	5.07%	4.31%	3.54%	4.14%		
Simulated with Industries	5.06%	4.62%	4.78%	4.68%	4.67%	3.58%	3.98%	6.98%		
Previous Year Adopted Losses		5.06%	4.84%	4.81%	4.75%	4.71%	4.15%	4.06%		
Adopted Losses with industries (%)	5.06%	4.84%	4.81%	4.75%	4.71%	4.15%	4.06%	5.52%		

**Table 46: Summary of transmission loss trajectory**

Category of Losses (%)	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30-2033/34	2034/35-2038/39	2039/40
Without new Industries (%)	<b>4.80%</b>	<b>4.91%</b>	<b>5.17%</b>	<b>5.09%</b>	<b>5.07%</b>	<b>4.31%</b>	<b>3.54%</b>	<b>4.14%</b>
With new Industries (%)	<b>5.06%</b>	<b>4.84%</b>	<b>4.81%</b>	<b>4.75%</b>	<b>4.71%</b>	<b>4.15%</b>	<b>4.06%</b>	<b>5.52%</b>



**Figure 15: Projected Transmission losses (%)**

**Explanation of Transmission losses**

The transmission loss trajectory generally increased over the period from 4.8% (May 2025) to 5.17% in 2026/27.

In the latter years the transmission losses are projected to reduce to 3.54%, largely due to an assumption that the load would be redistributed to newly constructed infrastructure in the different regions in the grid outside the Kampala Metropolitan Area and Jinja.

Upon commissioning of the Mbale Bulambuli project, the losses due to long dedicated distribution lines are expected to lower.

The losses are later seen to increase due to increased load in the network.

It should be noted that the further away the period from the current grid status, the more uncertain it is to predict the grid status.

Projects in the later years 2036 – 2040 mainly target reliability of the Grid rather than reduction of losses since the grid is almost saturated and yet demand keeps increasing. This therefore leads to an increase in losses as losses are directly proportional to the current flowing through the infrastructure.

It is observed that the power losses in the scenario with industries from 2025/2026 – 2029/2030 are lower than the losses without industries. This is due to the introduction of data centers that are located and consumer power closer the source, hence reducing the power losses that would be incurred in wheeling power to demand centers that are far from the power sources. In the later years, the power losses for industrial scenario increase due to increased demand across the grid.

The accuracy to predict the location where the load will grow lower with the passing year due to the less visibility of the later years.

### **Recommendations to reduce on the losses**

The Government should promote industrialization in areas that are lowly loaded to ensure that loading of the power grid is evenly distributed in a bid lower loss that would amass due to the high loading in the Kampala metropolitan area.

Implementation of the Transmission loss study consultancy that has been included as investment requirement in the GDP.

### 4.3. GRID INVESTMENT PLAN (2024/25–2039/40) FOR BAU SCENARIO

To ensure that the future electricity needs of the nation are satisfied, there is need to have major capital investments in the power sector. Such investments comprise of generation plants, transmission lines and expansion of the distribution network.

It is against this background that the Grid Investment Plan was developed to establish a rationale for building a robust transmission network, contribute to Government of Uganda's strategic objective to provide adequate and reliable energy supply to meet national and regional, socio-economic development.

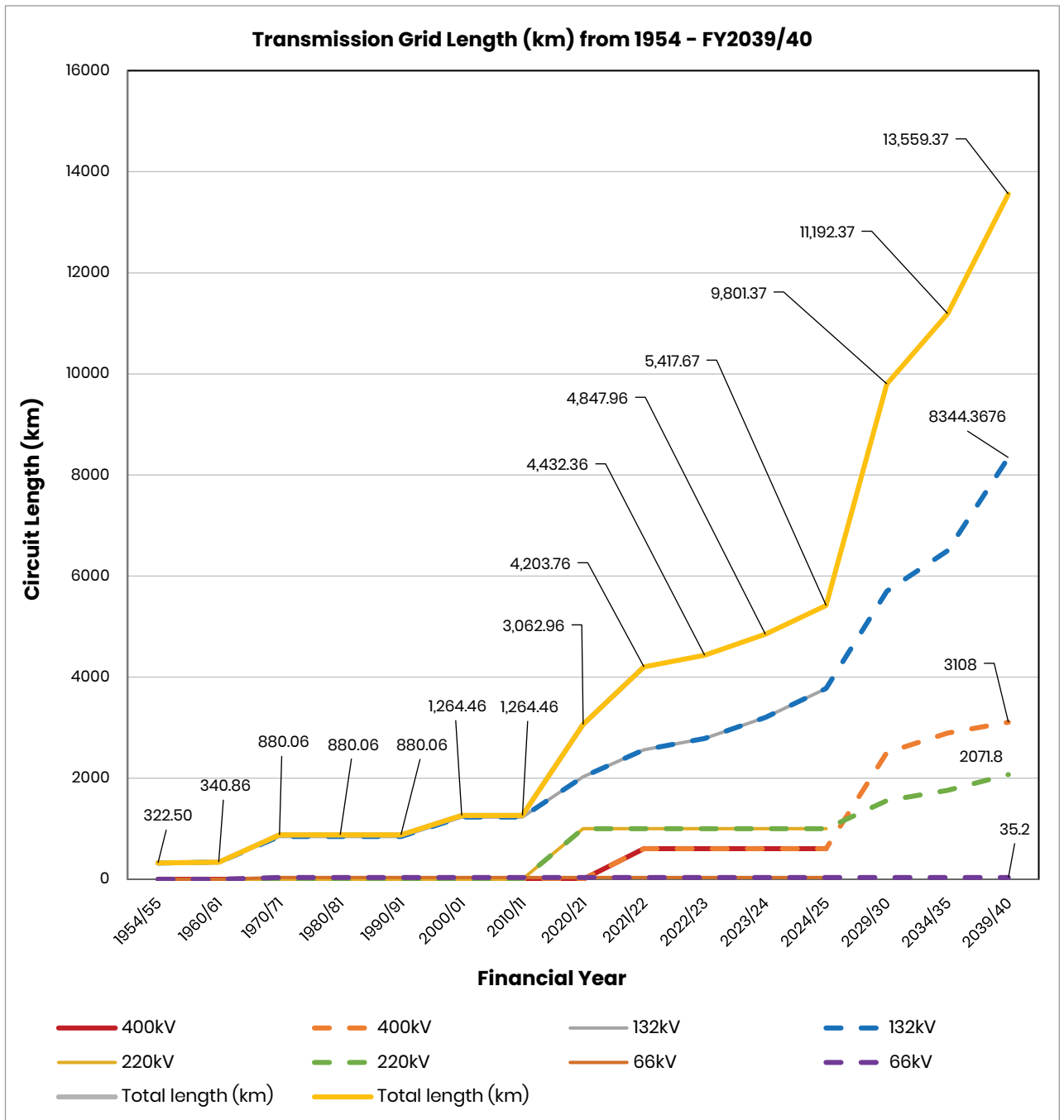
#### 4.3.1. GRID OUTLOOK BY 2040 TO INFORM REQUIRED INVESTMENTS

By the end of the planning period and upon successful implementation of this plan, the grid shall have a total additional circuit length of about **8711.41 km**, **52** additional substations/switching stations and **14,329MVA** additional transformation capacity.

Table 47 and Figure 16 here under illustrate the incremental transmission line length in the planning horizon.

**Table 47: Incremental transmission line length after the end of the planning period.**

Line Voltage (kV)	Line length at the Beginning of FY 2024/25 (km)	Total Additional Circuit length (km)	Line Length at the End of FY 2039/40 (km)
66	35.20	0.00	35.20
132	3,203.86	5,139.61	8,344.37
220	1,002.00	1,069.80	2,071.80
400	606.00	2,502	3,108
<b>Total</b>	<b>4,847.06</b>	<b>8,711.41</b>	<b>13,559.37</b>

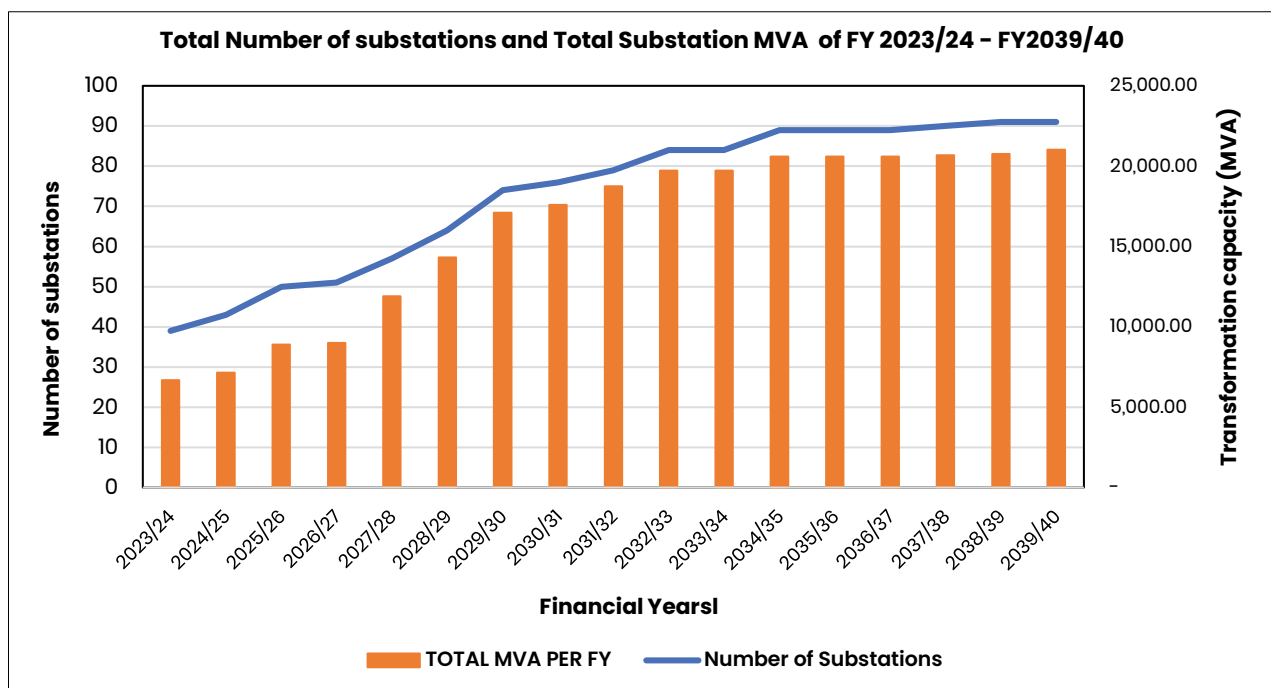


**Figure 16: HVTG Outlook by 2040**

Table 48 and Figure 17 here under illustrate the transformation capacity growth during the planning period.

**Table 48: Additional Substations and transformation capacity outlook by 2040**

Transformation level	Transformation capacity at the beginning of FY 2024/25 (MVA)	Additional Transformation capacity from 2024/25-2039/40 (MVA)	Transformation capacity at the end of FY 2039/40 (MVA)
400/132 kV	630.00	1,200.00	1,830.00
400/220/33kV	1,302.00	3,000	4,302.00
220/132/33 kV	2,060.00	3,550.00	5,610.00
220/33 kV	0	800.00	800.00
132/33 kV	2,395.50	5,449.00	7,844.50
132/11 kV	220.00	260.00	480.00
132/33/11kV Mobile TX	50.00	70.00	120.00
66/11 kV	28.00	-	28.00
<b>TOTAL MVA PER FY</b>	<b>6,685.50</b>	<b>14,329.00</b>	<b>21, 014.5</b>
<b>Number of Substations/ Switching stations</b>	<b>39</b>	<b>52</b>	<b>91</b>



**Figure 17: Additional Substations and transformation capacity outlook by 2040**

### 4.3.2. GRID INVESTMENT PLAN SUMMARY

The main deliverable of GDP is the Grid Investment Plan (GIP) which indicates estimated costs and implementation schedules for identified projects. The GIP is used to prepare company financial projections and annual budgets.

The Grid Investment Plan Projects have been classified into the following categories:

- Power evacuation projects
- Grid re-investment projects
- System Expansion projects
- Regional projects.

The Grid Investments, objectives and implementation period are presented in the Table 49 here under.

**Table 49”: UETCL Grid Investment Plan (2023/24-2039/40) – Implementation Schedule summary**

UETCL GRID INVESTMENT PLAN (2023/24-2039/40) : IMPLEMENTATION SCHEDULE SUMMARY					
No.	PROJECT	OBJECTIVE	IMPLEMENTATION PERIOD FROM BASE YEAR, FY2023/2024	CURRENT STATUS	FINANCIER
<b>A POWER EVACUATION PROJECTS</b>					
1	Ayago Interconnection Project <ul style="list-style-type: none"> <li>Nile HPP 400kV Switching station</li> <li>2km 400kV Ayago - Nile HPPs Switching Station Underground Cable</li> <li>10km Nile HPPs Switching Station - T- Ayago 400kV Underground Cable</li> <li>T-Ayago 400kV Switching station</li> </ul>	Provision of transmission capacity to evacuate power from Ayago HPP	2028/29-2031/32	Feasibility Stage	Under Consideration using EPC + F
2	37.3km 132kV Mirama- Nshongezi Transmission Line and Associated Nshongezi 2x32/40MVA 132/33kV Substation	Provision of transmission capacity to evacuate power	2025/26-2028/29	Feasibility Study Update	Under Consideration using EPC + F
3	92km 220kV Hoima-Kinyara-Kafu Transmission line and associated substations. 2X80MVA 220/33kV and 40MVAR(220kV) at Kinyara SS, 2x250MVA, 400/220/33kV, 2x40MVA 220/33kV, 40MVAR(400kV) and 20MVAR(220kV) at Kafu SS, 2x80MVA 220/132kV and 20MVAR(220kV) at Hoima SS.	Provision of transmission capacity to evacuate power	2024/25-2027/28	Feasibility Study Update	Under Consideration using EPC + F
4	76km 132kV Mbale - Bulambuli - Kween Transmission Line; 1X 60/80MVA 132/33kV Mbale SS, 2X60MVA 132/33kV Kween SS and 2X80MVA Bulambuli SS)	Provision of transmission capacity to evacuate power from IPPs in Bulambuli area	2026/27-2029/30	Feasibility Study Update	Under consideration for IPT model
5	400kV Oriang Interconnection project (10km 400kV Oriang - Nile HPPs Switching Station Underground Cable)	Provision of transmission capacity to evacuate power from Oriang HPP	2028/29-2033/34	To be packaged with HPP	To be determined
6	400kV Kiba Interconnection Project (10km 400kV Kiba - Nile HPPs Switching Station Underground Cable)	Provision of transmission capacity to evacuate power from Kiba HPP	2029/30-2032/33	To be packaged with HPP	To be determined

UETCL GRID INVESTMENT PLAN (2023/24-2039/40) : IMPLEMENTATION SCHEDULE SUMMARY						
No.	PROJECT	OBJECTIVE	IMPLEMENTATION PERIOD FROM BASE YEAR, FY2023/2024	CURRENT STATUS	FINANCIER	
7	400kV Uhuru Falls Interconnection Project (38km 400kV Uhuru - Olwiyo Underground Cable)	Provision of transmission capacity to evacuate power from Uhuru Falls	2034/35-2039/40	To be packaged with HPP	To be determined	
8	Evacuation of power from the proposed Nuclear Power Plant at Buyende <ul style="list-style-type: none"> <li>400kV line from Buyende switching station to Jinja Industrial and business park.</li> <li>400kV Line from Buyende switching station to Tororo.</li> <li>400kV line from Buyende switching station to Nakasongola</li> <li>400kV line from Buyende switching station to Opuyo</li> </ul>	Provision of transmission capacity to evacuate power from the proposed Buyende Nuclear power plant	2026/27-2035/36	Sourcing for Financing	To be determined	
9	47km 132kV Kabale-Nyakagyeme Transmission Line and associated substations (2X132kV line bays at Kabale SS and 2X40MVA 132/33kV Nyakagyeme substation)	Provision of transmission capacity to evacuate power from mini hydro power plants within the project environs	2027/28-2028/29	Consideration under IPT Arrangement	To be determined	
B GRID RE-INVESTMENT PROJECTS						
1	Mutundwe 132kV 150MVAR Capacitor Bank	Improvement of reliability and quality of power supply.	2027/28-2028/29	Sourcing for Financing	To be determined	
2	Kawanda 132kV 150MVAR Capacitor Bank	Improvement of reliability and quality of power supply	2028/29-2029/30	Sourcing for Financing	To be determined	
3	Mbale 132kV 140MVAR Capacitor Bank	Improvement of reliability and quality of power supply	2038/39-2039/40	Sourcing for Financing	To be determined	

**UETCL GRID INVESTMENT PLAN (2023/24-2039/40) : IMPLEMENTATION SCHEDULE SUMMARY**

<b>No.</b>	<b>PROJECT</b>	<b>OBJECTIVE</b>	<b>IMPLEMENTATION PERIOD FROM BASE YEAR, FY2023/2024</b>	<b>CURRENT STATUS</b>	<b>FINANCIER</b>
4	Nkenda 220kV 60MVAR Bus Reactor	Improvement of reliability and quality of power supply	2028/29-2029/30	Sourcing for Financing	To be determined
5	Kasese Industrial Park 400kV 100MVAR Bus Reactor	Improvement of reliability and quality of power supply	2033/34-2034/35	Sourcing for Financing	To be determined
6	Upgrade of Mutundwe – Buloba – Kabulasoke – Masaka and Kabulasoke – Nkonge – Rugonjo – Nkenda 359km 132kV Transmission Line and Associated substation works (2X40MVA 132/33kV Kabulasoke SS, 2X40MVA 132/33kV Nkonge SS)	Improvement of reliability and power supply quality	2025/26-2028/29	Procurement of EPC Contractor	Under Consideration using EPC + F
7	Kampala Metropolitan Area Improvement Project (Transmission Lines; 25.4km 132kV 1 cct Mukono branch point (Northern trunk line) – Kampala North Substation, 10.2km 2cct Kampala North Substation – Mutundwe Substation, 5.3km 132kV 2 cct Kampala North Substation – Lugogo Substation, 0.1km 132kV 2 cct Kawaala branch point – Kawaala Substation, 0.3km 132kV 2 cct (New Mukono Substation – Mukono Substation), 4.2km 220kV 4 cct New Mukono branch point – New Mukono Substation, 0.4km 132kV 2 cct New Mukono Substation – New Mukono branch point (Southern trunk line), 0.8km 132kV 2 cct Buloba branch point – Buloba Substation,	Provision of adequate capacity, improvement of reliability	2023/24-2026/27	Under Implementation	JICA at EPC

## UETCL GRID INVESTMENT PLAN (2023/24-2039/40) : IMPLEMENTATION SCHEDULE SUMMARY

No.	PROJECT	OBJECTIVE	IMPLEMENTATION PERIOD FROM BASE YEAR, FY2023/2024	CURRENT STATUS	FINANCIER
7	0.9km 220kV 4 cct Buloba branch point – Buloba Substation; Substations (2X125MVA 220/132kV Buloba SS, 2X40MVA 132/33kV Buloba SS, 3X200MVA 220/132/33kV Mukono SS, 3X40MVA 132/33kV Kawaala SS, 1X20MVA 132/11kV Kawaala SS, 1X250MVA 220/132/33kV Bujagali SS, 1X20MVA 132/33kV Mobile SS)	Provision of adequate capacity, improvement of reliability	2023/24-2026/27	Under Implementation	JICA at EPC
8	Mbarara North Substation 1x40MVA 132/33kV	Increase Substation Capacity	2023/24-2025/26	Commissioned. Under DLP	GOU
9	Nkenda upgrade 1x60/80MVA 132/33kV Power Transformer	Increase Substation Capacity	2023/24-2025/26	Commissioned. Under DLP	GOU
10	1X40MVAR Reactor at Fort Portal Substation	Improve reliability and quality of supply	2023/24-2025/26	Under Implementation	GOU
11	Mutundwe Upgrade 2x40MVA 132/11kV	Improvement of reliability and power supply quality	2024/25-2027/28	Under Implementation	GOU
12	Kawanda Substation Upgrade 2x60/80MVA 132/33kV	Improvement of reliability and power supply quality	2024/25-2027/28	Under Implementation	GOU
13	Tororo Substation Upgrade (1x60/80MVA, 132/33kV Power Transformer)	Improvement of reliability and power supply quality	2025/26-2027/28	Sourcing for financing	Under implementation as an IPT pilot project

UETCL GRID INVESTMENT PLAN (2023/24-2039/40) : IMPLEMENTATION SCHEDULE SUMMARY						
No.	PROJECT	OBJECTIVE	IMPLEMENTATION PERIOD FROM BASE YEAR, FY2023/2024	CURRENT STATUS	FINANCIER	
14	Tororo 1x60/80MVA, 132/33kV Upgrade	Improvement of reliability and power supply quality	2030/31-2031/32	Sourcing for financing	To be determined	
16	Mbarara North Substation Upgrade (1x32/40MVA,132/33kV Power Transformers)	Improvement of reliability and power supply quality	2025/26-2027/28	Project packaging for implementation	Under implementation as an IPT pilot project	
17	Nkenda Substation 132/33kV Upgrade (1x60/80MVA 132/33kV Transformers)	Improvement of reliability and power supply quality	2025/26-2027/28	Project packaging for implementation	Under implementation as an IPT pilot project	
18	Mirama Substation Upgrade (Relocation of 2X20MVA, 132/33kV Transformers from Mbarara North and Nkenda Substations) and Reallocation of 1X60MVA 220/132/33kV Transformer from Mbarara South to Mirama Substation)	Provision of additional Transformation capacity	2025/26-2027/28	Sourcing for financing	GOU	
19	2x125MVA 220/132/33kV Tororo substation Interbus Transformers	Improvement of reliability and power supply quality	2025/26-2027/28	Project packaging for implementation	Under implementation as an IPT pilot project	
20	2X125MVA 220/132/33kV Mbarara South Interbus Transformers	Improvement of reliability and power supply quality	2025/26-2027/28	Project packaging for implementation	Under implementation as an IPT pilot project.	
21	118km 132kV Bujagali-Iganga-Tororo Double circuit Line Re-conductoring	Provision of adequate capacity, improvement of reliability	2026/27-2027/28	Sourcing for financing	To be determined	

**UETCL GRID INVESTMENT PLAN (2023/24-2039/40) : IMPLEMENTATION SCHEDULE SUMMARY**

No.	PROJECT	OBJECTIVE	IMPLEMENTATION PERIOD FROM BASE YEAR, FY2023/2024	CURRENT STATUS	FINANCIER
22	Protection System Improvement (Fault Recorder and protection information system roll out)	Provision of adequate capacity, improvement of reliability	2023/24-2027/28	Pilot Programme under implementation	Under Consideration by JICA
23	Kasana Substation Power Transformer Upgrade (1x32/40MVA, 132/33kV)	Provision of adequate capacity, improvement of reliability	2025/26-2026/27	Procurement of EPC Contractor	GOU
24	1x20MVAR Reactor at Kabale Substation	Improve reliability and quality of supply	2026/27-2027/28	Sourcing for financing	To be determined
25	Masaka west Power Transformer Upgrades (2x60/80MVA, 132/33kV)	Improvement of reliability and power supply quality	2026/27-2028/29	Sourcing for financing	To be determined
26	Mirama 1x40MVA Power Transformer	Improvement of reliability and power supply quality	2026/27-2027/28	Sourcing for financing	To be determined
27	Kapeeka 1x32/40MVA, 132/33kV Power Transformer	Provision of adequate capacity, improvement of reliability	2026/27-2027/28	Procurement of EPC Contractor	GOU
28	Namanve 1x32/40MVA, 132/33kV Power Transformer Replacement	Provision of adequate capacity, improvement of reliability	2026/27-2027/28	Procurement of EPC Contractor	GOU

UETCL GRID INVESTMENT PLAN (2023/24-2039/40) : IMPLEMENTATION SCHEDULE SUMMARY						
No.	PROJECT	OBJECTIVE	IMPLEMENTATION PERIOD FROM BASE YEAR, FY2023/2024	CURRENT STATUS	FINANCIER	
29	Mbale Mobile Substations (50MVA 132/33-11kV)	Provision of adequate capacity, improvement of reliability	2025/26-2026/27	EPC Contract signed but tied to financing from MoFPED.	GOU	
<b>C SYSTEM EXPANSION PROJECTS</b>						
1	1km 132kV LILO from Owen Falls - Mukono transmission line to Njeru SS (Phase 1: 1x40MVA 132/33kV Njeru SS)	Improvement of reliability	2025/26-2027/28	Procurement of EPC Contractor	GOU	
2	141.2km 132kV Tororo - Opuyo Transmission Line Project	Improvement of reliability and quality of supply in the western region of Uganda & Provision of transmission capacity to evacuate power from other generation plants in the West.	2023/24-2025/26	Under Construction	GOU	
3	134km 400kV Masaka - Mbarara transmission Line and associated substation (initially operated at 220kV)	Improvement in availability of power supply	2025/26-2027/28	Procurement of EPC Contractor	KFW/AFD	
4	42.5 km 132kV Matuga - Kasana T/L, 132kV Switching Station at Matugga and 1x20MVA, 132/33kV Kasana substation.	Improvement of availability, reliability, and quality of power supply	2024/25-2025/26	Under Construction	GOU	
5	78km 132kV Nakasongola - Kasana Transmission Line and 2x40MVA Kasana Substation	Improvement of availability, reliability, and quality of power supply	2027/28-2029/30	Sourcing for Financing	To be determined	

## UETCL GRID INVESTMENT PLAN (2023/24-2039/40) : IMPLEMENTATION SCHEDULE SUMMARY

No.	PROJECT	OBJECTIVE	IMPLEMENTATION PERIOD FROM BASE YEAR, FY2023/2024	CURRENT STATUS	FINANCIER
6	<p>Electrification of industrial parks and free trade zones</p> <ul style="list-style-type: none"> <li>Sukulu Phosphate Transmission Line Project (1km 220kV LILO from Tororo – Lessos TL and 3x80MVA, 220/33kV Power Transformers) – Phase 2</li> <li>123km, 132kV double circuit Nakasongola, Kaweweta Kapeka transmission line and associated substations (2X32/40MVA 132/33kV Nakasongola SS, 2X32/40MVA 132/33kV Kaweweeta SS)</li> </ul>	Improvement of availability, reliability, and quality of power supply	2025/26-2029/30	EPC Contractor Procured - Awaiting Effectiveness of the Loan	China EXIM Bank
6	<ul style="list-style-type: none"> <li>37km 220kV Wobulenzi – Kapeeka Transmission Line (2x250MVA 400/220kV Wobulenzi Substation, 2x80 MVA 220/132kV Kapeeka Substation)</li> <li>Kapeeka Industrial Park Project (3X50/63MVA 132/33kV Kapeeka SS)</li> <li>Mbale Industrial Park substation and associated transmission 3x80MVA 132/33kV Substation</li> </ul>	Improvement of availability, reliability, and quality of power supply	2025/26-2029/30	EPC Contractor Procured - Awaiting Effectiveness of the Loan	China EXIM Bank
7	1km 132kV LILO from Tororo – Lessos transmission line to Sukulu Phosphate SS (2X80/80MVA 132/33kV Power Transformers – Phase 1)	Improvement of availability, reliability, and quality of power supply	2023/24-2025/26	Under Construction	GOU
8	132kV Kabaale Industrial Park Substation Phase 1 (132/33kV 3x60/80MVA Kabaale SS); 6km Underground Cable LILO from Hoima – Fort Portal transmission line to Kabaale Industrial Park SS	Improvement of availability, reliability, and quality of power supply	2024/25-2025/26	Under Construction	GOU

UETCL GRID INVESTMENT PLAN (2023/24-2039/40) : IMPLEMENTATION SCHEDULE SUMMARY						
No.	PROJECT	OBJECTIVE	IMPLEMENTATION PERIOD FROM BASE YEAR, FY2023/2024	CURRENT STATUS	FINANCIER	
9	<p>Upgrade of Nkenda - Fort Portal - Hoima to 220kV and associated substations at Nkenda, FortPortal, Lyanda, Kabaale and Hoima</p> <ul style="list-style-type: none"> <li>Nkenda 2x250MVA 220/132kV Interbus transformers</li> <li>Fort Portal 2x80MVA 220/132 Substation</li> <li>Kabaale 2x250 MVA 220/132kV, 3x80MVA 132/33kV Substation</li> <li>Lyanda/Muzizi 2x80MVA 220/132kV, 1x40MVA 132/33kV Substation</li> <li>6km 220kV underground cable to Kabaale substation</li> </ul>	Improvement of reliability and quality of supply in the western region of Uganda. Provision of transmission capacity to evacuate power from Kabaale 53MW Testcrude	2026/27-2029/30	Feasibility study Update	Consideration Under EPC+F	
10	95km 132kV Kabale – Ishaka Transmission Line Project	Improvement in availability of power supply	2036/37-2038/39	Sourcing for financing	To be determined	
11	60km 132kV Kabale – Kisoro Transmission Line (2 x 32/40MVA 132/33kV Kisoro Substation)	Improvement of availability, reliability, and quality of power supply	2035/36-2037/38	Sourcing for financing	To be determined	
12	0.5km 132kV LILO from Mbarara - Nkenda transmission line to Kasese Industrial Park SS (2x80MVA 132/33kV Kasese Industrial Park Substation)	Improvement of availability, reliability, and quality of power supply	2029/30-2032/33	Sourcing for financing	To be determined	
13	2km 220kV LILO from Bujagali – Tororo transmission line to Jinja Industrial Park SS (2x80MVA 220/33kV Jinja Industrial Park Substation)	Improvement of availability, reliability, and quality of power supply	2029/30-2032/33	Sourcing for financing	To be determined	
14	10km 132kV LILO from Bujagali – Iganga transmission line to Masese SS (2x80MVA 132/33kV Masese Substation)	Improvement of availability, reliability, and quality of power supply	2028/29-2030/31	Sourcing for financing	To be determined	

## UETCL GRID INVESTMENT PLAN (2023/24-2039/40) : IMPLEMENTATION SCHEDULE SUMMARY

No.	PROJECT	OBJECTIVE	IMPLEMENTATION PERIOD FROM BASE YEAR, FY2023/2024	CURRENT STATUS	FINANCIER
15	Njeru SS (2x80MVA 132/33kV Njeru Substation) Permanent Solution	Improvement of availability, reliability, and quality of power supply	2028/29-2030/31	Sourcing for financing	To be determined
16	5km 132kV LILO from Mbarara - Nkenda transmission line to Ishaka Industrial Park SS (2x80MVA 132/33kV Ishaka Industrial Park Substation)	Improvement of availability, reliability, and quality of power supply	2029/30-2032/33	Sourcing for financing	To be determined
17	Grid Strengthening Project <ul style="list-style-type: none"> <li>Refurbishment of the old Lira Substation (2x40MVA, 132/33kV Power transformer)</li> <li>132kV, 211km Double circuit Kapeeka - Nkonge - Mubende - Kiboga 132kV Transmission Line and associated substations (2x40MVA, 132/33kV Power transformer Mubende Substation and 2x40MVA, 132/33kV Power transformers at Kiboga substation)</li> <li>132kV, 13km LILO to Rakai SS and new Rakai Substation (2x80MVA, 132/33kV Power transformer)</li> <li>132kV, 2km LILO to Lugazi Substation and New Lugazi substation (2x40MVA, 132/33kV Power transformer)</li> <li>Mutundwe SS Upgrade (2x80MVA, 132/33kV Power transformer)</li> <li>Lugogo SS Upgrade (2x80MVA, 132/11kV Power transformer)</li> </ul>	Improvement of availability, reliability, and quality of power supply	2029/30-2034/35	At Concept Stage	To be determined
18	2km 132kV LILO from Masaka - Mbarara transmission line to Akageti substation (Akageti 2x40MVA 132/33kV Substation)	Improvement of availability, reliability, and quality of power supply	2028/29-2031/32	Sourcing for financing	To be determined

**UETCL GRID INVESTMENT PLAN (2023/24-2039/40) : IMPLEMENTATION SCHEDULE SUMMARY**

<b>No.</b>	<b>PROJECT</b>	<b>OBJECTIVE</b>	<b>IMPLEMENTATION PERIOD FROM BASE YEAR, FY2023/2024</b>	<b>CURRENT STATUS</b>	<b>FINANCIER</b>
19	20km 220kV LILO from Bujagali – Kawanda transmission line to Busiika substation (Busiika 2x80MVA 220/33kV Substation)	Improvement of availability, reliability, and quality of power supply	2028/29-2030/31	Sourcing for financing	To be determined
20	345km 400kV Karuma – Tororo Transmission Line (2X250MVA 400/220kV Boarder SS in Tororo District, 2X400kV line bays at Karuma SS) and Ntinda 2x40MVA 132/33kV Substation and Associated 2km 132kV Transmission Line.	Improvement of availability, reliability, and quality of power supply	2025/26-2029/30	Financial negotiations ongoing between Kalpa-taru and MoFPED	Under EPC+F with EPC commercial contract signed. - Awaiting Loan signature
21	130km 132kV Bulambuli – Moroto Transmission Line (2X132kV Line bays at Bulambuli SS)	Improvement in availability of power supply	2036/37-2039/40	At Concept Stage	To be determined
22	220km 132kV Moroto – Kitgum Transmission Line (2X132kV Line bays at Kitgum SS)	Improvement in availability of power supply	2036/37-2039/40	At Concept Stage	To be determined
23	50km 132kV Bibia – Adjumani Transmission Line Project (2X132kV Line bays at Bibia SS)	Improvement of reliability and power supply quality	2026/37-2039/40	At Concept Stage	To be determined
24	150km 132kV Adjumani – Arua Transmission Line (2X32/40MVA 132/33kV Adjumani SS)	Improvement of reliability and power supply quality and evacuation IPP's	2027/28-2029/30	At Concept Stage	To be determined
25	70km 132kV Arua – Oraba Transmission Line (2X40MVA 132/33kV Oraba SS)	Power supply to Oraba Industrial park	2027/28-2029/30	At Concept Stage	To be determined
26	160km, 132kV Agago/Achwa – Kitgum – Bibia East Transmission Line and Associated Sub-stations Project (2X32/40MVA 132/33kV Kitgum SS)	Improvement in availability of power supply	2032/33-2034/35	At Concept Stage	To be determined

## UETCL GRID INVESTMENT PLAN (2023/24-2039/40) : IMPLEMENTATION SCHEDULE SUMMARY

No.	PROJECT	OBJECTIVE	IMPLEMENTATION PERIOD FROM BASE YEAR, FY2023/2024	CURRENT STATUS	FINANCIER
27	132kV Buloba – Entebbe – Gaba-Luzira (2x32/40MVA 132/33kV Gaba SS; 40km 132kV Buloba – Entebbe Transmission Line, 45km 132kV Entebbe – Gaba Transmission Line and 8km 132kV Ggaba – Luzira Transmission Line)	Improvement of availability, reliability, and quality of power supply	2026/27-2029/30	At Concept Stage	To be determined
28	29.2km 132kV Moroto – Katikekile Transmission Line and 2x40MVA, 132/33kV Substation	Improvement of availability, reliability, and quality of power supply	2026/27-2027/28	At Concept Stage	To be determined
29	150km 220kV Kapeeka- Kiboga – Hoima Transmission Line (2x125MVA 220/132kV Kiboga substation interbus transformers)	Improvement of availability, reliability, and quality of power supply	2036/37-2039/40	At Concept Stage	To be determined
30	Standard Gauge Railway Transmission Line Project Substations: <ul style="list-style-type: none"> <li>2x32/40MVA Nagongongera substation</li> <li>2x32/40MVA Buwoola substation</li> </ul> Transmission Lines: <ul style="list-style-type: none"> <li>6.7km 132kV double Circuit transmission line from proposed new 132/33kV 2X32/40MVA Nagongera substation to TPS-01 UETCL 132kV busbar</li> <li>39.4km 132kV Double circuit transmission line from proposed new 132/33kV 2X32/40MVA Nagongera substation to the proposed new 132/33kV 2x32/40MVA Buwola substation at TPS-02</li> <li>1.9km of 132kV double circuit from the existing 132/33kV Iganga substation with 2 line bays to TPS 03 132kV busbar</li> </ul>	Improvement of availability, reliability, and quality of power supply	2025/26-2028/29	Sourcing for Financing	To be determined

UETCL GRID INVESTMENT PLAN (2023/24-2039/40) : IMPLEMENTATION SCHEDULE SUMMARY					
No.	PROJECT	OBJECTIVE	IMPLEMENTATION PERIOD FROM BASE YEAR, FY2023/2024	CURRENT STATUS	FINANCIER
	<ul style="list-style-type: none"> <li>1.3km of 132kV single circuit transmission line from existing Owen Falls – Lugogo transmission line through a single circuit line in line out to TPS-04 UETCL 132kV busbar.</li> <li>6.8km single circuit line in line out to TPS-05 UETCL 132kV busbar</li> </ul>	Improvement of availability, reliability, and quality of power supply	2025/26-2028/29	Sourcing for Financing	To be determined
<b>OTHER SYSTEM EXPANSION PROJECTS</b>					
1	SCADA and Communication upgrade and Emergency Control Centre	Improvement of availability, reliability, and quality of power supply	2023/24-2025/26	Under Implementation	World Bank
<b>E REGIONAL INTERCONNECTION PROJECTS</b>					
1	220kV NELSAP (Bujagali – Tororo & Mbarara – Mirama); Residual work at Mirama and Tororo SSs; Transmission Lines: 131.2km 220kV Bujagali – Tororo- UG/KY Border	Regional Power Trade	2025/26-2026/27	Substations under implementation, Sourcing for Financing for Transmission Line	AfDB and JICA at EPC and GOU
2	160km 400kV New Mbarara – Kasese – D.R.Congo Uganda's side, Kasese Industrial Park SS ( 2x250MVA 400/220/33kV substation) and 2x250MVA, 400/220/33kV transformers at New Mbarara SS	Regional Power Trade	2027/28-2031/32	At Concept Stage	To be determined

## UETCL GRID INVESTMENT PLAN (2023/24-2039/40) : IMPLEMENTATION SCHEDULE SUMMARY

No.	PROJECT	OBJECTIVE	IMPLEMENTATION PERIOD FROM BASE YEAR, FY2023/2024	CURRENT STATUS	FINANCIER
3	72.5km 400kV (220kV) Nkenda- Mpondwe (D.R.Congo) Transmission line (2X220kV bays at 220/132kV Nkenda SS)	Regional Power Trade	2025/26-2029/30	At Feasibility Stage	Feasibility study being financed by AfDB under coordination by NELSAP. EPC Financing to be determined.
4	92km 400kV Masaka – Mutukula – Mwanza Transmission Line, 151km Wobulenzi – Masaka, and associated substations (2X250MVA 400/220kV Masaka substation)	Regional Power Trade	2025/26-2028/29	At Feasibility Stage	World Bank under EDPP
5	150km 400kV Olwiyo – Bibia – Juba (Sudan) Transmission Line, Olwiyo 2x250MVA 400/132kV interbus transformers, Bibia 2x100MVA 400/132kV, 2x40MVA 132/33kV substation - (Uganda's part)	Regional Power Trade	2025/26-2028/29	financing negotiations between AfDB and MoFPED ongoing	AfDB financing the implementation of the project under coordination by NELSAP
6	70km 400kV New Mbarara South – Shango Double Circuit Transmission line and associated substations (5.5km 220kV Double Circuit Transmission Line from 220/132kV Mbarara SS to 400/220kV new Mbarara SS)	Improvement of availability, reliability, and quality of power supply	2037/35-2039/40	Feasibility Study Concluded	Government of Uganda, Government of Rwanda/ Government of Kenya at FS
7	15km 132kV Arua (Uganda) – Aru – Duruba (DRC) Transmission Line Project – Uganda Part (2X32/40MVA 132/33kV Arua SS Upgrade)	Regional Power Trade	2028/29-2030/31	At Concept Stage	To be determined

UETCL GRID INVESTMENT PLAN (2023/24-2039/40) : IMPLEMENTATION SCHEDULE SUMMARY					
No.	PROJECT	OBJECTIVE	IMPLEMENTATION PERIOD FROM BASE YEAR, FY2023/2024	CURRENT STATUS	FINANCIER
<b>OTHER INVESTMENTS</b>					
1	Grid Stability	To assess the stability of the transmission system	2024/25-2025/26	Under implementation	GOU
2	Transmission loss study	To determine triggers for high transmission losses and provision of recommendations to minimise the losses	2025/26-2026/27	Sourcing for Financing	To be determined
3	Consultancy services for using the overhead shield wire to transmit power at 33kV	To assess the viability of using overhead shield wire to transmit power at 33kV	2024/2025-2025/26	Under implementation	GOU

### 4.3.3. SUMMARY OF FINANCIAL REQUIREMENTS BY THE YEAR 2040

The cost implication to implement all the projects of grid investment plan (as shown in Table 49 above) under this scenario in the planning horizon is 4,359,005,010 USD and is premised on an exchange rate of 1USD=UGX 3,884.46: Source BOU 22/03/2024. The summarized cost breakdown is shown in Table 50 below.

**Table 50: Summary of financial requirements by 2039/40**

Project Category	Estimated Cost (Billion UGX)	Estimated Cost (x1000 USD)
Power Evacuation Projects	3,949	1,016,662
Re-Investment Projects	1,455	374,598
System Expansion Projects	8,200	2,111,057
Regional Interconnection Projects	3,321	855,032
Other Investments	6	1,656
<b>Total Grid Investment Requirement</b>	<b>16,932</b>	<b>4,359,005</b>

## 4.3.3.1. COMMITTED FUNDING AND ADDITIONAL FUNDING REQUIREMENT 2023/24 – 2039/40

Table 51: Committed Funding and Additional Funding Requirement 2023-2040

PROJECT CATEGORY	FEASIBILITY		EPC		COUNTERPART FUNDS	
	COMMITTED FUNDS (X 1000USD)	ADDITIONAL REQUIREMENT (X 1000USD)	COMMITTED FUNDS (X 1000USD)	ADDITIONAL REQUIREMENT (X 1000USD)	COMMITTED FUNDS (X 1000USD)	ADDITIONAL REQUIREMENT (X 1000USD)
Power Evacuation Projects	1,092	9,332		922,126		84,111
Re-Investment Projects		0	106,510	262,085	4,498	1,505
System Expansion Projects	-	13,811	129,349	1,540,701	1,906	425,290
Regional Interconnection Projects	-	3,151	-	577,297	-	274,584
Total Grid Investment Requirement	1,092	26,294	235,859	3,302,210	6,404	785,490

\*Counterpart funds include RAP Costs, Feasibility/ESIA, and RAP study costs.

4.3.3.2. THE FIVE-YEAR PLAN GDP 2023/24–2039/40 INVESTMENTS SUMMARY

Table 52: 5 Year Plan GDP 2023/24 – 2039/40 Investment Requirement Summary

Project Category	Estimated Cost (x 1000USD)			
	FY23/24 -FY24/25	FY25/26 -FY29/30	FY30/31 -FY34/35	FY35/36 - FY39/40
Power Evacuation Projects	46,839	315,524	434,690	219,608
Re-Investment Projects	39,274	309,429	16,874	9,021
System Expansion Projects	21,917	1,283,078	467,462	338,600
Regional Interconnection Projects	2,812	617,505	115,625	119,091
Other Investments	1,656	-	-	-
Total Grid Investment Requirement	112,498	2,525,537	1,034,650	686,320

4.3.3.3. THE FIVE-YEAR PLAN GDP 2023/24–2039/40 DONOR FUNDING AND COUNTERPART FUNDING REQUIREMENTS

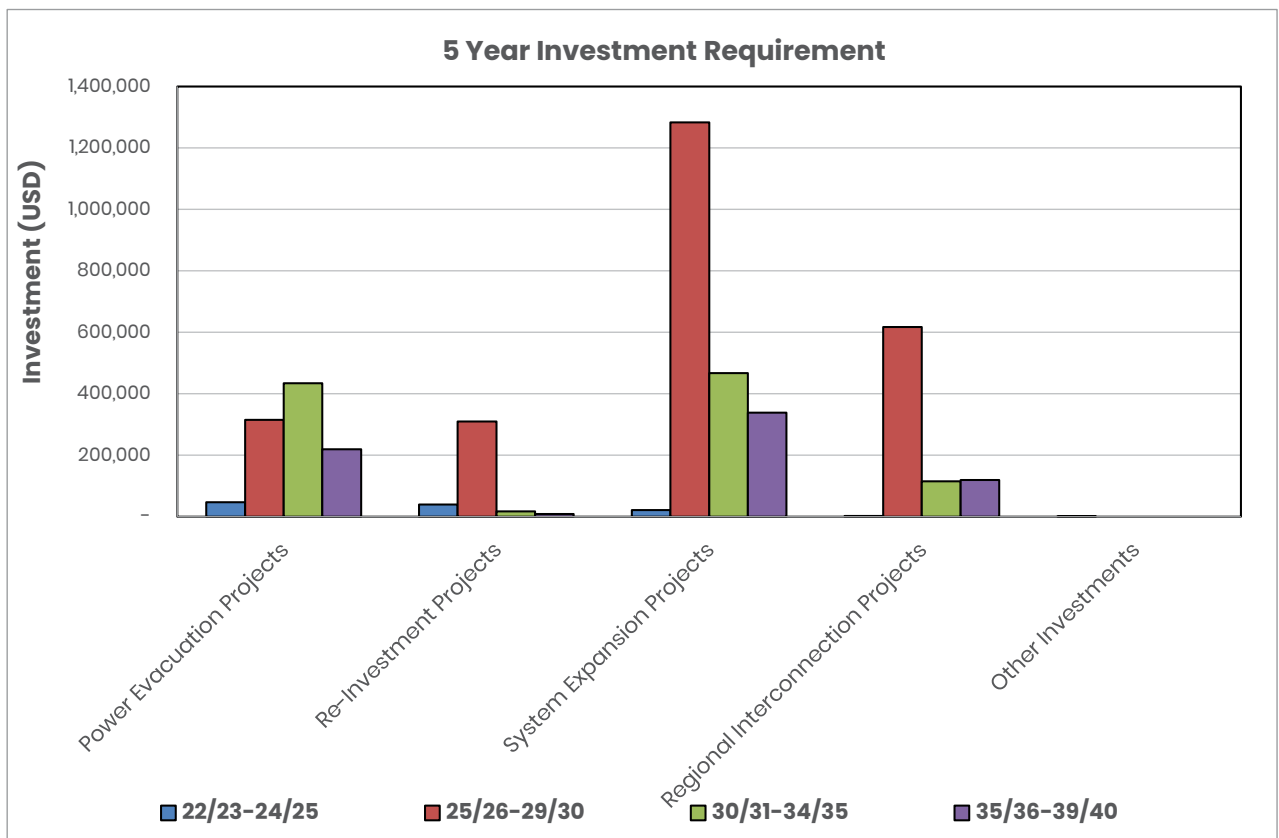


Figure 18: 5 Year Plan GDP 2023/24 – 2039/40 Investment Requirement

**Table 53: 5 Year Plan GDP 2023/24 – 2039/40 Donor Funding and Counterpart Funding Requirements**

Project Category	Estimated Cost (x 1000USD)											
	FY23/24 - FY24/25		FY25/26 - FY29/30		FY30/31 - FY34/35		FY35/36 - FY39/40		FY35/36 - FY39/40		TOTAL	
	EPC	RAP	EPC	RAP	EPC	RAP	EPC	RAP	EPC	RAP	EPC	RAP
Power Evacuation Projects	-	13,676	322,249	45,369	447,276	3,255	124,793	1,112	957,730			
Re-Investment Projects	34,776	4,498	310,434	1,505	14,025	-	9,021	-				
System Expansion Projects	19,449	41	955,969	307,858	431,004	41,198	237,537	77,566	2,070,621			
Regional Interconnection Projects	-	2,812	385,612	228,120	115,625	-	76,060	41,933	850,162			
Total Grid Investment Requirement	54,225	21,026	1,974,264	582,852	1,007,930	44,453	447,411	120,611	4,252,772			

### 4.3.3.4. INVESTMENT REQUIREMENT SUMMARY

The grid Investment requirements for the planning horizon are shown in the graph in Figure 19 below.

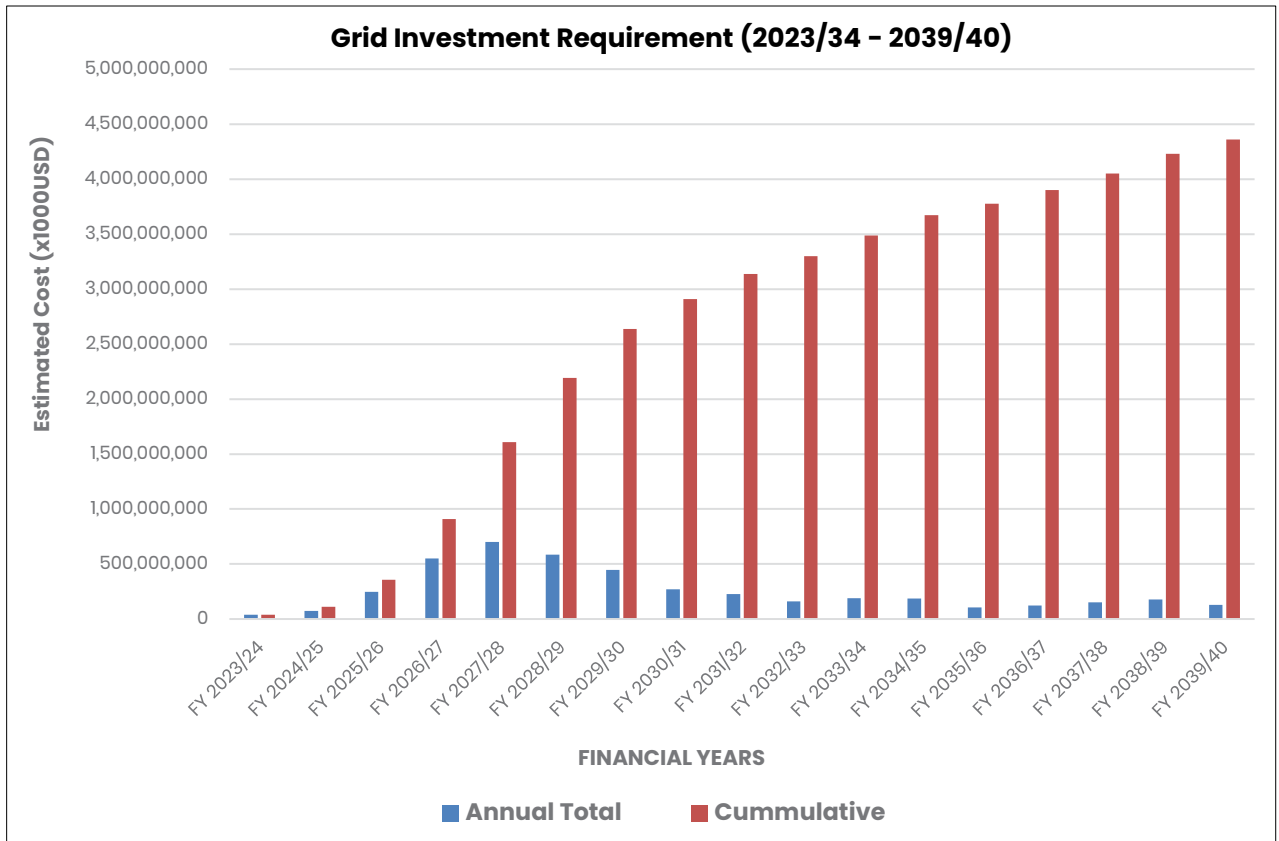


Figure 19: UETCL Grid Investment Requirements 2023/24-2039/40

### 4.3.4. REGIONAL INTERCONNECTION POWER LINES

Regional interconnection power lines are based on the recommendations from the interconnection studies carried out by the regional bodies (NBI and EAC) including EAPMP, the Comprehensive Basin Wide Study undertaken by the Nile Basin Initiative (NBI) and the Eastern Africa Power Pool Master Plan by EAPP.

Within the Nile Basin Initiative framework, the NELSAP has engaged in solidarity actions to promote poverty reduction, economic growth and reverse the environmental degradation process in member countries.

Regarding the energy sector, the NBI focused on optimization and development of hydroelectric power generation and interconnection among member states.

The East African Power Pool (EAPP) is a regional institution established in 2005 to coordinate cross-border power trade and grid interconnection among nations of the Eastern Africa region.

In February 2005, seven countries in the Eastern African region came together because they saw mutual benefit in having one power pool. The original member countries that signed the Inter-Governmental Memorandum of Understanding (IGMOU) were, Burundi, Democratic Republic of Congo, Egypt, Ethiopia, Kenya, Rwanda, and Sudan. Later, Tanzania (2010), Libya (2011), Djibouti, Uganda (2012) joined the pool. South Sudan and Somalia joined recently bringing the number of member countries to thirteen (13) and there’s a possibility that Eritrea may join.

The current member utilities are; REGIDESO of Burundi, SNEL of DRC, EEHC of Egypt, EEP of Ethiopia, GECOL of Libya, KenGen of Kenya, KPLC of Kenya, KETRACO of Kenya, REG of Rwanda, SETCO of Sudan, SINELAC of DRC – Rwanda – Burundi, TANESCO of Tanzania, UETCL of Uganda, EDD of Djibouti and the newly joined SSEC of South Sudan and Electricity utilities of Somalia. The governing instrument for the utilities is the Inter Utility Memorandum of Understanding (IUMOU).

The objectives of the Eastern Africa Power Pool include

- a) The reduction of power costs within the region
- b) Facilitation of power trade between the members
- c) increasing energy availability to citizens of member countries
- d) Increase the grid security of the member countries.

The Interconnections projects are currently at the following stages.

### Completed

- Uganda (Mbarara) – Rwanda (Birembo) 220kV Transmission line

### Construction

- Uganda (Bujagali) – Kenya (Lessos) 220 kV Transmission line

### Update of Feasibility Study

- Uganda (Nkenda - DRC (Beni/Bunia) 400kV transmission line; The feasibility study was completed in 2013 and the feasibility study is currently being updated.
- Uganda (Masaka) – Tanzania (Mwanza) 400kV line and 400kV Wobulenzi – New Masaka line; Feasibility Study was completed in 2011 for Masaka-Mutukula T/L and the feasibility study is currently being updated.
- Uganda (Olwiyo)- Juba (Southern Sudan) 400kV line; The feasibility study is completed.

### Other Projects

- 400kV Northern Corridor; There was a change in scope for this project.  
The transmission line in the new scope include 400kV Mbarara – Shango line. The full 400kV transmission ring is Tororo – Karuma, Karuma – Kawanda, Kawanda – Wobulenzi, Wobulenzi – New Masaka, Masaka – Mbarara and Mbarara – Shango.
- Arua – Aru 132kV transmission line is at concept stage.
- Mbarara South – Kasese industrial 400kV transmission line is at concept stage.

### 4.3.5. PROJECT PRIORITIZATION FOR FINANCING

It is observed, from the Grid Development Plan process, that there are numerous grid projects that must be implemented in the first five to ten years of the planning horizon.

It is therefore necessary to prioritize these projects as a means of allowing special attention to the most critical ones.

The projects have prioritized as follows

- Power Evacuation Projects
- Projects leading to industrial Growth
- Regional Interconnection projects
- Projects currently under consideration for IPT (Independent Power Transmitter) model.

The priority projects have been extracted from the GIP and are presented in Table 54 below

**Table 54: Project Prioritization for Financing**

No.	PROJECT	RATIONALE	FINANCING STATUS
1	72.5km 400kV (initially operated at 220kV) Nkenda- Mpondwe (D.R. Congo) Transmission line (2X220kV bays at 220/132kV Nkenda SS)	Regional Power Trade	Feasibility study being financed by AfDB under coordination by NELSAP. EPC Financing to be determined.
2	400kV Olwiyo-Bibia-Juba (Sudan) 200km Transmission Line, Olwiyo 2x250MVA 400/132kV interbus transformers, Bibia 2x100MVA 400/132kV, 2x40MVA 132/33kV substation- (Uganda's part)	Regional Power Trade	AfDB financing the implementation of the project under coordination by NELSAP.
3	92km 400kV Masaka – Mutukula – Mwanza Transmission Line, 151km Wobulenzi – Masaka and associated substations (2X250MVA 400/220kV Masaka substation)	Regional Power Trade	EPC funding under consideration by World Bank
4	15km 132kV Arua (Uganda) – Aru – Duruba (DRC) Transmission Line Project – Uganda Part (2X32/40MVA 132/33kV Arua SS Upgrade)	Regional Power Trade	Under consideration for EPC+F
5	76km 132kV Mbale – Bulambuli – Kween Transmission Line; 1X 60/80MVA 132/33kV Mbale SS, 2X60MVA 132/33kV Kween SS and 2X80MVA Bulambuli SS)	Provision of transmission capacity to evacuate power from IPPs in Bulambuli area	Under consideration for IPT model
6	Upgrade of Mbarara South substation (2x125MVA 220/132kV interbus transformers), Mbarara North substation (1x40MVA, 132/33kV power transformers), Tororo substation (2x125MVA 220/132kV interbus transformers and 1x80MVA, 132/33kV power transformers), Nkenda Substation (1x80MVA, 132/33kV Substation)	Enable power supply to ensure grid reliability and meet the domestic and industrial demand.	Under implementation as an IPT pilot project.

No.	PROJECT	RATIONALE	FINANCING STATUS
7	<p>Upgrade of Nkenda – Fort Portal – Hoima to 220kV and associated substations at Nkenda, Fort Portal, Lyanda, Kabaale and Hoima</p> <ul style="list-style-type: none"> <li>• Nkenda 2X250MVA 220/132kV Interbus transformers</li> <li>• Fort Portal 2X80MVA 220/132 Substation</li> <li>• Kabaale 2x250 MVA 220/132kV, 3x80MVA 132/33kV Substation</li> <li>• Lyanda/Muzizi 2x80MVA 220/132kV , 1x40MVA 132/33kV substation.</li> <li>• 6km 220kV underground cable to Kabaale substation</li> </ul>	<p>Evacuation of power from Tilenga and Kingfisher oil fields through the proposed Kabaale Substation, and Muzizi Hydro-power plant through Lyanda substation and to strengthen electricity transmission infrastructure around Kasese, Fort Portal, Hoima, and the Albertine Region</p>	<p>under consideration for EPC+F with JBIC financing</p>
8	<p>Electrification of Jinja, Ishaka and Kasese Industrial Parks (Jinja 132/33kV 2x80MVA, Njeru 132/33kV 2x80MVA, Masese 132/33kV 2x80MVA, Ishaka 132/33kV 2x80MVA and associated 90km of 132kV Transmission line, and Kasese 132/33kV 2x80MVA Substations</p>	<p>To supply power to Industrial parks of Jinja industrial substation (at Kiira EV plant), Njeru Substation (along Jinja Kayunga Road) and Masese Substation (near steel Jinja Rolling Mills). Ishaka and Kasese industrial parks</p>	<p>To be determined</p>
9	<p>37.3km 132kV Mirama-Kikagati-Nsongezi (2X32/40MVA 132/33kV Nsongezi SS)</p>	<p>Provision of transmission capacity to evacuate power</p>	<p>Under Consideration using EPC + F</p>
10	<p>92km 220kV Hoima-Kinyara-Kafu Transmission line and associated substations. 2X80MVA 220/33kV and 40MVAR(220kV) at Kinyara SS, 2x250MVA, 400/220/33kV, 2x40MVA 220/33kV, 40MVAR(400kV) and 20MVAR(220kV) at Kafu SS, 2x80MVA 220/132kV and 20MVAR(220kV) at Hoima SS</p>	<p>Provision of transmission capacity to evacuate power</p>	<p>Under Consideration using EPC + F</p>
11	<p>Upgrade of Mutundwe – Buloba – Kabulasoke – Masaka and Kabulasoke – Nkonge – Rugonjo – Nkenda 359km 132kV Transmission Line and Associated substation works (2X40MVA 132/33kV Kabulasoke SS, 2X40MVA 132/33kV Nkonge).</p>	<p>Provision of adequate capacity, improvement of reliability</p>	<p>Under consideration of EPC+F</p>

No.	PROJECT	RATIONALE	FINANCING STATUS
12	<p>Electrification of industrial parks and free trade zones</p> <ul style="list-style-type: none"> <li>Sukulu Phosphate Transmission Line Project (1km 220kV LILO from Tororo – Lessos TL and 3x80MVA, 220/33kV Power Transformers) – Phase 2</li> <li>123km, 132kV double circuit Nakasongola, Kaweweta Kapeka transmission line and associated substations (2X32/40MVA 132/33kV Nakasongola SS, 2X32/40MVA 132/33kV Kaweweeta SS)</li> <li>37km 220kV Wobulenzi – Kapeeka Transmission Line (2x250MVA 400/220kV Wobulenzi Substation, 2x80 MVA 220/132kV Kapeeka Substation)</li> <li>Kapeeka Industrial Park Project (3X50/63MVA 132/33kV Kapeeka SS)</li> <li>Mbale Industrial Park substation and associated transmission 3x80MVA 132/33kV Substation</li> </ul>	Improvement of availability, reliability, and quality of power supply	Under EPC+F with EPC commercial contract signed. – Awaiting Effectiveness of the Loan
13	345km 400kV Karuma – Tororo Transmission Line (2x250MVA 400/220kV Boarder SS in Tororo District, 2X400kV line bays at Karuma SS) and Ntinda 2x40MVA 132/33kV Substation and Associated 2km 132kV Transmission Line	Improvement of availability, reliability, and quality of power supply	Under EPC+F with EPC commercial contract signed. – Awaiting Loan signature
14	29.2km 132kV Moroto – Katikekile Transmission Line and 2x40MVA, 132/33kV Substation	To supply reliable power to support industries in Katikekile	To be funded by GOU through direct procurement
15	Electrification of the Standard Gauge Railway Project Transmission lines and substations.	To supply reliable power to the railway traction substations	Under consideration of EPC+F
16	400kV 190km Mbarara South to Kasese Industrial Park SS (2x250MVA, 400/220/33kV) and (New Mbarara 400kV Substation)	Regional Power Trade	To be determined
17	60km 132kV Kabale – Kisoro Transmission Line (2 x 32/40MVA 132/33kV Kisoro Substation)	To supply reliable bulk power to Kisoro	To be determined

No.	PROJECT	RATIONALE	FINANCING STATUS
18	95km 132kV Kabale – Ishaka Transmission Line Project (via Nyakagayeme)	Improvement of availability, reliability, and quality of power supply and provision of transmission capacity to evacuate power	To be determined
19	2km LILo to Akageti substation from Masaka-Mbarara 132kV Transmission line and Akageti 2x40MVA 132/33kV Substation	To supply power to Akageti Industrial Park that has commenced construction	To be determined
20	132kV 70km Arua – Oraba 2 x 23/40MVA 132/33kV Oraba substation	To supply reliable bulk power to Oraba industrial park and environs	To be determined
21	132kV 150km Arua – Adjumani and 32/40MVA 132/33kV Adjumani substation	To supply reliable bulk power to West Nile region and Adjumani	To be determined
22	78km 132kV Nakasongola – Kasana Transmission Line and 2x40MVA Kasana Substation	To supply reliable bulk power to support industrial development	To be determined
23	<p>Grid Strengthening Project</p> <ul style="list-style-type: none"> <li>• Reinforcement of the proposed Lira Substation (2x40MVA, 132/33kV Power transformer)</li> <li>• 132kV, 211km Double circuit Kapeeka – Nkonge – Mubende – Kiboga 132kV Transmission Line and associated substations (2x40MVA, 132/33kV Power transformer Mubende Substation and 2x40MVA, 132/33kV Power transformers at Kiboga substation).</li> <li>• 132kV, 13km LILo to Rakai SS and new Rakai Substation (2x80MVA, 132/33kV Power transformer).</li> <li>• 132kV, 2km LILo to Lugazi Substation and upgrade of Lugazi substation (2x40MVA, 132/33kV Power transformer)</li> <li>• Mutundwe SS Upgrade (2x80MVA, 132/33kV Power transformer)</li> <li>• Lugogo SS Upgrade (2x80MVA, 132/11kV Power transformer)</li> </ul>	Improvement of availability, reliability, and quality of power supply	To be determined

No.	PROJECT	RATIONALE	FINANCING STATUS
24	50km 132kV Bibia – Adjumani Transmission Line Project	To supply reliable bulk power to West Nile region and Adjumani	To be determined
25	150km 220kV Kapeeka – Kiboga – Hoima Transmission Line and 2x125MVA 220/132kV interbus transformers at Kiboga SS		To be determined
26	132kV Buloba – Entebbe – Gaba-Luzira (2x32/40MVA 132/33kV Gaba SS; 40km 132kV Buloba – Entebbe Transmission Line, 45km 132kV Entebbe – Gaba Transmission Line and 8km 132kV Ggaba – Luzira Transmission Line)	Improvement of availability, reliability and power supply quality	To be determined
27.	20km 220kV LLO from Bujagali – Kawanda transmission line to Busiika substation (Busiika 2x80MVA 220/33kV Substation)	Improvement of availability, reliability, and quality of power supply	To be determined

#### 4.3.6. INFORMATION AND COMMUNICATION TECHNOLOGY

UETCL's objective is to build and maintain a smart national grid that maintains a flexible and reliable electricity supply. This requires a changed approach to grid investment and a similar change in its telecommunications investment.

UETCL currently implements the Optical Fibre with Ground Earth wire (OPGW) as part of every EPC contract for construction of transmission lines and as such the communication infrastructure is expanding at the same pace as the power transmission grid.

The current UETCL telecommunications network is in most cases up to date but there is need to make certain that it shall continue to be future proof.

The demand for a reliable communication network that ensures optimum management of the power system and its ability to meet other business requirements are increasing.

UETCL's response to the challenges faced includes and shall continue to have the following initiatives:

- Communication infrastructure that enables improved monitoring and control of the power system as well as increased access to detailed power system network information.
- The telecommunications network needs to support UETCL's critical grid services comprising of tele-protection, SCADA, telemetry and voice communication.
- The move towards an IP based environment is leading UETCL into paying more attention to communication networks.
- Cybersecurity measures put in place to:
  - Protect operators against threats that cause outages and data breaches such as viruses, ransomware and malware.
  - Ensure safe communication between components and provide for secure storage of data.
  - Providing secure management services such as authentication, encryption and robust monitoring.
- Unified converged system that integrates CCTV and access control components to provide robust surveillance and automated approval for authorised personnel to infrastructure.
- Embracing new initiatives like Internet of Things (IoT) and Wireless Sensor Networks (WSN) to perform accurate monitoring and measurements on the grid.
- Leveraging Artificial Intelligence (AI) combined with Machine Learning (ML) to improve analytics of data that is available from the grid and foster; power usage optimisation, flexible demand-side management, precise forecasting, self-repairing and many other improved operations.

In addition, new lines of business in telecommunication are being identified by the company. This shall ensure better utilisation of present and future grid communication infrastructure.

Optical Fibre Leasing: This is a business area that has been identified by UETCL. All new transmission lines shall have sufficient optical fibre installed to cater for other users who wish to lease the fibre. An aggressive marketing campaign shall be used to attract more users. UETCL, however, has a challenge of avoiding service interruptions resulting from vandalising the towers that support the fibre.

#### 4.3.7. GEOGRAPHICAL INFORMATION SYSTEM

Whenever there is an occurrence on earth, the most important question that comes into the human mind is where and when it took place. UETCL to address the aforementioned question as well as keep up with global trends where a service is as good as the convenience it comes with embarked on implementing a Geographical information system (GIS).

Geographical Information System (GIS) will continue to play a big part in UETCL's portfolio, acting as a cornerstone on its journey towards Digital transformation, paving the way for Grid modernization. With its ability to manage and analyze spatial power transmission systems data. GIS will help UETCL in improving the reliability and efficiency of its operations as well as maintenance of ISO Certifications through:

- **Asset Maintenance and Forecasting** – GIS can primarily be employed for Transmission Asset Management, helping UETCL manage detailed information about the location and condition of their assets on the network. This will help in the timely maintenance and servicing of assets in return enabling operators to quickly identify the location of faults or outages, enabling rapid response and minimizing downtime.
- **Network Planning and Design** – UETCL will use GIS in Site Selection which will include analyzing and selecting optimal locations for new substations or power lines based on factors such as terrain, accessibility, and environmental considerations.
- **Land Management** – UETCL acquires multiple parcels of land during transmission project execution and also has existing land that was inherited from UEB. GIS gives a good platform for the management of land parcels as well as rights from easements, Licenses and Leases.
- **Safety Management** – UETCL Substation installations are high-risk areas, application of GIS to geo-fence all substation areas and triggering an alert for all staff to follow safety measures before access will greatly reduce the accidents both at our substations but also in our project areas during construction.
- **Brand improvement** – GIS facilitates effective communication with customers through interactive maps and real-time updates. Providing customers with information about planned power outages, maintenance schedules, and other relevant details can enhance transparency and trust in the brand

UETCL is going to embark on full operationalization of GIS in the areas mentioned and any other priority area as a way of achieving its mission of buying, transmitting and selling quality bulk power

## 4.4. FINANCIAL PROJECTION AND ANALYSIS

This section presents the resultant Financial Projections and Analysis based on the Grid Investment Plan, the Demand and Supply balance projections as the key inputs.

The Grid Investment Plan shows the various projects to be undertaken, the associated costs and project life cycle timelines. These are used to derive the projected Fixed Asset base (Work in Progress and the Capitalized Assets). The Financing structure of the project costs i.e. EPC Costs have been assumed to be financed from debt instruments (concessional loans) whereas the feasibility studies, Land and RAP Costs are assumed to be funded through GoU contribution.

The Demand and Supply balance projects the domestic demand, system demand, primary and secondary spinning reserve, the generator installed capacity and the resultant energy generation. This is used to establish the resultant company Revenue requirements accordingly.

The section below discusses the assumptions made and the resultant Financial Projections.

### 4.4.1. ASSUMPTIONS

#### 4.4.1.1. MACRO-ECONOMIC ASSUMPTIONS

The macro-economic assumptions are briefly highlighted below.

- **Exchange Rate:** Over 95% of Invoices from power generators are in foreign currency denomination (USD). These USD invoices are affected by the movement in exchange rates during conversion to UGX at payment. The Exchange rate has been projected basing on the previous years' BoU rates. The exchange rates are also used to adjust the Foreign Exchange portion of the Transmission System Operator costs periodically.
- **Consumer Price Index (CPI):** The CPI is used in the adjustment of the Local Currency component of the Transmission System Operator Costs periodically.
- **Producer Price Index (PPI):** The Producer Price Index is used in the adjustment of the O&M component of the Generator prices (Tariffs) as provided for in the respective Power Purchase Agreements. This parameter has been projected based on the previous trend.
- The fuel price affects the prices of power produced by thermal power plants. It is important to note that in addition to the existing thermal plants (UEGCL-Namanve and Electromax) UETCL anticipates additional thermal plants on to the grid which include Gas to Power (Tilenga) and Gas to Power (Kingfisher), yet thermal Prices are determined at the world global markets.

#### 4.4.1.2. ENERGY PROJECTIONS ASSUMPTIONS

The energy projection assumptions are discussed briefly below.

- **Energy Units Projections:** The Energy Projections are based on the Demand and Supply balance projections. This is based on normal organic demand growth, the anticipated industrial loads inclusive data centres and the projected export potential from time to time.
- **Energy Cost Projections:** The Energy cost projections are based on the prevailing tariffs in the Power Purchase Agreements and the ERA REFIT Phase VI Tariffs guidelines. The O&M component of the generation tariffs are adjusted for inflation annually.
- The Power generators are projected to generate power beyond the Power Purchase

Agreement term if they still have useful economic life.

- Bujagali and Kiira-Nalubaale have been projected as capacity plants. Other large power plants like Karuma, Isimba Ayago, Oriang, Kiba, Uhuru and Muzizi are projected as energy deals and dispatched for demand supply balance after taking care of the must run plants.

#### 4.4.1.3. TRANSMISSION SYSTEM OPERATOR COSTS ASSUMPTIONS

Transmission System Operator Costs include Grid Repair and Maintenance costs, Staff Costs, General Administrative Costs and Grid investments that are approved by ERA.

- Grid and Maintenance costs comprise of substation maintenance, software maintenance, transmission lines maintenance, other grid maintenance.
  - Substation maintenance costs have been projected based on the expansion in the number of substations. These costs have further been adjusted for by movement in inflation.
  - Transmission line maintenance have been projected based on the growth in the transmission line route length. These costs have further been adjusted for by movement in inflation.
- Staff costs have been projected based on the previous trends and projected further based on inflation movement.
- The General Administrative costs have been projected based on the previous trends and projected further based on inflation movement.
- Depreciation: this has been assumed as a percentage of the Gross Fixed Asset, basing on the previous trend. Depreciation is catered for in form of spares, repair and maintenance of the grid.

#### 4.4.1.4. WORKING CAPITAL

- Accounts Receivables and Payables: these have two months of credit to allow collections from energy sales and make payments thereto.
- Inventories have been assumed as a percentage of the fixed assets and is based on the previous trend.
- Impairment of financial instruments; This provision has been based on the IFRS 9 Standard that requires recognition of financial assets impairment.

#### 4.4.1.5. ASSETS, GOU CONTRIBUTIONS AND BORROWINGS

- **Fixed Assets:** Fixed assets comprise both the work in progress and the capitalized projects. The fixed asset base is projected basing on the number of projects anticipated to be implemented during this period following the respective project life cycles.
- **GOU Contributions:** GOU has been projected to cover the RAP implementation within the project costs.
- **Borrowings:** Borrowing for projects is projected to be paid by GoU and as such do not impact the tariff but impact on the Statement of Financial Position. For projects with already secured financing, borrowings / long term debt is projected based on the terms in the loan agreements. For projects without secured financing, an average assumption of 5% loan interest with a

twenty (20) year loan period inclusive of a five (05) year grace period is assumed.

- Some projects are projected to be passed through within the tariff. However, a cap of Ugx 90Bn which can be accommodated in the tariff has been used.

#### 4.4.1.6. OTHERS

- Corporate Income Tax has been assumed at 30%
- Generation Levy has been assumed at 0.7% while Rural Electricity Levy has not been considered as per the Electricity Amendment Bill 2022.
- All Projections have been based on the financial year
- All IPPs are expected to be in dispatch even after their contract term (expiry) if they still have the economic useful life.
- UEGCL Kiira -Nalubaale and Bujagali power plants expected to be dispatched as capacity deals. Other large hydro plants projected like Ayago, Oriang, Kiba, Uhuru and Muzizi expected to be dispatched as energy deals

#### 4.4.1.7. ENERGY PURCHASES

The following events in generation are expected to drive the power supply projections

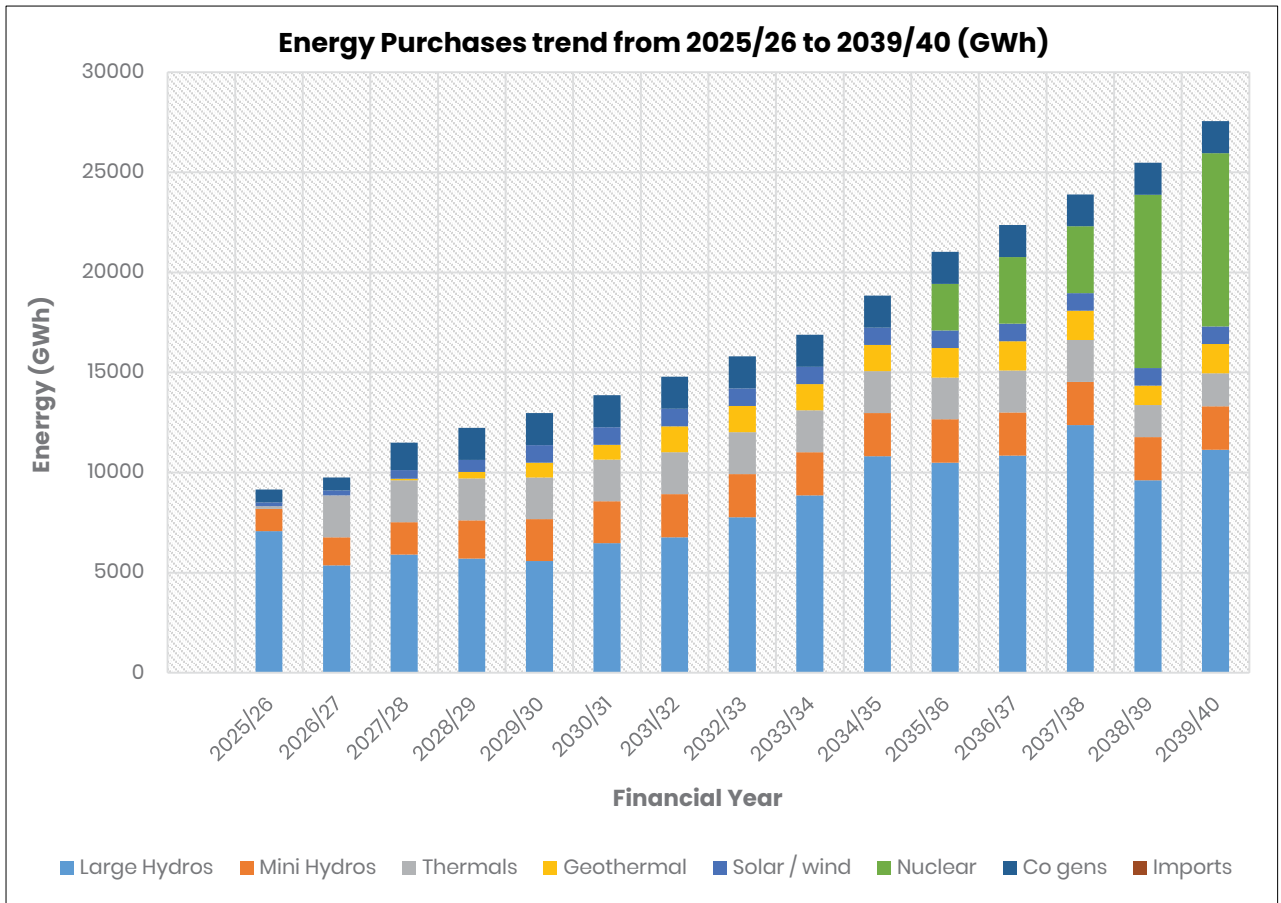
- Commissioning of large hydro power plants such as Kiba 400MW in 2032/33, Muzizi 45MW in 2029/30, Oriang 392MW in 2033/34, Ayago 840MW in 2035/36, Uhuru 100MW in 2039/40.
- The total installed Capacity is projected to increase from projected 2,087.92MW in 2025/26 to MW 6,498.23 in 2039/40. This Increase is premised to ensure that there is ample generation capacity to always meet the growing projected demand for electricity.
- Hydro power plants installed capacity is premised to increase to 3,747.8 MW (both Large hydro plants and Mini Hydro plants) by 2039/40 and continue being the major contributor to the required generation capacity.
- The current thermal power plants of Namanve 50MW and Electro Maxx 50MW are expected to remain in the mix until 2040 and will be supplemented with 2 additional thermal plants (Gas to Power Tilenga(200MW) & Kingfisher (39.1MW) which are expected in 2026/2027. This will bring the total Installed thermal capacity to 339.1 MW by 2039/40.
- Geothermal is expected to come into the generation mix bringing on board 183MW from two power plants, Panyimur 150MW in a phased manner from 2027/2028 and Kabale peat 30MW in 2028/2029.
- Numerous solar plants have been lined in the generation mix that will have a total 479MW of solar Installed capacity by 2039/2040.
- Wind is expected to be added into the mix, bringing on board 20MW from Senok wind power plant in 2026/2027
- Nuclear Energy Is projected onto the grid in 2035/36 with the commissioning of Buyende Nuclear Power Plant (1400MW).
- Numerous Co-generation plants have also been lined in a phased implementation manner bringing the total Cogen Installed capacity to 332.3MW by 2039/40

Based on the aligned installed capacity trend above, the expected energy production which is

required to meet the growing demand (inclusive of energy sales to the National distributors, Northern Tanzania exports and industrial loads inclusive data centres) is expected to be 27,560.55GWh by 2039/40 from the projected base of 9,146.81 GWh in 2025/26. This represents an average annual growth of 10. % and overall growth of 201% over the period as shown in Table 55 and Figure 20 here under.

Table 55: Energy Purchases (based on Required Generation (BAU)+NTZ+IND+DC)

Period	Energy Purchases in GWh										Total
	Large Hydrops	Mini Hydrops	Thermals	Geothermal	Solar / wind	Nuclear	Co gens	Imports			
2025/26	7,075.39	1,099.12	142.96	-	188.38	-	640.96	-			9,146.81
2026/27	5,369.90	1,396.66	2,093.38	-	245.56	-	640.96	-			9,746.46
2027/28	5,897.59	1,620.14	2,093.38	81.57	430.57	-	1,371.59	-			11,494.84
2028/29	5,695.56	1,910.12	2,093.38	326.29	607.17	-	1,601.55	-			12,234.08
2029/30	5,577.55	2,088.98	2,093.38	734.16	876.28	-	1,601.55	-			12,971.89
2030/31	6,471.09	2,088.98	2,093.38	734.16	876.28	-	1,601.55	-			13,865.43
2031/32	6,757.84	2,159.62	2,093.38	1,305.17	876.28	-	1,601.55	-			14,793.83
2032/33	7,764.21	2,159.62	2,093.38	1,305.17	876.28	-	1,601.55	-			15,800.21
2033/34	8,854.03	2,159.62	2,093.38	1,305.17	876.28	-	1,601.55	-			16,890.02
2034/35	10,810.10	2,159.62	2,093.38	1,305.17	876.28	-	1,601.55	-			18,846.09
2035/36	10,497.00	2,159.62	2,093.38	1,468.32	876.28	2,330.90	1,601.55	-			21,027.04
2036/37	10,841.58	2,159.62	2,093.38	1,468.32	876.28	3,330.90	1,601.55	-			22,371.62
2037/38	12,368.84	2,159.62	2,093.38	1,468.32	876.28	3,330.90	1,601.55	-			23,898.90
2038/39	9,617.95	2,159.62	1,593.38	968.32	876.28	8,658.16	1,601.55	-			25,475.24
2039/40	11,145.90	2,159.62	1,650.74	1,468.32	876.28	8,658.16	1,601.55	-			27,560.55
<b>Average growth</b>											<b>10%</b>
<b>Overall growth</b>											<b>201%</b>



**Figure 20: Energy Purchase Generation Mix 2025/26 to 2039/40**

**4.4.1.8. RESULTANT REVENUE REQUIREMENTS**

The Revenue Requirements comprise of Single Buyer and Transmission System Operator (TSO) costs. UETCL is a not-for-profit public limited company. Therefore, the Bulk Supply Tariff mainly is to recover the revenue requirements for the company. Single Buyer costs are mainly driven by Power Purchase costs and other costs (third party charges / levies) as approved by ERA.

The third-party charges are computed as 0.7% of exports in accordance with the Electricity Amendment act 2022.

The Transmission System Operator costs component mainly comprise of staff costs, administrative costs, transport costs, grid maintenance and repair, license fees, bank guarantee charges, insurance and communication levy.

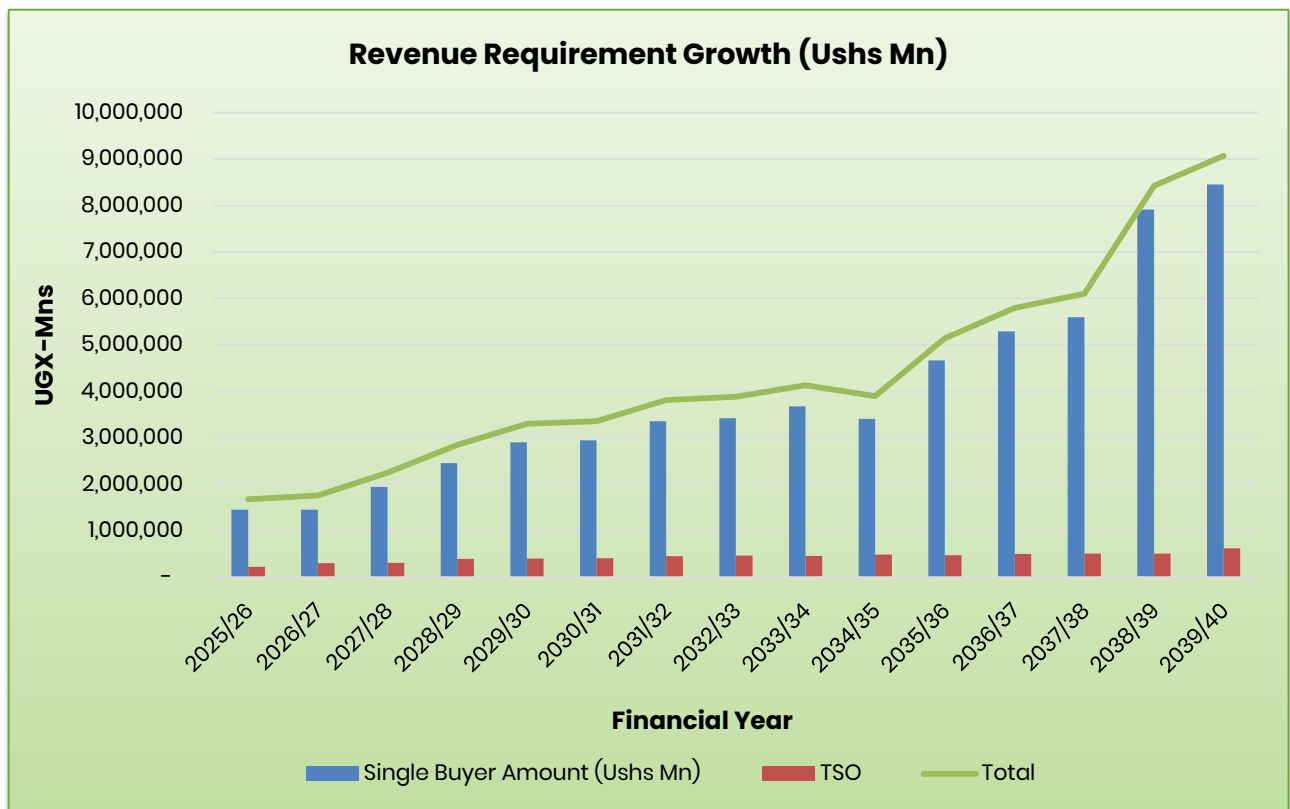
Based on the single buyer and transmission system operations assumptions above, the resultant revenue requirements are expected to increase from Ugx 1,678,319.37Mn in 2025/26 to UGX 9,072,036 Mn in 2039/40 leading to 440.54% growth. Single buyer costs are expected to contribute an average of 88.73% while Transmission System Operator (TSO) costs expected to contribute 11.27%.

In the year 2035/2036, energy costs are seen to increase due to majorly the phased projected commissioning of Buyende Nuclear Plant (1400MW) in addition to the large hydro’s of Kiba (400MW), Oriang (392MW) and Ayago (840MW).

Table 56 and the graph shown in Figure 21 here under show the trend of the single buyer costs and the Transmission Operations Costs (TSO)

**Table 56: Single buyer Costs and Transmission Operations Costs for the period 2025/26 - 2039/40.**

Year	Amount (Ushs Million)			Single Buyer Contribution (%)	TSO Contribution (%)
	Single Buyer	TSO	Total		
2025/26	1,452,368	225,951	1,678,319	86.54%	13.46%
2026/27	1,454,008	302,357	1,756,365	82.79%	17.21%
2027/28	1,940,711	309,167	2,249,877	86.26%	13.74%
2028/29	2,452,381	391,640	2,844,021	86.23%	13.77%
2029/30	2,901,240	401,099	3,302,338	87.85%	12.15%
2030/31	2,944,610	410,492	3,355,102	87.77%	12.23%
2031/32	3,360,165	450,475	3,810,640	88.18%	11.82%
2032/33	3,420,308	466,331	3,886,639	88.00%	12.00%
2033/34	3,676,264	456,356	4,132,620	88.96%	11.04%
2034/35	3,410,036	488,565	3,898,601	87.47%	12.53%
2035/36	4,666,912	474,375	5,141,286	90.77%	9.23%
2036/37	5,291,322	502,450	5,793,773	91.33%	8.67%
2037/38	5,595,246	506,486	6,101,732	91.70%	8.30%
2038/39	7,912,709	510,710	8,423,419	93.94%	6.06%
2039/40	8,452,372	619,665	9,072,036	93.17%	6.83%
<b>Total</b>	<b>58,930,651.35</b>	<b>6,516,117.81</b>	<b>65,446,769.17</b>		
<b>Growth</b>	<b>481.97%</b>	<b>174.25%</b>	<b>440.54%</b>	<b>88.73%</b>	<b>11.27%</b>



**Figure 21: Revenue Requirements**

The single buyer costs account for approximately 88.73% of the total revenue requirement while the transmission Costs account for the 11.27% of the total revenue requirement.

The single buyer costs paid to the power generators, are external and heavily influenced by long term high value Power Purchase agreements (PPAs) signed between UETCL and the Independent Power Producers. They are volume driven (variable based on amount of electricity dispatched from the power Plant), foreign currency indexed, globally affected by fuel prices and also include Capacity payments for capacity plants. The Single buyer costs are pass through costs to the end user.

The transmission operational costs are Internal costs purely controlled and managed by the Utility based on agreed Internal operation and maintenance plans and governance structures.

#### 4.4.1.9. ENERGY REVENUES, COST OF SALES AND GROSS PROFIT

UETCL revenue is mainly generated from the sale of energy to various power distributors. UETCL however, generates additional income from leasing of optic fibre co-location - rentals and others which reduce the operation and maintenance costs.

The energy sales revenue is used to pay off the cost of sales (power purchase costs) and the third-party levies which leads to gross profit. The gross profit is used to pay off the transmission system operator costs. The Company is expected to recover all the costs through a cost reflective tariff and therefore the profit (loss) after tax is projected to be zero during the period.

The Company is expected to generate revenue of approximately Ugx 10,200,328Mn in 2039/40 from Ugx 2,058,991.97 Mn in 2025/26 leading to 395.40% overall revenue growth throughout the period. On the other hand, the cost of sales is expected to increase from Ugx 1,846,129.59Mn in 2025/26 to Ugx 9,589,346 Mn in 2039/40 leading to 419.43% overall growth. Gross profit is expected to be Ugx

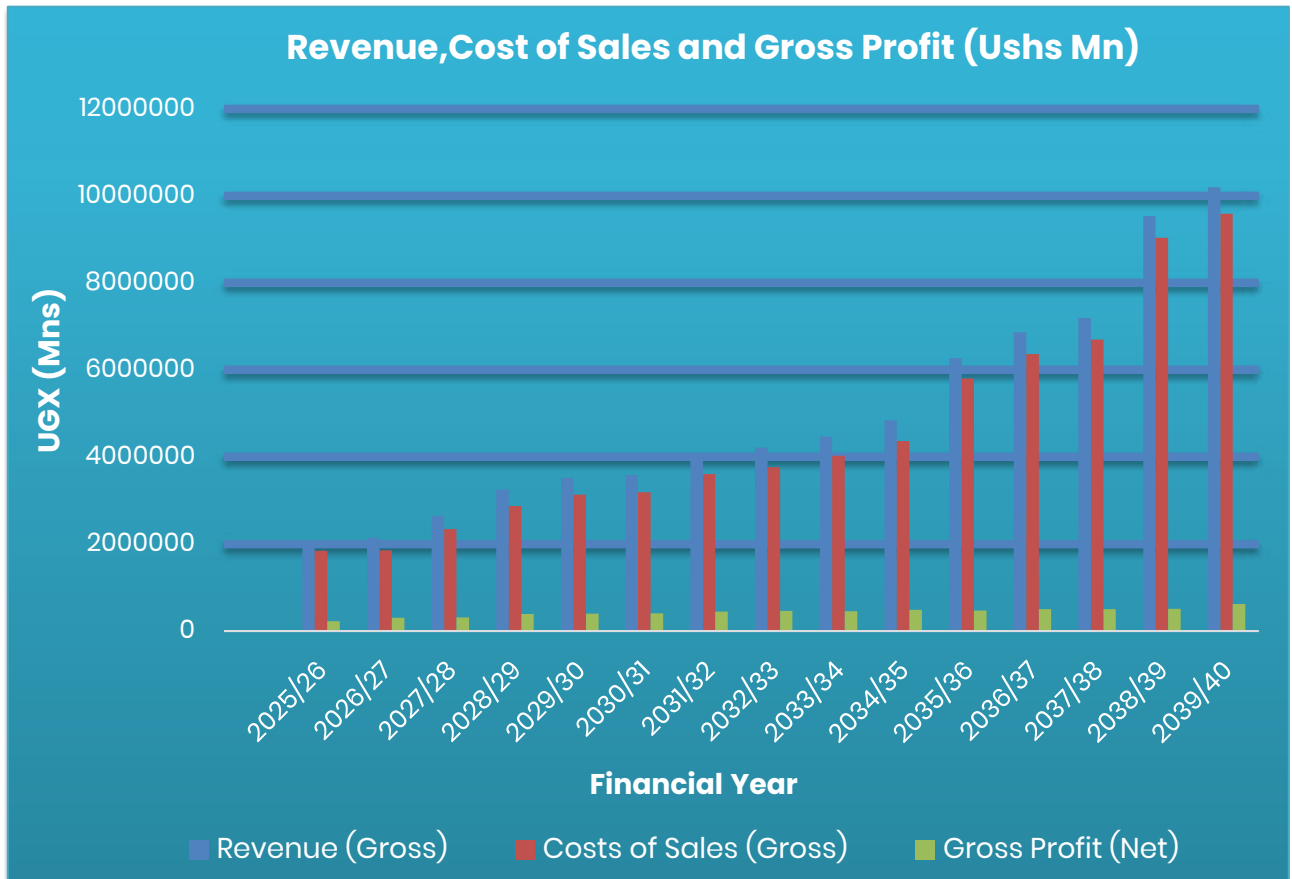
619,665Mn in 2039/40 from Ugx 225,951.03 Mn in 2025/26 representing 174.25% overall growth.

Table 57 below presents the revenue, cost of sales and gross profit during the projection period.

**Table 57: Revenue, Cost of Sales and Gross profit**

Year	Amount (Ushs Million)		
	Revenue (Gross)	Costs of Sales (Gross)	Gross Profit (Net)
2025/26	2,058,992	1,846,130	225,951
2026/27	2,142,210	1,852,965	302,357
2027/28	2,640,896	2,344,863	309,167
2028/29	3,249,300	2,870,754	391,640
2029/30	3,523,304	3,136,648	401,099
2030/31	3,582,316	3,186,282	410,492
2031/32	4,041,224	3,605,242	450,475
2032/33	4,216,096	3,763,626	466,331
2033/34	4,467,545	4,025,070	456,356
2034/35	4,844,347	4,365,447	488,565
2035/36	6,268,951	5,803,027	474,375
2036/37	6,861,541	6,368,019	502,450
2037/38	7,198,728	6,701,026	506,486
2038/39	9,535,866	9,033,891	510,710
2039/40	10,200,328	9,589,346	619,665
<b>Total</b>	<b>74,831,644.49</b>	<b>68,492,338.47</b>	<b>6,516,117.81</b>
<b>Growth</b>	<b>395.40%</b>	<b>419.43%</b>	<b>174.25%</b>

Figure 22 below illustrates the trend of revenue, cost of sales and gross profit during the projection period.



**Figure 22: Revenue, Cost of Sales and Gross profit (Ushs Mn)**

The Revenue trend is based on the projected domestic loads plus Northern Tanzania, the Industrial loads (Inclusive data centres) and the additional exports through the grid Interconnectors. Based on the demand forecast the loads are projected to grow from 1,385.51 MW In 2025/26 to 4,099.82MW In 2039/40 representing period growth of 195%.

The Cost of sales are seen to increase in the later years of 2035/36 – 2039/40 and this is attributed to majorly the commissioning of Buyende Nuclear Plant, which is projected to have Installed capacity of 1,400MW coming into the generation mix. This is associated with the nature of nuclear plants which are expensive to build with low variable operational costs and have a very high-capacity factor.

**4.4.1.10. FIXED ASSET BASE**

UETCL Fixed Assets are mainly comprised of Property, Plant and Equipment (PPE), way leaves and easements, prepaid lease rentals and intangible assets. The fixed assets are mainly financed by Government of Uganda through debt (concessional loans). The way leaves are mainly financed by Government contributions. Debt contributes mainly 85% while Government of Uganda contributions contribute 15% on UETCL balance sheet. The fixed assets are therefore relatively proportion to the long-term debt.

Fixed Assets are expected to grow from an asset base of Ugx 8,652,740.86 Mn in 2025/26 to Ugx 37,848,866.99 Mn leading to period growth of 337.42%. Fixed assets growth is expected to be driven by the new projects being implemented (work in progress) and the capitalized assets after their respective defects' liability period.

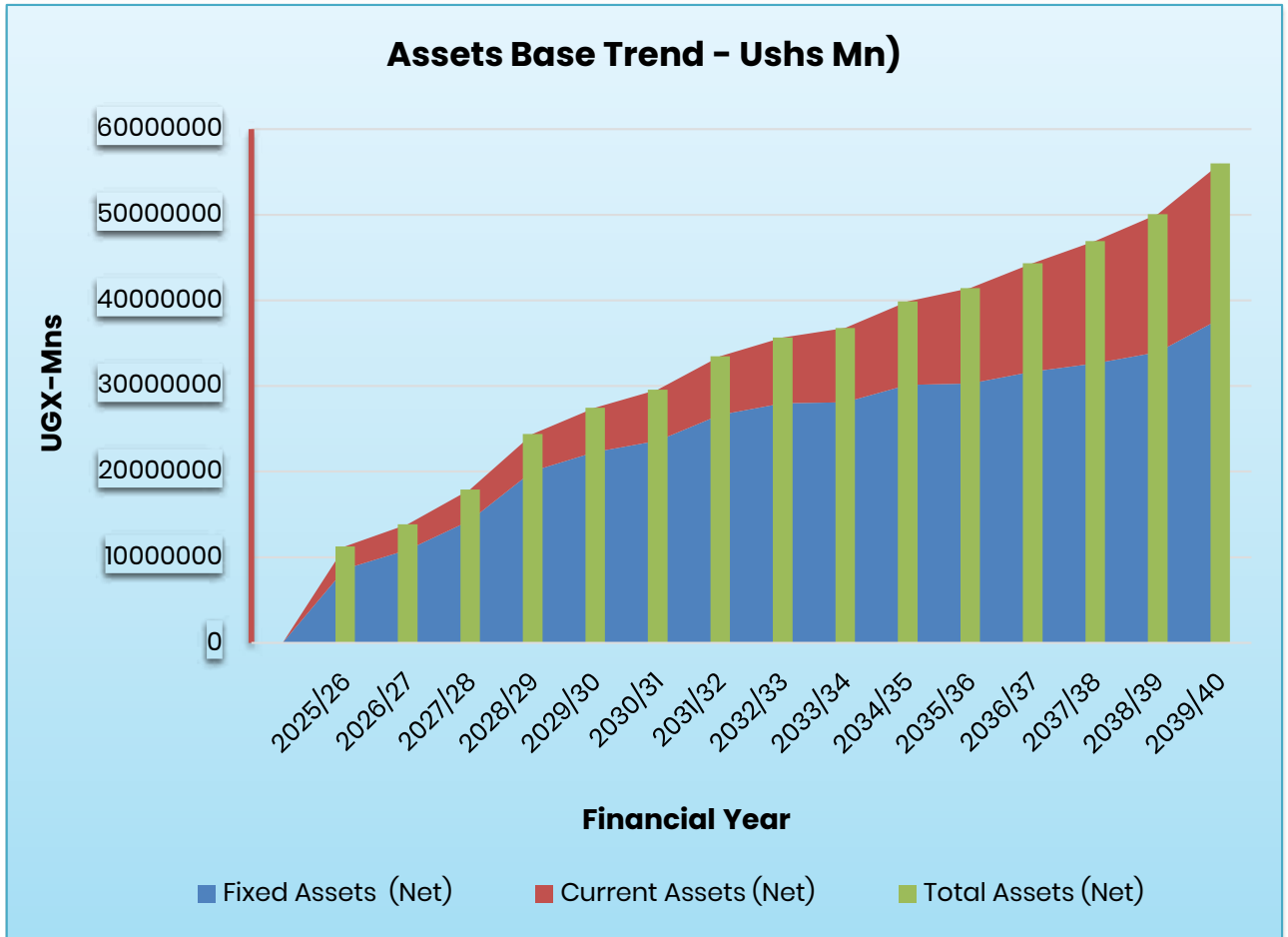
The Current Assets are majorly comprised of Accounts receivables, Inventory and Spares, Cash and bank balances among others and these are expected to grow from Ugx 2,604,287Mn in 2025/26 to Ugx 18,129,156 Mn leading to period growth of 596.13%. Current assets growth is expected to be driven by majorly the increase in trade receivables arising from Increased sales that will speak to increased bank and cash balances.

Table 58 below presents the projected asset base growth from 2025/26 to 2039/40.

**Table 58: Asset base growth from 2025/26 to 2039/40**

Year	Amount (Ushs Mn)		
	Fixed Assets (Net)	Current Assets (Net)	Total Assets (Net)
2025/26	8,652,740.86	2,604,287	11,257,028.32
2026/27	10,862,586.56	2,999,140	13,861,726.42
2027/28	14,306,914.36	3,583,736	17,890,650.43
2028/29	20,056,527.35	4,321,843	24,378,370.78
2029/30	22,276,856.90	5,174,251	27,451,107.93
2030/31	23,588,560.64	5,993,118	29,581,678.60
2031/32	26,637,080.66	6,814,095	33,451,175.46
2032/33	27,963,874.34	7,705,705	35,669,579.56
2033/34	28,081,874.17	8,673,620	36,755,493.92
2034/35	30,111,801.04	9,770,953	39,882,753.68
2035/36	30,268,705.26	11,143,556	41,412,261.47
2036/37	31,668,323.82	12,657,576	44,325,899.96
2037/38	32,648,490.38	14,262,413	46,910,903.78
2038/39	33,962,845.95	16,112,385	50,075,231.20
2039/40	37,848,866.99	18,129,156	55,978,023.00
Total	394,015,843.17	129,945,835.21	508,881,884.49
<b>Growth</b>	<b>337.42%</b>	<b>596.13%</b>	<b>397.27%</b>

Figure 23 illustrates the trend of asset base growth from 2025/26 to 2039/40.



**Figure 23: Asset trend growth (in Ushs Mn)**

A good Asset base offers several strategic and operational advantages for UETCL for Instance financial stability and creditworthiness, Income generation from assets, business expansion, Investment and risk management due to diversified asset base which increases operational efficiency in addition to sustainability and self-sufficiency.

**4.4.1.11. BULK SUPPLY TARIFF (BST)**

Bulk Supply Tariff (BST) is the resultant cost reflective tariff computed from the projected Net revenue requirements as allocated to the projected domestic energy sales (units) to be sold by UETCL. The BST trend is mainly steered by the periodic commissioning of the several generations mix as projected to meet the growing demand/loads.

The commissioning of large hydro plants (energy deals) during the period is projected to reduce the weighted average generation tariff because of their low purchase prices However, there are also several new mini-Hydros, solar, co-generation, geo-thermal power plants that will be dispatched as must runs based on the grid code for whose tariffs are relatively high and tend to increase the overall weighted average generation tariff in the short run as they have priority in dispatch over the large hydro’s which are majorly dispatched for demand supply balance..

The projected commissioning of nuclear energy power plant in Buyende in 2035/36 (Buyende Nuclear plant - 1,400 MW) is likely to lead to increase in Energy purchase cost because nuclear plants have high upfront costs and are capital intensive in nature.

It is important to note that the energy projections for purpose of determination of the resultant Bulk supply Tariff as adjusted by the projected transmission Losses trend is the Generation requirement of the sales to the National Distributors, exports to Northern Tanzania Exports, and industrial additions which include Data centres. This follows an organic sustainable growth trend.

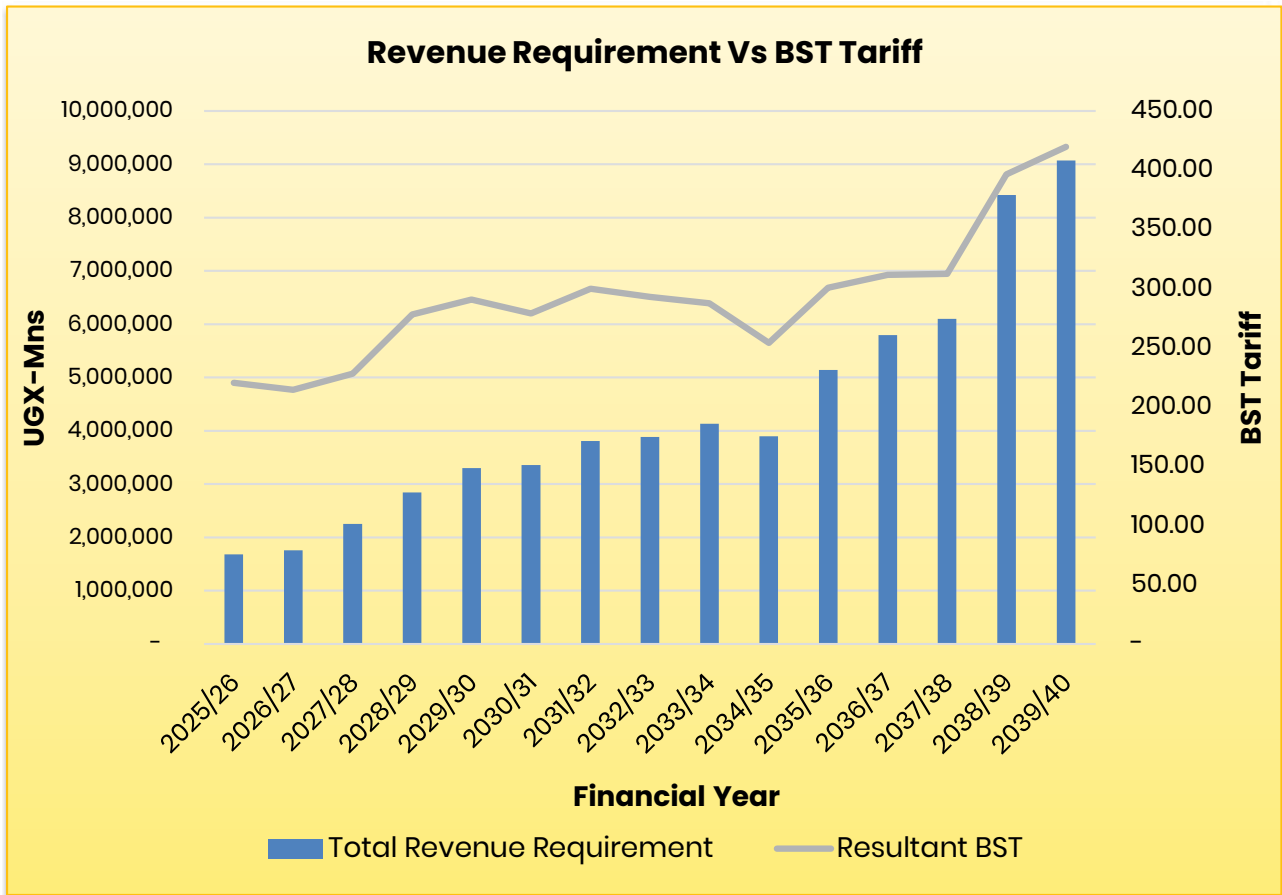
The Revenue requirement is based on the projected single buyer business and the transmission costs for the period 2025/26 to 2039/40.

Table 59 below show the resultant bulk supply Tariff computed from the annualised total revenue requirement and the projected Net sales (Units) to the national distributors.

**Table 59: Computed Bulk Supply Tariff**

Year	Total Revenue Requirement	Net Units to Distributors (GWh)	Resultant BST
	UGX-Mns		(Ugx/kWh)
2025/26	1,678,319	7,611	220.52
2026/27	1,756,365	8,184	214.60
2027/28	2,249,877	9,856	228.28
2028/29	2,844,021	10,225	278.14
2029/30	3,302,338	11,358	290.75
2030/31	3,355,102	12,022	279.08
2031/32	3,810,640	12,709	299.83
2032/33	3,886,639	13,260	293.11
2033/34	4,132,620	14,374	287.51
2034/35	3,898,601	15,343	254.10
2035/36	5,141,286	17,089	300.85
2036/37	5,793,773	18,587	311.72
2037/38	6,101,732	19,528	312.46
2038/39	8,423,419	21,247	396.46
2039/40	9,072,036	21,615	419.71
<b>Total</b>	<b>65,446,769.17</b>	<b>213,007.43</b>	
<b>Average BST</b>			<b>292.47</b>

Figure 24 below illustrates the trend of the total revenue requirement and resultant bulk supply for the planning horizon.



**Figure 24: Computed Bulk Supply Tariff in the planning horizon**

The average energy pricing is projected to follow a controlled upward trend to accommodate the rise in energy purchase costs due to increased volumes to meet the growing demand and the relatively increasing but controlled transmission operational costs from time to time. With a period, average BST of Ugx 292.47, this bulk supply Tariff trend reflects a stable tariff regime with minimal annual increments supporting affordability and financial predictability.

**4.4.1.12. AVAILABLE ENERGY (GWH) BASED ON INSTALLED CAPACITY VS THE REQUIRED ENERGY (GWH) BASED ON PROJECTED GENERATION REQ (BAU)+NORTH TZ+IND+DATA CENTRES.**

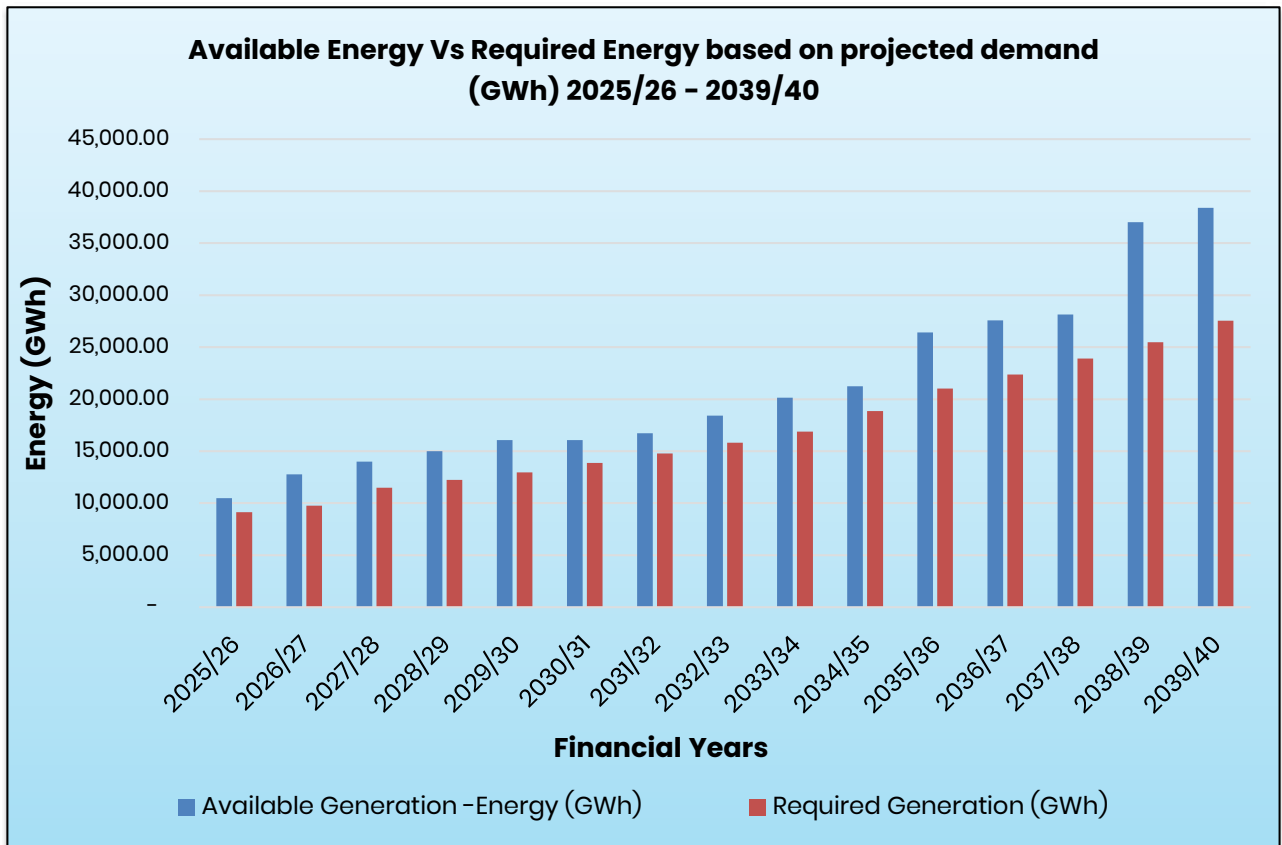
During the period, the installed capacity is projected to grow by 230% from 2,087.92MW in 2025/2026 to 6,498.23MW in 2039/2040. This Installed capacity is premised to provide the required energy (GWh) to meet the growing demand for both organic, industrial and through export potential. Based on the projected energy requirement (GWh), there will be on average a 81.82% optimisation or utilisation of the available energy as lined up or made available for dispatch by the generation plants during the period 2025/26 - 2039/40 and therefore this means that there will be enough reserve margin to meet any out of range spike in demand other than that as projected under the base case.

Table 60 below shows the percentage utilisation of projected available energy (GWh) based on installed capacities against the required energy (GWh) generation requirement to meet the projected loads.

**Table 60: Utilization of available projected energy (GWh) based on installed capacity against required energy (GWh) generation based on projected demand.**

Year	Available Energy (Based on installed capacities) (GWh)	Generation requirement (BAU) + Northern TZ+ Industrial additions inclusive data centers	Utilization (%)
2025/26	10,475.91	9,146.81	87.31%
2026/27	12,781.05	9,746.46	76.26%
2027/28	14,001.74	11,494.84	82.10%
2028/29	15,003.14	12,234.07	81.54%
2029/30	16,075.47	12,971.89	80.69%
2030/31	16,075.47	13,865.43	86.25%
2031/32	16,717.12	14,793.83	88.50%
2032/33	18,425.06	15,800.21	85.75%
2033/34	20,132.99	16,890.02	83.89%
2034/35	21,226.07	18,846.09	88.79%
2035/36	26,428.06	21,027.04	79.56%
2036/37	27,566.69	22,371.63	81.15%
2037/38	28,136.00	23,898.89	84.94%
2038/39	37,032.57	25,475.24	68.79%
2039/40	38,398.92	27,560.56	71.77%
<b>Average</b>			<b>81.82%</b>

Figure 25 below illustrates the projected available energy (GWh) based on installed capacities against the required energy (GWh) generation requirement to meet the projected loads.



**Figure 25: Utilization of projected Energy Requirement against available energy**

From the above table and illustration, the projected installed Capacity (MW) throughout the period from 2025/2026 to 2039/2040, will be enough to avail the required Energy (GWh) to meet the UETCL’s projected electricity demand accordingly.

The extra Capacity acts as a spinning or non-spinning reserve during emergencies caused by for instance grid failure, natural disasters to mention but a few.

The above position also supports voltage and frequency regulation for an effective and efficient power system.

Having more generation capacity than demand is strategically beneficial for a power system because of the following reasons.

- Enhanced reliability and security of supply - This ensures that power supply even during unexpected demand spikes and supports the grid in case of plant outages, Maintenance or even break downs. It also reduces the likelihood of black outs and load shedding.
- Flexibility In dispatch and Maintenance - This will allow UETCL to take some generators offline for scheduled maintenance without compromising supply. It also Ensures economic dispatch by choosing the most cost-effective generators accordingly.
- Integration of Intermittent renewables - This helps buffer the variability of renewable sources like wind and solar and provides backup when renewable output drops suddenly.

- Capacity to support economic growth – This accommodates future increases in demand from industrialisation, urbanisation and population growth, and attracts investors who value reliable infrastructure.
- Improved bargaining Power – With the growth in generation capacity UETCL will be able to negotiate better commercial and Tariffs from developers because the utility (UETCL) will not be desperate for capacity.

However, there is need to efficiently and strategically invest into the electricity transmission grid to ensure there is enough reserve margin for additional loads and further due care and concern to avoid poor return on investment arising from idle capacity because of too much unutilised capacity (wasteful investment).

#### 4.4.1.13. LONG TERM DEBT TO FIXED ASSETS RATIO.

The relationship between fixed assets and long-term debt is an Important one for financial management especially for capital Intensive sectors like energy, manufacturing and Infrastructure. This is because energy Infrastructure projects are long term Investments that provide for value over many years and therefore because of their large costs and long useful life, they are typically financed using long term debt e.g. Loans, bonds.

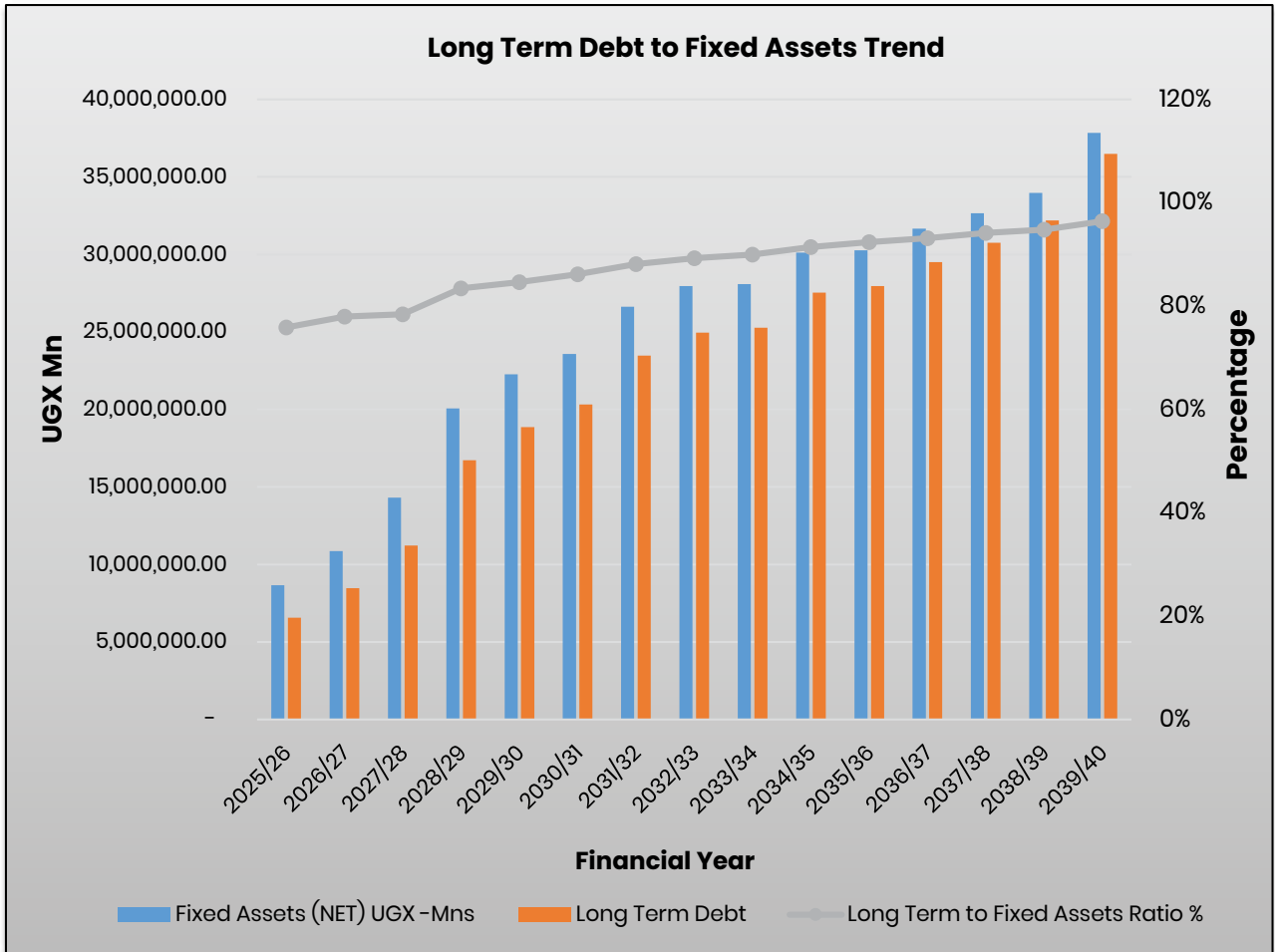
Based on the debt financing assumptions used i.e. an average of 5% Interest rate, 5-year grace period and 20-year repayment period.

Table 61 below shows the ratio of the long-term debt to Net Fixed Assets throughout the period 2025/26 – 2039/40.

**Table 61: Long term debt to Net Fixed Assets in the planning horizon**

Period	UGX –Mns		%
	Fixed Assets (NET)	Long Term Debt	Long Term to Fixed Assets Ratio
2025/26	8,652,740.86	6,564,834.22	76%
2026/27	10,862,586.56	8,470,915.99	78%
2027/28	14,306,914.36	11,219,683.98	78%
2028/29	20,056,527.35	16,728,503.15	83%
2029/30	22,276,856.90	18,852,113.94	85%
2030/31	23,588,560.64	20,321,360.95	86%
2031/32	26,637,080.66	23,478,113.14	88%
2032/33	27,963,874.34	24,964,086.58	89%
2033/34	28,081,874.17	25,272,825.23	90%
2034/35	30,111,801.04	27,531,649.62	91%
2035/36	30,268,705.26	27,963,006.49	92%
2036/37	31,668,323.82	29,500,910.27	93%
2037/38	32,648,490.38	30,751,332.84	94%
2038/39	33,962,845.95	32,191,143.87	95%
2039/40	37,848,866.99	36,494,394.91	96%
<b>Average Long Term to Fixed Assets ratio</b>			<b>88% (0.88)</b>

The table above shows a debt to Fixed assets ratio of 0.88 which is potentially over leveraged, higher financial risk but may be managed because the financed fixed assets are transmission lines and substations that are backed by strong cash flows and regulatory and statutory guarantees. The strong cashflows are due to sale of electricity through the said infrastructure because of reliable available infrastructure and high anticipated energy access rates.



**Figure 26: The trend of Long-Term Debt to Fixed Assets**

The graphical representation of Long-Term Debt to Fixed Assets trend is presented below in Figure 26.

The graph above shows the relationship between Net Fixed assets and long-term Debt which relationship is explained by a matching principal where long term assets are funded by the long-term debt. Long Term Debt is useful because it aligns the asset lifespan with the repayment period (Matching principal), Eases pressure on short term liquidity, Enables timely Investment in Infrastructure expansion.

It is therefore paramount that fixed assets and long-term debt be balanced by having an effective and inclusive planning that ensures grid expansion, financial stability and sustainability accordingly. For UETCL, the phased implementation of grid evacuation, grid expansion and re-investment and regional power trade projects that form the fixed asset base after capitalisation are backed by the revenues from the projected additional loads as a result of several government initiatives to increase investor confidence in the energy sector boost electricity consumption by increasing the energy access rates and availing favourable tariffs among others in addition all loans towards UETCL grid extension and expansion are on lent loans and thus the obligation for repayment lies with the Government of Uganda through the ministry of Finance, Planning and economic development.

## 4.5. RESULTS MONITORING AND EVALUATION

### 4.5.1. INTRODUCTION

A Monitoring and Evaluation (M&E) framework has been developed to track the progress and performance of the Grid Development Plan (GDP) to support organizational learning and improved decision-making.

The framework outlines the Key Performance Indicators (KPIs) that will be used to measure progress towards achievement of the GDP objectives and provides a strategy for assessing the performance of initiatives under the 2025–2040 Grid Investment Plan (GIP) Implementation Schedule.

The GDP is a strategic document in UETCL’s overall planning and is in line with the Corporate Strategic Plan (CSP) 2024–2029, energy sector objectives, National Development Plan 2025/26–2029/30 (NDP IV) and Vision 2040.

Consequently, the M&E results framework has been designed to consider the strategic direction of the NDP IV sustainable energy development goal of increasing access to and consumption of reliable, affordable, clean, and modern energy services, as well as UETCL’s Corporate Strategic Plan (CSP) goals of strengthening the transmission grid and improving operational efficiency, as illustrated in Figure 27 here under.

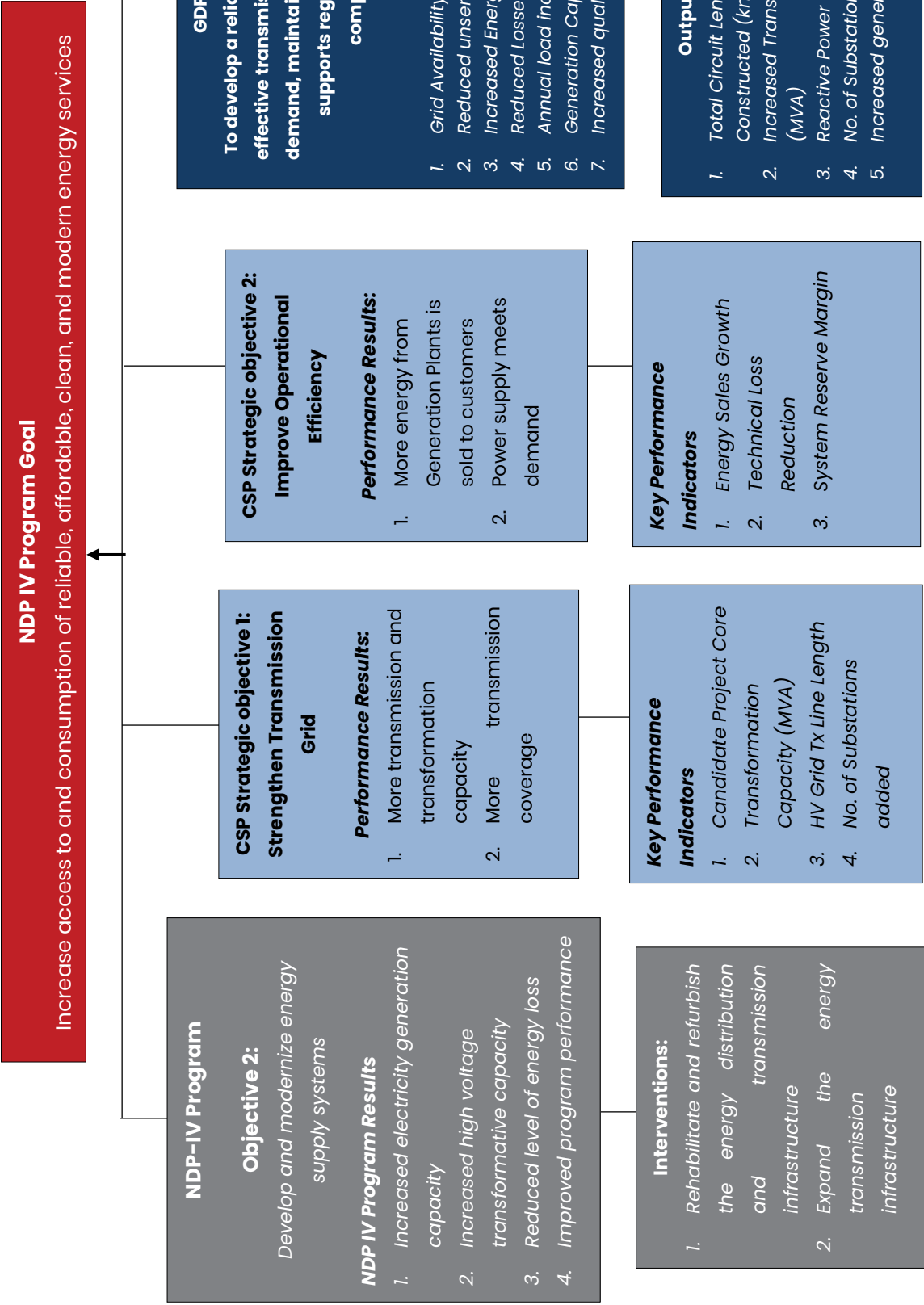


Figure 27: M & R Results Framework

#### 4.5.2. INDICATORS AND TARGETS FOR GDP 2025–2040

The key performance indicators (KPIs), along with their baseline values and corresponding targets for the GDP 2025 – 2040 outputs and outcomes are presented in tables Table 62 and Table 63 respectively as shown below.

**Table 62: Indicators and Targets for GDP 2025–2040 outputs**

Output Indicators				
Year	1	2	3	4
	Total Circuit Length of Transmission Lines Constructed	Increased Transformation capacity	No. of Substations constructed	Installed electricity generation capacity
	km	MVA	No.	MW
2023/24 Baseline	4,847.96	6,685.5	39	2,029.2
2024/25	5,417.668	7,145.5	43	2,078.0
2025/26	5,627.968	8,905.5	50	2,087.9
2026/27	5,759.168	8,995.5	51	2,407.0
2027/28	6,265.568	11,904.5	57	2,705.7
2028/29	8,011.368	14,324.5	64	2,971.8
2029/30	9,801.368	17,104.5	74	3,264.6
2030/31	9,861.368	17,664.5	77	3,264.6
2031/32	10,207.37	18,824.5	80	3,346.2
2032/33	10,402.37	19,804.5	85	3,646.2
2033/34	10,422.37	19,804.5	85	3,946.2
2034/35	11,192.37	20,684.5	90	4,138.2
2038/39	12,232.37	20,764.5	91	6,258.2
2039/40	13,559.37	21,014.5	91	6,498.2

Table 63: Indicators and Targets for GDP 2025–2040 outcomes

Long Term Results/Outcome Indicators							
Year	1	2	3	4	5	6	7
UOM	Technical losses	Level of Reserve Margin	Annual Load growth rate	Voltage Stability Index	Un-served Energy	Grid Availability	Energy Sales Growth Rate
	%	%	%		MWh	%	%
2023/24 (Baseline)	4.79%	21.8%	11.49%	<1	TBD	98.4%	-2.31%
2024/25	4.80%	>10%	9.25%	<1	<5,000	>98%	24.99%
2025/26	4.91%	>10%	6.18%	<1	<5,000	>98%	6.99%
2026/27	5.17%	>10%	6.29%	<1	<5,000	>98%	7.07%
2027/28	5.09%	>10%	6.41%	<1	<5,000	>98%	7.15%
2028/29	5.07%	>10%	6.52%	<1	<5,000	>98%	7.21%
2029/30	4.31%	>10%	6.62%	<1	<5,000	>98%	7.29%
2030/31	4.31%	>10%	6.60%	<1	<5,000	>98%	7.25%
2031/32	4.31%	>10%	6.69%	<1	<5,000	>98%	7.26%
2032/33	4.31%	>10%	6.78%	<1	<5,000	>98%	7.33%
2033/34	4.31%	>10%	6.86%	<1	<5,000	>98%	7.37%
2034/35	3.54%	>10%	6.94%	<1	<5,000	>98%	7.42%
2038/39	3.54%	>10%	6.99%	<1	<5,000	>98%	7.36%
2039/40	4.14%	>10%	7.04%	<1	<5,000	>98%	7.39%

## Assumptions

The successful achievement of the desired results outlined above is dependent on the following assumptions:

- Generation capacity is expanded as planned.
- Funding for both compensation/resettlement activities and project implementation is obtained in a timely manner.
- Compensation and resettlement activities are implemented in a timely manner.
- Deliberate steps are taken to increase electricity utilization and to grow the load

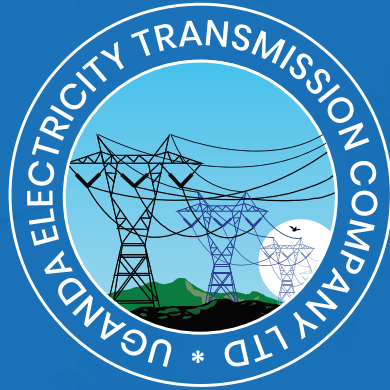
## Key stakeholders

- Uganda Electricity Generation Co. Ltd (UEGCL)
- Uganda Electricity Distribution Co. Ltd (UEDCL)
- Electricity Regulatory Authority (ERA)
- Ministry of Energy and Mineral Development
- Ministry of Finance Planning and Economic Development

### 4.5.3. MONITORING OF THE GIP PERFORMANCE

The performance of the GIP will be monitored annually, using data from the Annual Power System Operation Reports prepared by the Network Operations and Maintenance (NO&M) Department, quarterly progress reports from the Grid Development and Planning Department, as well as reports from Projects Implementation Departments.

Progress will be assessed against planned targets, and necessary recommendations will be made to align implementation with the GIP's goals and objectives



# **THE NDP IV (2025/26–2029/30) SCENARIO**

## 5. THE NDP IV (2025/26–2029/30) SCENARIO

### 5.1. LOAD AND GENERATION PROGNOSIS FOR NDPIV 2030 SCENARIO

This National Development Plan (2025/26–2029/30) is the fourth in a series of six National Development Plans (NDPs) aimed at accelerating the socio-economic transformation of Uganda. It is the first of three 5-year NDPs that will deliver the 10-fold economic growth, which is expected to be achieved by doubling the size of the economy every five years.

The goal of the Plan is to “Achieve higher household incomes, full monetization of the economy, and employment for sustainable socio-economic transformation”. This goal will be achieved under the theme “Sustainable Industrialization for Inclusive Growth, Employment, and Wealth Creation”.

#### 5.1.1. ASSUMPTIONS FOR DEMAND SUPPLY PROGNOSIS OF NDPIV 2030 SCENARIO

The assumptions<sup>24</sup> guiding the demand supply prognosis for the NDP IV 2030 scenario are highlighted below.

- Electricity per Capita Consumption raised from 218 kWh (2023/2024) to 1090 kWh by 2029/2030
- Access of population to electricity services raised from the 58% (2023/24) to 70% by 2029/30
- Generation capacity shall be increased from the current 2,047 MW to 15,420 MW by 2029/30.
- Gross Domestic Product growth rate to increase from 6.1% (2023/24) to 10.6% by 2029/30.
- Population growth rate should decrease from 3% (2023/24) to 2.9% by 2029/30.

It is key to note that Exports to Northern Tanzania (40MW) were considered and assumed as the only export potential for this scenario.

<sup>24</sup> Source of NDP IV assumptions: NPA NDP IV document.

**Table 64: Projected Population and Gross Domestic Product growth rate for NDP IV 2030 scenario**

Indicators	Financial Years					
	Baseline		NDP IV Targets			
	2023/24	2025/26	2026/27	2027/28	2028/29	2029/30
GDP growth rate (%)	6.1%	7.3%	8.0%	8.8%	9.7%	10.6%
Population Growth Rate (%)	3.00%	2.97%	2.95%	2.93%	2.92%	2.90%

### 5.1.2. DEMAND FORECAST FOR THE NDP IV 2030 SCENARIO

The demand projections for the NDP IV 2030 scenario were computed utilizing the above-mentioned assumptions. The growth outlook of demand is presented in the Table 65 below.

**Table 65: Demand Prognosis NDP IV 2030 scenario**

Financial Year	Consumption per Capita (kWh)	Population Growth Rate (%)	Forecasted Population	Population with access to electricity (%)	Population accessing electricity	Computed Consumption (GWh)	Computed Demand (MW)	Installed Generation Capacity (MW)
2025/26	373	2.97%	48,708,692	62%	30,079,291	11,213	1,280	2,239
2026/27	487	2.95%	50,145,540	64%	31,952,880	15,576	1,778	2,753
2027/28	637	2.93%	51,616,491	66%	33,937,726	21,633	2,470	3,192
2028/29	834	2.92%	53,122,111	68%	36,040,114	30,041	3,429	4,428
2029/30	1,090	2.90%	54,662,652	70%	38,263,856	41,708	4,761	15,420

### 5.1.3. EXISTING AND PROPOSED GENERATION RESOURCES FOR THE NDP IV 2030 SCENARIO

The NDP IV identified key projects with high multiplier effects that were critical in realizing the plan's desired results. Among these projects, there were major energy infrastructure projects aimed at expanding generation capacity to reach the target of 15,420MW by 2030.

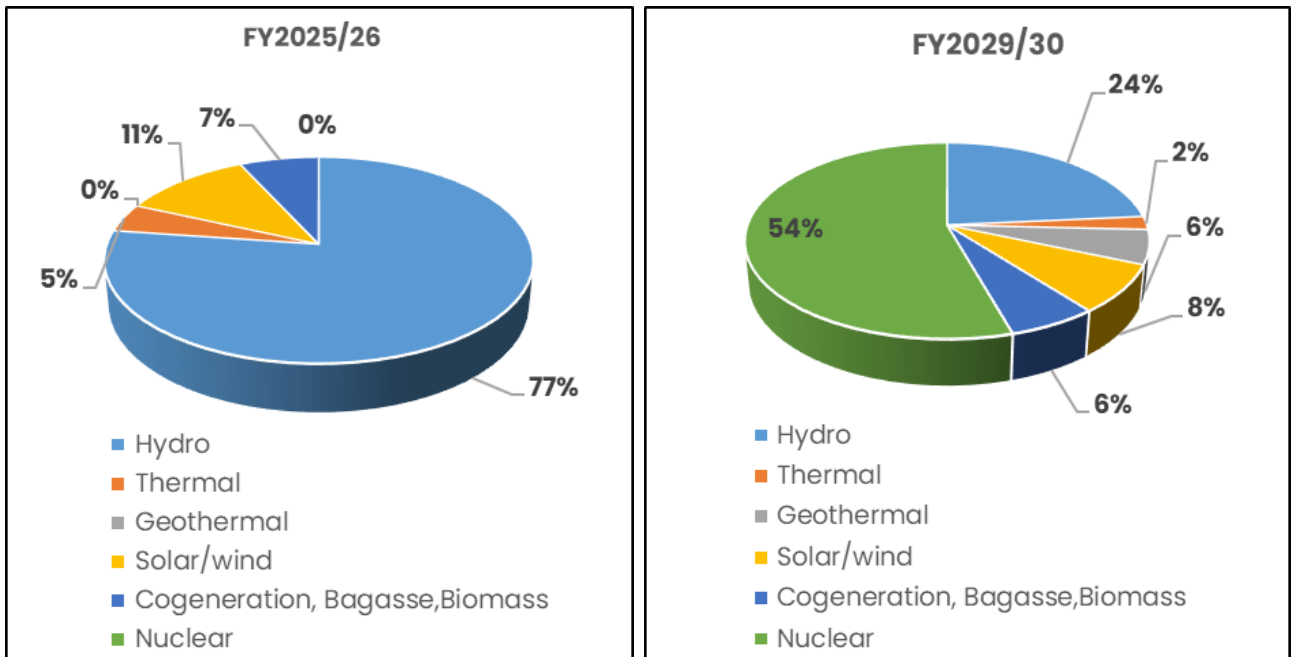
This goal would be realized through the commissioning of several generation plants including.

- Kiba Hydro power plant
- Oriang Hydro power plant
- Ayago Hydro power plant
- Buyende Nuclear power plant
- Wind power plants in Karamoja
- Solar power plants

With the above considerations, the generation mix for the NDP IV scenario was projected from the baseline installed capacity as shown in Table 66

**Table 66: Projected Installed capacity for NDP IV 2030 Scenario**

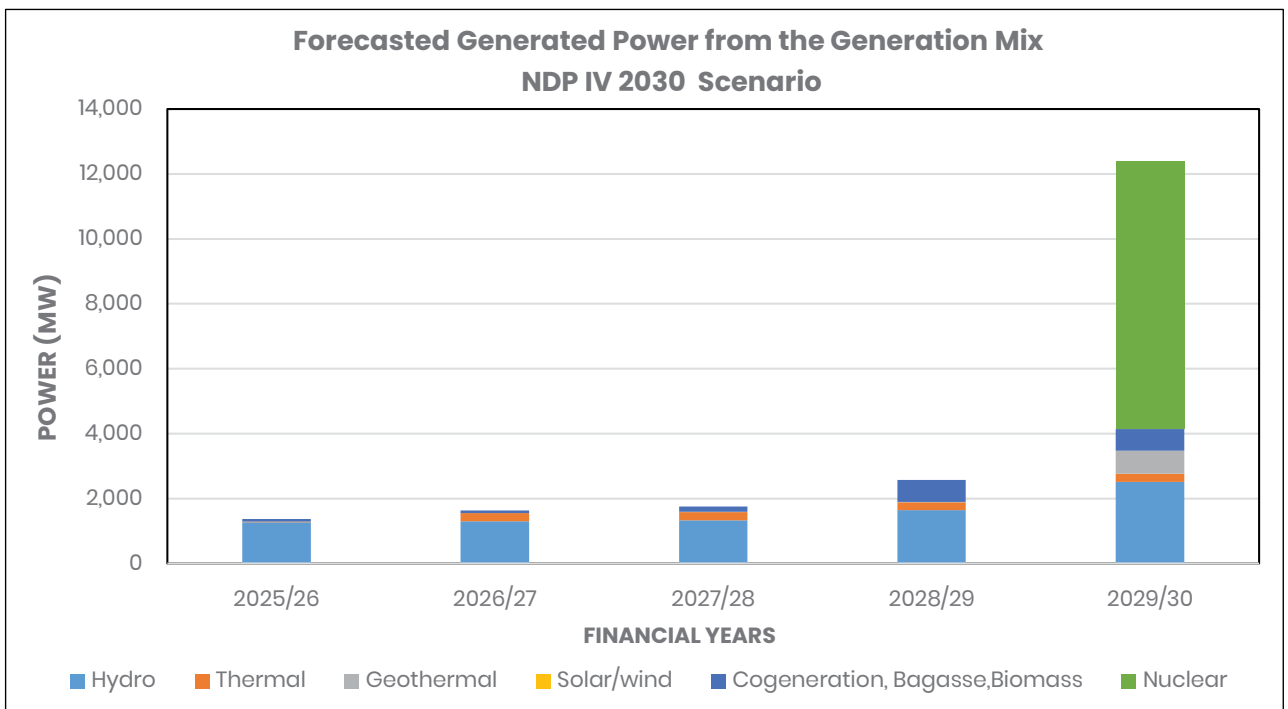
Technology	Baseline 2023/24	2025/26	2029/30
Hydro	1,705.6	1,728.3	3,631.3
Thermal	100.0	100.0	339.1
Geothermal	0.0	0.0	870.0
Solar/Wind	84.0	255.1	1,247.3
Cogeneration, Bagasse, Biomass	139.6	155.6	932.3
Nuclear	0.0	0.0	8,400.0
<b>Total</b>	<b>2,029.2</b>	<b>2,239.0</b>	<b>15,420.0</b>



**Figure 28: Forecast Installed Capacity of Generation Mix for NDP IV 2030 Scenario**

The forecast installed capacity of the generation mix for the NDP IV 2030 scenario is illustrated in Figure 28 below

The forecast generated power realized from the generation mix in the planning horizon of the is shown in Figure 29 below



**Figure 29: Forecasted Dispatched Power of the Generation mix for the NDP IV 2030 scenario**

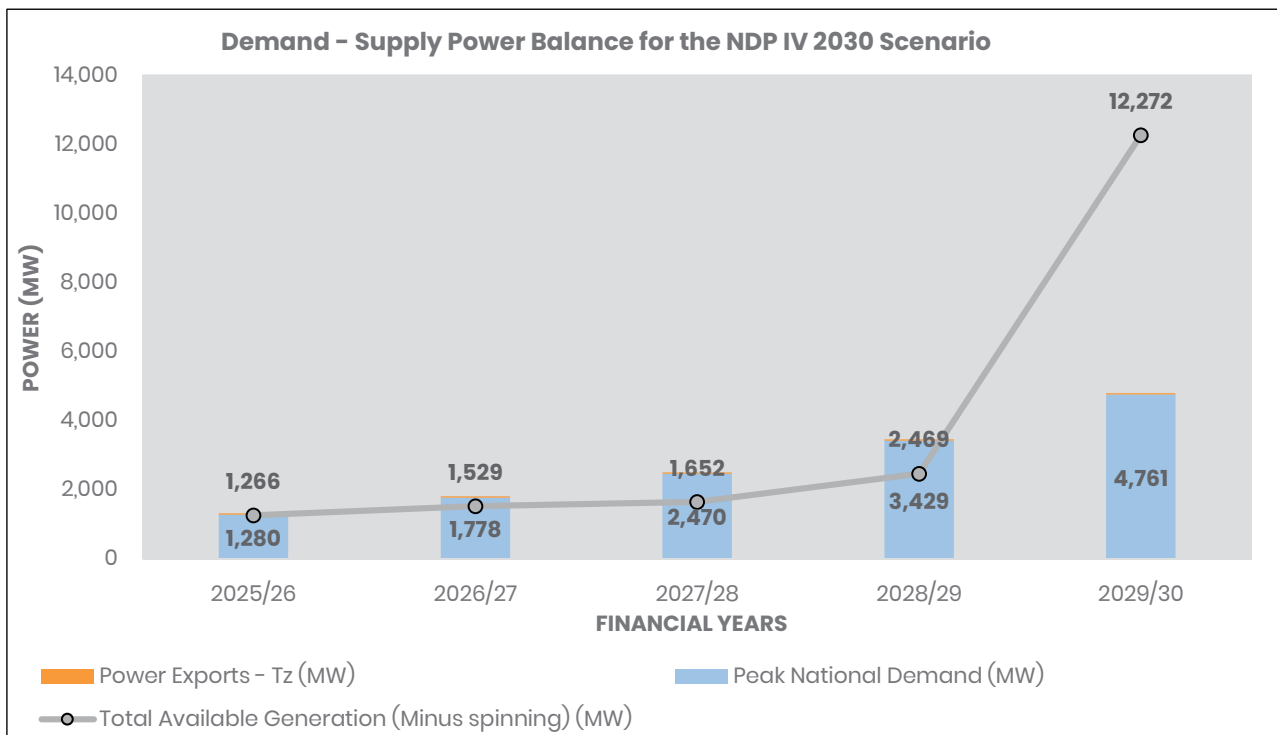
**5.1.4. DEMAND SUPPLY BALANCE FINDINGS OF THE NDP IV 2030 SCENARIO**

A Demand-Supply balance was conducted to ascertain whether the generation capacity meets the projected demand ads including the Northern Tanzania exports requirements and required spinning reserve.

The Demand-Supply Power balance detailed results for the NDP IV 2030 scenario are presented in Appendix A.1.2, and summarized as shown below in Table 67 and illustrated in Figure 30 respectively.

**Table 67: Demand-Supply of the NDPIV 2030 scenario for the planning horizon**

Description	2025/26	2026/27	2027/28	2028/29	2029/30
National Peak Demand (MW)	1,280	1,778	2,470	3,429	4,761
Northern Tanzania Exports (MW)	40	40	40	40	40
Installed Generation Capacity (MW)	2,239	2,753	3,192	4,428	15,420
Total Available Generation (minus spinning reserve) (MW)	1,266	1,529	1,652	2,469	12,272
Excess/Deficit (MW)	-54.5	-289.0	-857.0	-999.9	7,470.5



**Figure 30: Demand - Supply Power Balance of the NDP IV 2030 scenario**

### 5.1.4.1. OBSERVATIONS FROM DEMAND SUPPLY BALANCE

#### Observations

For the Demand-Supply Power Balance:

- The available surplus generation capacity to meet additional demand and exports is projected at 7,470.5MW by 2029/30. This significant increase is attributed to the planned commissioning of new generation plants, including Ayago (840 MW), Oriang (392 MW), additional solar installations (such as East PV and Jinja Floating Solar), and the 8,400 MW Buyende Nuclear Power Plant. These developments are expected to raise the total installed capacity to 15,420 MW by FY2029/30.
- Deficits in the generation capacity ranging from 54.5MW in FY2025/25 to 999.9 MW by FY2028/29 are observed in the planning horizon, indicating that the generated power would be insufficient to meet national demand and subsequently exports to Northern Tanzania. This shortfall is likely to be due to delays in the construction and/or commissioning of upcoming power plants.

### 5.1.4.2. RECOMMENDATIONS

To mitigate risks of power generation deficits relative to projected demand, it is essential to align project implementation timelines with demand forecasts and ensure timely execution of generation projects.

## 5.2. GRID INVESTMENT PLAN FOR NDP IV 2030 SCENARIO

The Grid Investment Plan of the NDP IV 2030 scenario indicates objectives, estimated costs and implementation schedules for identified projects. Similar to the BAU scenario, the projects in the NDP IV 2030 scenario have been categorised as follows:

- Power evacuation projects
- Grid re-investment projects
- System Expansion projects
- Regional projects.

The summarized Grid Investment Plan of the NDP IV 2030 scenario is presented in the Table 68 here under.

**Table 68: UETCL Grid Investment Plan Implementation Schedule summary for NDP IV 2030 Scenario**

UETCL GRID INVESTMENT PLAN FOR NDP IV: IMPLEMENTATION SCHEDULE SUMMARY					
No.	PROJECT	OBJECTIVE	IMPLEMENTATION PERIOD FROM BASE YEAR, FY2023/2024	CURRENT STATUS	FINANCIER
<b>A POWER EVACUATION PROJECTS</b>					
1	37.3km 132kV Mirama- Nshongezi Transmission Line and Associated Nshongezi 2x32/40MVA 132/33kV Substation	Provision of transmission capacity to evacuate power	2025/26-2028/29	Feasibility Study Update	Under Consideration using EPC + F
2	92km 220kV Hoima-Kinyara-Kafu Transmission line and associated substations. 2X80MVA 220/33kV and 40MVAR(220kV) at Kinyara SS, 2x250MVA, 400/220/33kV, 2x40MVA 220/33kV, 40MVAR(400kV) and 20MVAR(220kV) at Kafu SS, 2x80MVA 220/132kV and 20MVAR (220kV) at Hoima SS.	Provision of transmission capacity to evacuate power	2024/25-2027/28	Feasibility Study Update	Under Consideration using EPC + F
3	76km 132kV Mbale - Bulambuli - Kween Transmission Line; IX 60/80MVA 132/33kV Mbale SS, 2X60MVA 132/33kV Kween SS and 2X80MVA Bulambuli SS)	Provision of transmission capacity to evacuate power from IPPs in Bulambuli area	2026/27-2029/30	Feasibility Study Update	Under consideration for IPT model
4	400kV Oriang Interconnection project (10km 400kV Oriang - Nile HPPs Switching Station Underground Cable)	Provision of transmission capacity to evacuate power from Oriang HPP	2028/29-2033/34	To be packaged with HPP	To be determined
5	400kV Kiba Interconnection Project (10km 400kV Kiba - Nile HPPs Switching Station Underground Cable)	Provision of transmission capacity to evacuate power from Kiba HPP	2029/30-2032/33	To be packaged with HPP	To be determined

UETCL GRID INVESTMENT PLAN FOR NDIV: IMPLEMENTATION SCHEDULE SUMMARY					
No.	PROJECT	OBJECTIVE	IMPLEMENTATION PERIOD FROM BASE YEAR, FY2023/2024	CURRENT STATUS	FINANCIER
6	Evacuation of power from the proposed Nuclear Power Plant at Buyende <ul style="list-style-type: none"> <li>400kV line from Buyende switching station to Jinja Industrial and business park.</li> <li>400kV Line from Buyende switching station to Tororo.</li> <li>400kV line from Buyende switching station to Nakasongola</li> <li>400kV line from Buyende switching station to Opuyo</li> </ul>	Provision of transmission capacity to evacuate power from the proposed Buyende Nuclear power plant	2026/27–2035/36	Sourcing for Financing	To be determined
<b>B</b>	<b>GRID RE-INVESTMENT PROJECTS</b>				
1	Upgrade of Mutundwe – Buloba – Kabulasoke – Masdka and Kabulasoke – Nkonge – Rugonjo – Nkenda 359km 132kV Transmission Line and Associated substation works (2X40MVA 132/33kV Kabulasoke SS, 2X40MVA 132/33kV Nkonge SS)	Improvement of reliability and power supply quality	2025/26–2028/29	Procurement of EPC Contractor	Under Consideration using EPC + F
<b>C</b>	<b>SYSTEM EXPANSION PROJECTS</b>				
1	345km 400kV Karuma – Tororo Transmission Line (2X250MVA 400/220kV Boarder SS in Tororo District, 2X400kV line bays at Karuma SS) and Ntinda 2x40MVA 132/33kV Substation and Associated 2km 132kV Transmission Line.	Improvement of availability, reliability, and quality of power supply	2025/26–2029/30	Financial negotiations ongoing between Kalpataaru and MoFPED	Under EPC+F with EPC commercial contract signed. – Awaiting Loan signature
<b>D</b>	<b>REGIONAL INTERCONNECTION PROJECTS</b>				

UETCL GRID INVESTMENT PLAN FOR NDIV: IMPLEMENTATION SCHEDULE SUMMARY

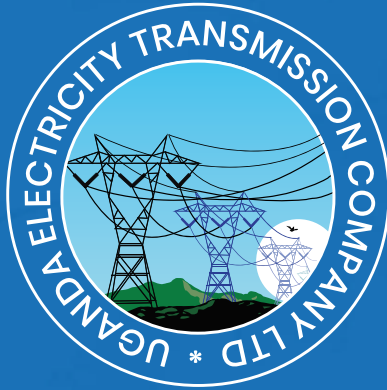
No.	PROJECT	OBJECTIVE	IMPLEMENTATION PERIOD FROM BASE YEAR, FY2023/2024	CURRENT STATUS	FINANCIER
1	72.5km 400kV (220kV) Nkenda- Mpondwe (D.R.Congo) Transmission line (2x220kV bays at 220/132kV Nkenda SS)	Regional Power Trade	2025/26-2029/30	At Feasibility Stage	Feasibility study being financed by AfDB under coordination by NELSAP. EPC Financing to be determined.
2	92km 400kV Masaka - Mutukula - Mwanza Transmission Line, 151km Wobulenzi - Masaka, and associated substations (2x250MVA 400/220kV Masaka substation)	Regional Power Trade	2025/26-2028/29	At Feasibility Stage	World Bank under EDPP
3	150km 400kV Olwiyo - Bibia - Juba (Sudan) Transmission Line, Olwiyo 2x250MVA 400/132kV interbus transformers, Bibia 2x100MVA 400/132kV, 2x40MVA 132/33kV substation - (Uganda's part)	Regional Power Trade	2025/26-2028/29	financing negotiations between AfDB and MoFPED ongoing	AfDB financing the implementation of the project under coordination by NELSAP

### 5.2.1. SUMMARY OF FINANCIAL REQUIREMENTS BY THE YEAR 2040

The cost implication to implement all the projects of grid investment plan (as shown in Table 68 above) under this scenario in the planning horizon is 1,177,656,712 USD. The summarized cost breakdown is shown in Table 69 below

**Table 69: Summary of financial requirements for NDP IV 2030 scenario**

Project Category	Estimated Cost (Billion UGX)	Estimated Cost (USD)
Power Evacuation Projects	927	238,598,772
Re-Investment Projects	518	133,408,200
System Expansion Projects	1,237	318,545,252
Regional Interconnection Projects	1,892	487,104,488
<b>Total Grid Investment Requirement</b>	<b>4,574</b>	<b>1,177,656,712</b>



# TENFOLD 2040 SCENARIO

## 6. TENFOLD 2040 SCENARIO

### 6.1. LOAD AND GENERATION PROGNOSIS FOR TENFOLD 2040 SCENARIO

The Tenfold growth strategy is anchored by the country's desire and ambition for socio-economic transformation, aligned with emerging trends in agriculture, transport, manufacturing, science, technology & innovation, and globalization.

Under this strategy (referred to as the Tenfold Strategy ATMs), the model focuses on targeted investments in the following high-growth demand clusters:

- Agriculture- Through mechanization and development of agro-processing clusters
- Transport – Through deployment of e-mobility solutions (e.g., electric vehicles, e-boda charging infrastructure) and implementation of the Standard Gauge Railway (SGR)
- Manufacturing – Through the establishment of industrial parks and expansion of steel and cement production facilities

These sectors are recognized as priority growth areas under national policy due to their substantial potential to drive electricity demand.

The strategy assumes a tenfold increase in the generation installed capacity, from 2,050 MW to 22 GW by 2040. It provides a scenario that maps the electricity supply industry's development trajectory in line with the government's vision to achieve a tenfold economic growth over the next 15 years, with a strong start during the NDP IV implementation period, which targets double-digit growth.

#### 6.1.1. DEMAND FORECAST FOR THE TENFOLD 2040 SCENARIO

The demand was projected to grow from the existing National peak demand of 891.84MW (as of 2023/24) to 18,405.42 MW by 2039/40, at an average annual growth rate of 20.05%.

The existing peak demand was projected to meet baseline demand targets presented in Table 70 as extracted from the region-based demand breakdown indicated in Table 71 below.

**Table 70: Forecast Demand targets for Tenfold 2040 scenario**

Financial Year	National Peak Demand (MW)
2029/30	4,917.51
2034/35	12,517.44
2039/40	18,405.42

**Table 71: Tenfold Region-based Demand Breakdown for the respective financial years**

Zone	2029/2030	2034/2035	2039/2040
CENTRAL	211.94	510.05	944.20
EAST	426.84	895.99	1,597.59
GKM	3,084.26	8,397.64	10,675.14
JINJA_METRO	506.50	1,063.21	1,895.76
NORTH	147.53	412.90	901.87
WEST	423.89	889.79	1,586.55
WEST_NILE	116.54	347.87	804.32
<b>TOTALS</b>	<b>4,917.51</b>	<b>12,517.44</b>	<b>18,405.42</b>

The export potential for this scenario was assumed as highlighted in Table 72 below.

**Table 72: Projected Exports for Tenfold Scenario**

Country/Financial Year	2024/2025	2025/26 – 2039/40
Kenya	100	4 - 100
Tanzania	40	40 - 180
Rwanda	60	60
DRC		20 - 100
South Sudan		45 - 260

### 6.1.2. GENERATION FORECAST FOR THE TENFOLD 2040 SCENARIO

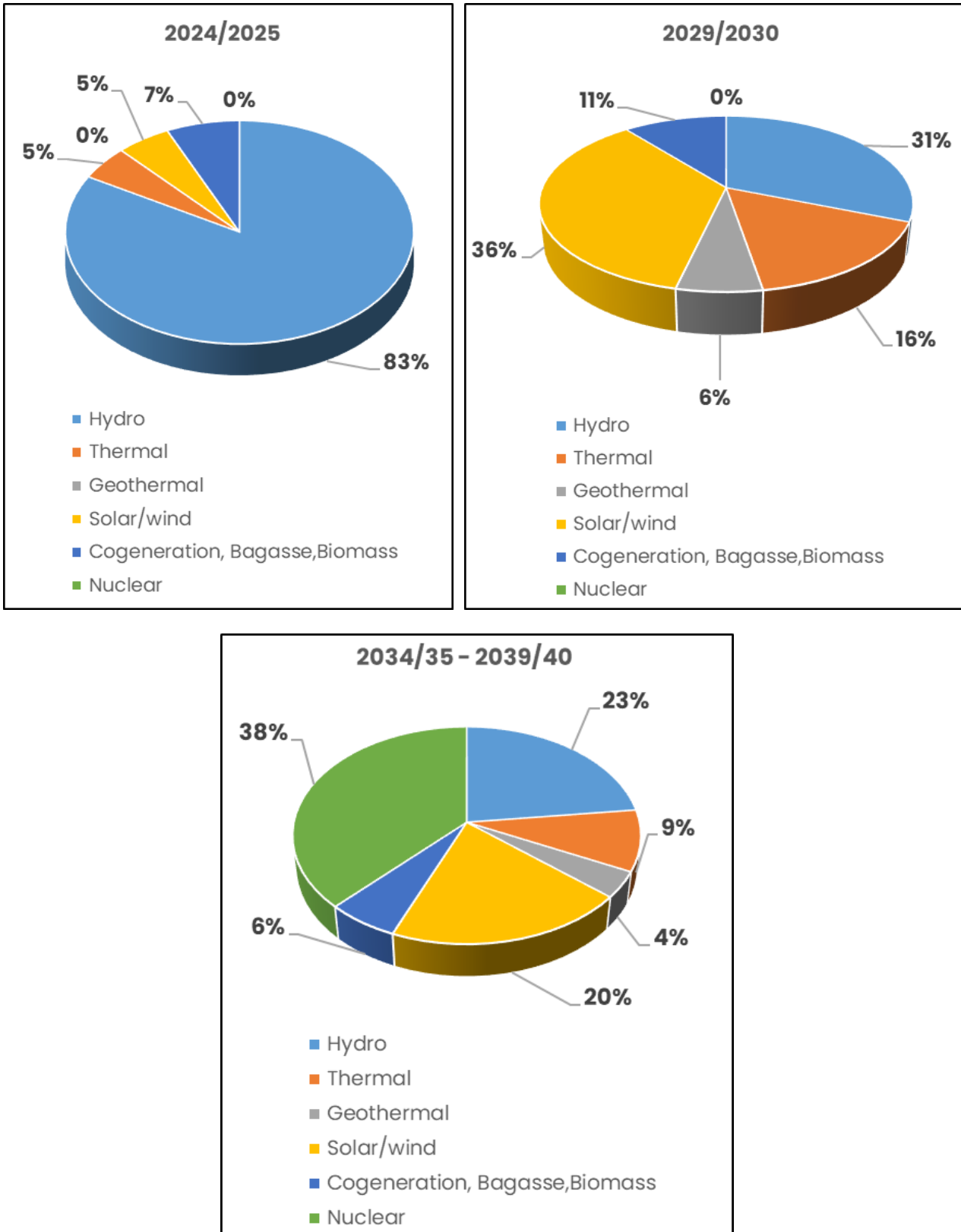
The Tenfold 2040 scenario assumes a tenfold growth of the existing installed generation capacity from 2,050MW (as of February 2025) to 22GW by 2040.

The breakdown of the installed capacity for the generation mix is represented in Table 73 below and illustrated in Figure 31 here under.

**Table 73: Estimated installed generation mix for the Tenfold scenario by 2040**

Technology	Estimated Capacity (MW)
Hydro	5,143
Thermal	2,023
Geo-thermal	870
Solar/Wind	4,478
Cogeneration, Bagasse, Biomass	1,313
Nuclear	8,400

Figure 31: Forecast Generation Mix for Tenfold 2040 scenario



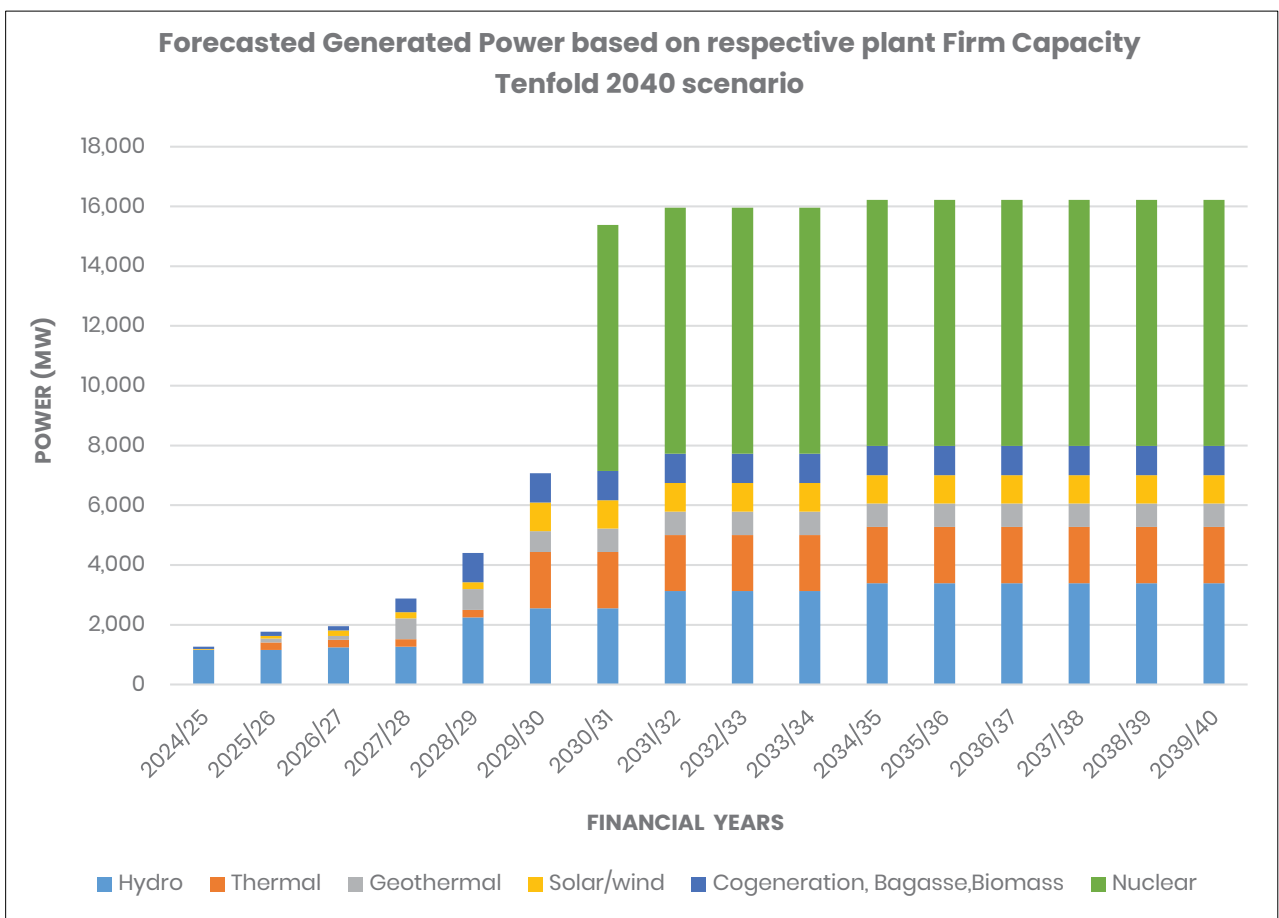
### 6.1.3. DEMAND SUPPLY BALANCE OF TENFOLD 2040 SCENARIO

A demand – supply power balance was conducted to determine whether the generation capacity would meet the projected National demand and export requirements. It was carried out following two approaches briefly discussed below.

#### 6.1.3.1. UNBALANCED DEMAND–SUPPLY OF TENFOLD 2040 SCENARIO

The unbalanced demand-supply approach considered power generation from each plant based on the plant’s firm capacity, which was determined by the plant factor and installed capacity of the generation plant. The resulting total generation output was then compared against the projected demand to identify potential surpluses or deficits.

Figure 32 below provides a graphical representation of the generated power based on plant firm capacity in the generation mix.

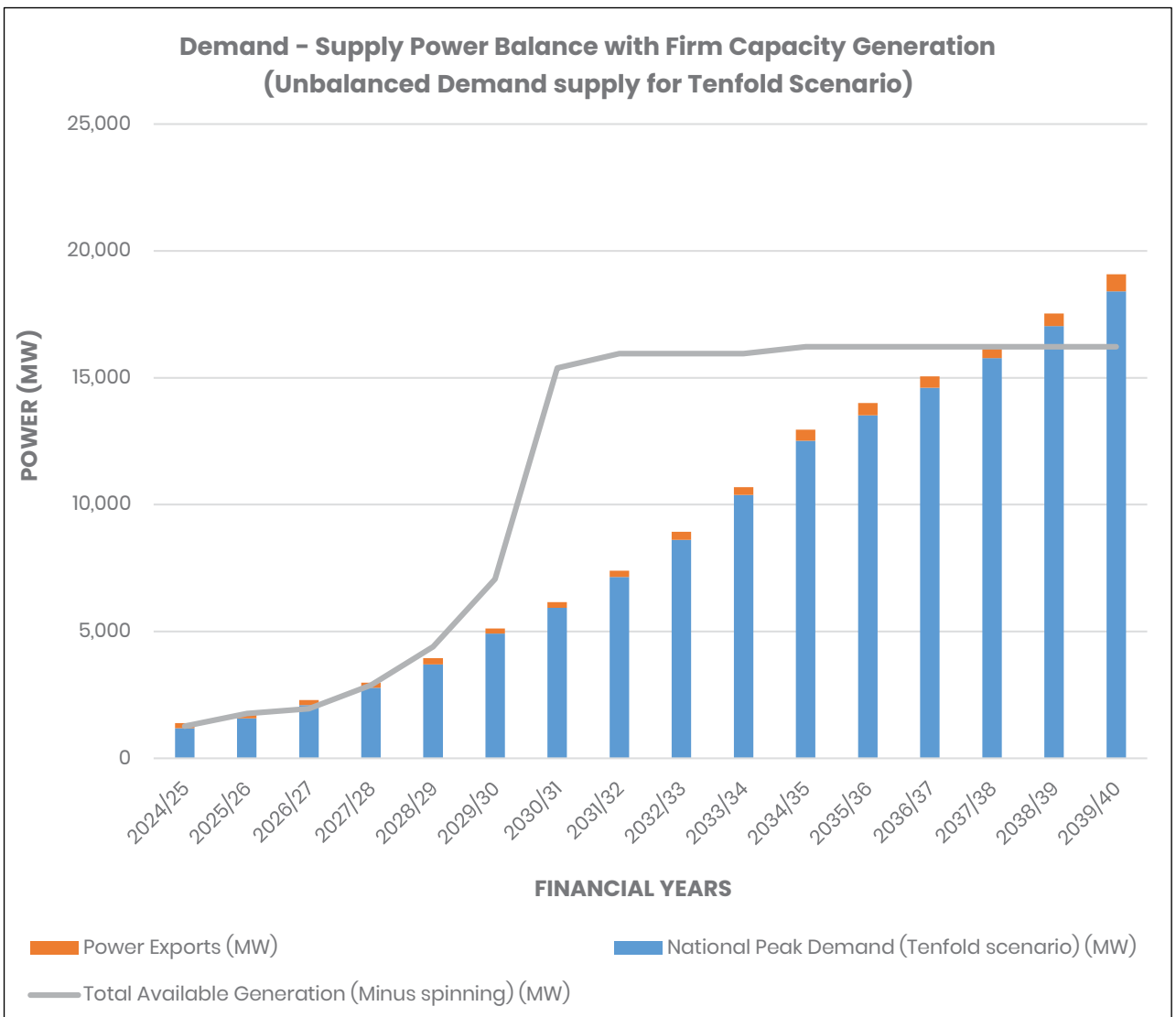


**Figure 32: Forecast generated power based on firm capacity**

The unbalanced Demand-Supply Power detailed results are summarized as shown in Table 74 below and illustrated in Figure 33 here under.

**Table 74: Unbalanced Demand-Supply for Tenfold 2040 scenario for the planning horizon**

Financial Years	Installed Capacity (MW)	Available Generation (minus spinning reserve)(MW)	Total National demand (MW)	Total Exports (MW)	National demand + Exports (MW)	Total demand + Exports (MW)	Excess/Deficit For National Demand + Exports (MW)
2024/25	2,064.2	1,265.6	1,185.40	200	1,385.40	1,385.40	-119.76
2025/26	2,749.1	1,771.2	1,575.58	200	1,775.58	1,775.58	-4.39
2026/27	3,387.6	1,949.1	2,094.19	200	2,294.19	2,294.19	-345.11
2027/28	4,595.9	2,881.0	2,783.51	200	2,983.51	2,983.51	-102.48
2028/29	6,844.9	4,400.3	3,699.72	249.7	3,949.42	3,949.42	450.90
2029/30	12,484.1	7,070.4	4,917.51	197.4	5,114.91	5,114.91	1,955.52
2030/31	20,974.1	15,383.4	5,927.88	223.2	6,151.08	6,151.08	9,232.35
2031/32	21,825.8	15,954.6	7,145.84	252.5	7,398.34	7,398.34	8,556.28
2032/33	21,825.8	15,954.6	8,614.05	312.3	8,926.35	8,926.35	7,028.28
2033/34	21,825.8	15,954.6	10,383.92	302.3	10,686.22	10,686.22	5,268.40
2034/35	22,225.8	16,222.6	12,517.44	435.7	12,953.14	12,953.14	3,269.49
2035/36	22,225.8	16,222.6	13,520.77	485.7	14,006.47	14,006.47	2,216.15
2036/37	22,225.8	16,222.6	14,604.53	455.7	15,060.23	15,060.23	1,162.39
2037/38	22,225.8	16,222.6	15,775.16	525.2	16,300.36	16,300.36	-77.73
2038/39	22,225.8	16,222.6	17,039.61	495.8	17,535.41	17,535.41	-1,312.79
2039/40	22,225.8	16,222.6	18,405.42	671.3	19,076.72	19,076.72	-2,854.10



**Figure 33: Unbalanced Demand-Supply for Tenfold 2040 scenario**

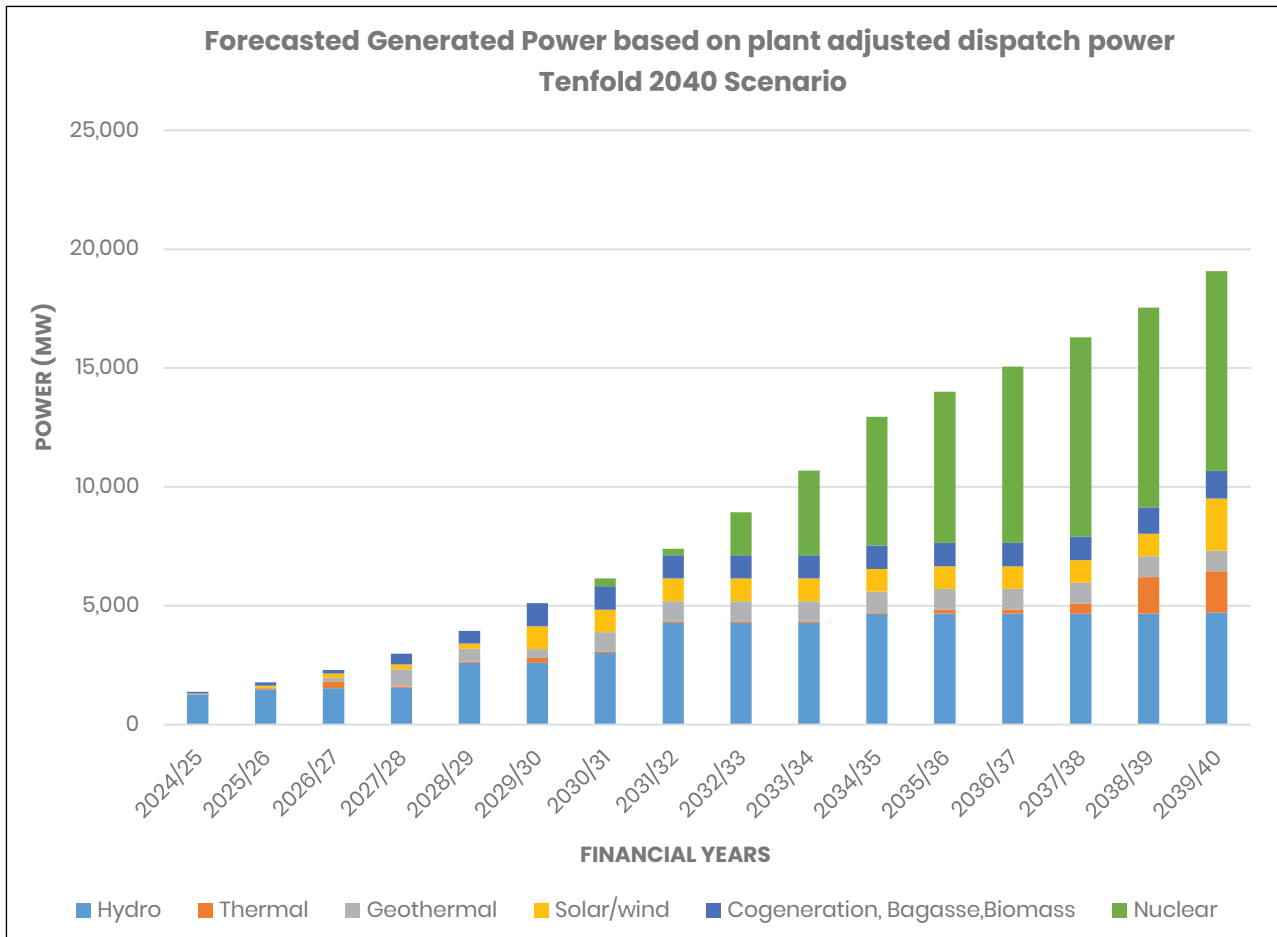
**Observations**

- Surplus generation capacity to meet any additional demand and exports range from 450.90MW in 2028/29 to 9,232.35MW in 2030/31, indicating the need to explore demand growth opportunities to match generation capacity
- However, deficits ranging from 4.39MW in 2025/26 to 2,854.10MW in 2039/40 are observed, indicating that in some years, the available generation would be insufficient to meet the forecast demand.

### 6.1.3.2. BALANCED DEMAND–SUPPLY OF TENFOLD 2040 SCENARIO

The balanced demand-supply approach involved adjusting the power output from generation plants proportionally to match the forecast demand. This ensured that for each year in the planning horizon, the total supply matched the projected demand, thereby eliminating potential surpluses or deficits.

Figure 34 below provides a graphical representation of the generated power based on the plant adjusted dispatched power in the generation mix.

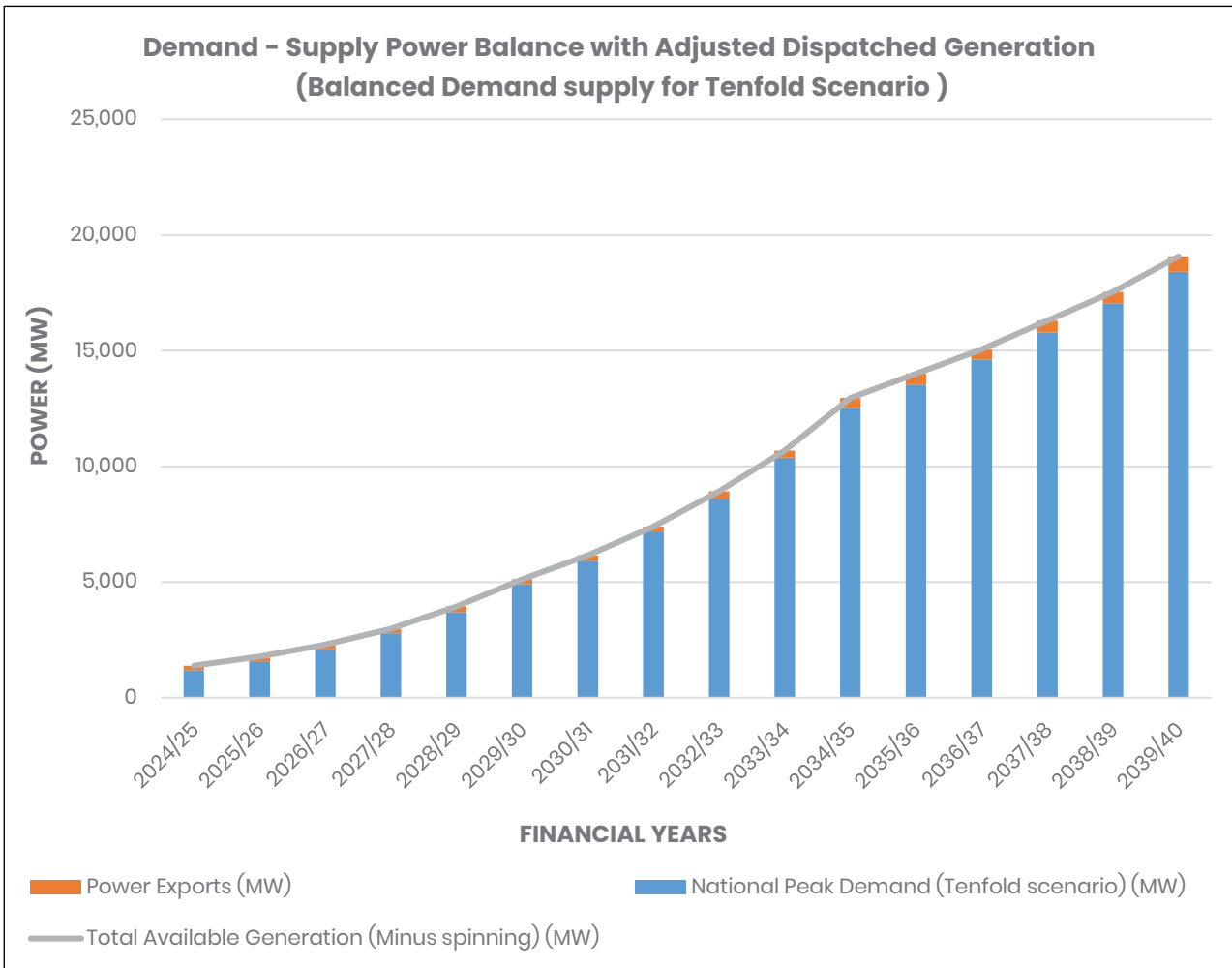


**Figure 34: Forecast generated power based on adjusted dispatched power**

The balanced Demand-Supply Power detailed results are summarized as shown in Table 75 and illustrated in Figure 35 here under.

**Table 75: Balanced Demand-Supply for Tenfold 2040 scenario for the planning horizon**

Financial Years	Installed Capacity (MW)	Available Generation (minus spinning reserve)(MW)	Total National demand (MW)	Total Exports (MW)	Total National demand + Exports (MW)	Excess/Deficit For National Demand + Exports (MW)
2024/25	2,064.2	1,385.40	1,185.40	200	1,385.40	0
2025/26	2,749.1	1,775.58	1,575.58	200	1,775.58	0
2026/27	3,387.6	2,294.19	2,094.19	200	2,294.19	0
2027/28	4,595.9	2,983.51	2,783.51	200	2,983.51	0
2028/29	6,844.9	3,949.41	3,699.72	249.7	3,949.42	0
2029/30	12,484.1	5,114.91	4,917.51	197.4	5,114.91	0
2030/31	20,974.1	6,151.08	5,927.88	223.2	6,151.08	0
2031/32	21,825.8	7,398.34	7,145.84	252.5	7,398.34	0
2032/33	21,825.8	8,926.35	8,614.05	312.3	8,926.35	0
2033/34	21,825.8	10,686.22	10,383.92	302.3	10,686.22	0
2034/35	22,225.8	12,953.14	12,517.44	435.7	12,953.14	0
2035/36	22,225.8	14,006.48	13,520.77	485.7	14,006.47	0
2036/37	22,225.8	15,060.23	14,604.53	455.7	15,060.23	0
2037/38	22,225.8	16,300.36	15,775.16	525.2	16,300.36	0
2038/39	22,225.8	17,535.42	17,039.61	495.8	17,535.41	0
2039/40	22,225.8	19,076.73	18,405.42	671.3	19,076.72	0



**Figure 35: Balanced Demand-Supply for Tenfold 2040 scenario**

**Observations**

- No deficits or surpluses are observed in the balanced demand-supply, since the generation plants are dispatched in proportion to the demand.

However, beyond FY2029/30, all the large hydro power plants and geo-thermal power plants would be required to operate at their full installed capacity, to meet the forecast demand.

Additionally, the nuclear power plant and some thermal power plants would be required to run at full installed capacity beyond 2036/37 to sustain the projected demand.



## 6.2. GRID INVESTMENT PLAN FOR TENFOLD 2040 SCENARIO

The Grid Investment Plan under the Tenfold 2040 scenario outlines the objectives, estimated costs and implementation timelines for the identified projects. It incorporates all projects included in the Business-As-Usual (BAU) scenario, along with additional projects necessary to achieve the targets set under the Tenfold 2040 scenario. The projects are categorized into the following as follows:

- Power evacuation projects
- Grid re-investment projects
- System Expansion projects
- Regional projects.

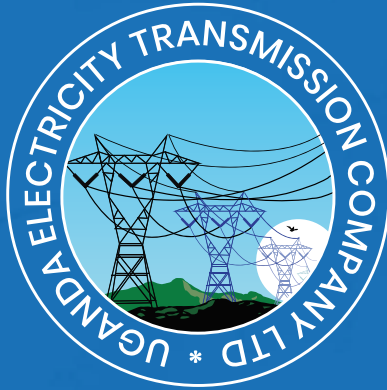
### 6.2.1. SUMMARY OF FINANCIAL REQUIREMENTS BY THE YEAR 2040

The total cost of implementing all the projects outlined in the Grid Investment Plan under the Tenfold 2040 scenario over the planning horizon is estimated at 16,003,667,269 USD. This amount includes 4,359,005,010 USD for projects carried over from the Business-As-Usual (BAU) scenario.

The summarized cost breakdown for Tenfold 2040 scenario is shown in Table 76 below.

**Table 76: Summary of financial requirements for Tenfold 2040 scenario**

Project Category	Estimated Cost (USD)
BAU Investment Requirements	4,359,005,010
CENTRAL REGION	824,223,230
EASTERN REGION	1,711,106,667
GKM AREA	5,293,318,010
JINJA METRO AREA	524,275,215
NORTHERN REGION	1,418,092,745
WESTERN REGION	948,295,974
WEST NILE REGION	925,350,419
Total Grid Investment Requirement	16,003,667,269



# **ENERGY POLICY 2023 – VISION 2040 SCENARIO**

## 7. ENERGY POLICY 2023 – VISION 2040 SCENARIO

### 7.1. LOAD AND GENERATION PROGNOSIS FOR THE ENERGY POLICY 2023 – VISION 2040 SCENARIO

Uganda Vision 2040 provides development paths and strategies to operationalize Uganda’s Vision statement which is “A Transformed Ugandan Society from a Peasant to a Modern and Prosperous Country within 30 years” as approved by Cabinet in 2007.

It aims at transforming Uganda from a predominantly peasant and low-income country to a competitive upper middle-income country.

#### 7.1.1. ASSUMPTIONS FOR DEMAND SUPPLY PROGNOSIS OF ENERGY POLICY 2023 – VISION 2040 SCENARIO

In line with Vision 2040 and having benchmarked it with selected Upper Middle Income (UMI) countries that have achieved similar level of development status, several socio-economic indicators and targets were developed for Uganda as reference points to indicate the desired level of development and social-economic transformation.

Some of these targets<sup>25</sup> include.

- Electricity per capita consumption raised to 3,668 kWh by 2040
- Electricity Access of the population raised to 80% by 2040
- An installed Generation Capacity shall be raised to 41,738 MW by 2040
- Uganda’s population is expected to increase to 60.4 million by 2040

The Energy Policy for Uganda (2002) was recently reviewed, culminating in the development of the Energy Policy for Uganda (2023). One of the key objectives of the updated policy is to enhance electricity generation by diversifying the energy mix and increasing the installed generation capacity to 52,451 MW by 2040.

As a result of this policy revision, the Vision 2040 target for installed generation capacity was revised from 41,738 MW to 52,451 MW to align with the new strategic ambitions.

The Electricity System Planning and Coordination Committee (ESPCC) and a Least Cost Generation & Transmission Plan (LCGTP) were thereafter drafted with an objective to develop a more granular view of the transmission infrastructure in line with the Revised Electricity Policy 2023, capable of sustaining the target of a Generation Installed Capacity of 52GW by 2040.

An average load factor of 0.746 was assumed by the LCGTP Sector working team led by MEMD, presenting approximately 38GW of the National peak Demand in 2040 with 100% electrification

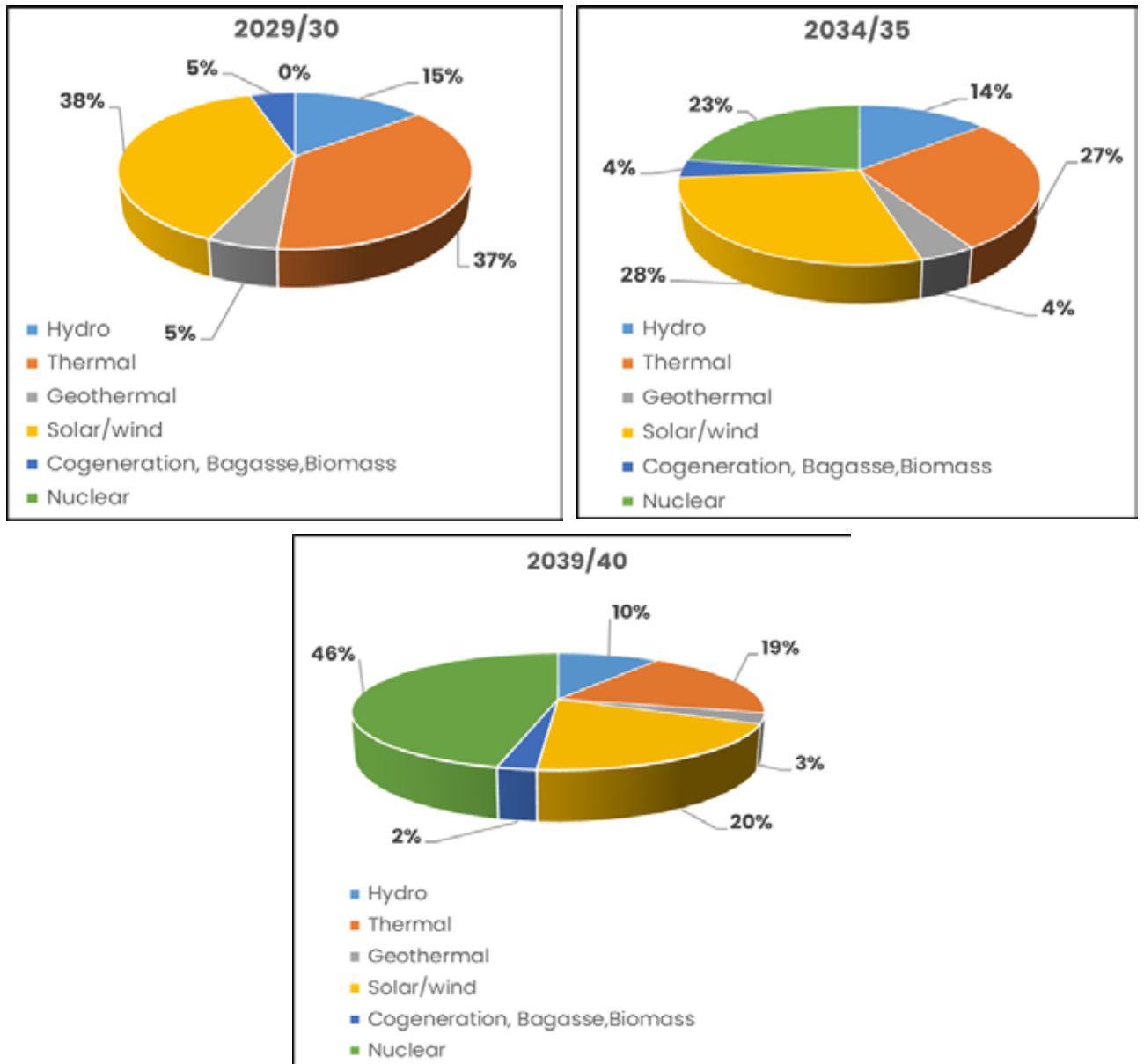
<sup>25</sup> Source of Vision 2040 Targets: NPA – Vision 2040

### 7.1.2. GENERATION FORECAST FOR THE ENERGY POLICY 2023 – VISION 2040

Following the updated of the generation installed capacity target from 41GW to 52GW, the estimated breakdown for the generation resources is shown below in Table 77, and illustrated in Figure 36 here under of the forecasted generation mix.

**Table 77: Estimations on available energy resources for the Energy Policy 2023 – Vision 2040 scenario**

Technology	Estimated Capacity (MW)
Hydro	5,143
Thermal	9,919
Geo-thermal	1,550
Solar/Wind	10,328
Cogeneration, Bagasse, Biomass	1,313
Nuclear	24,200



**Figure 36: Forecasted Generation mix for the Energy Policy 2023 – Vision 2040**

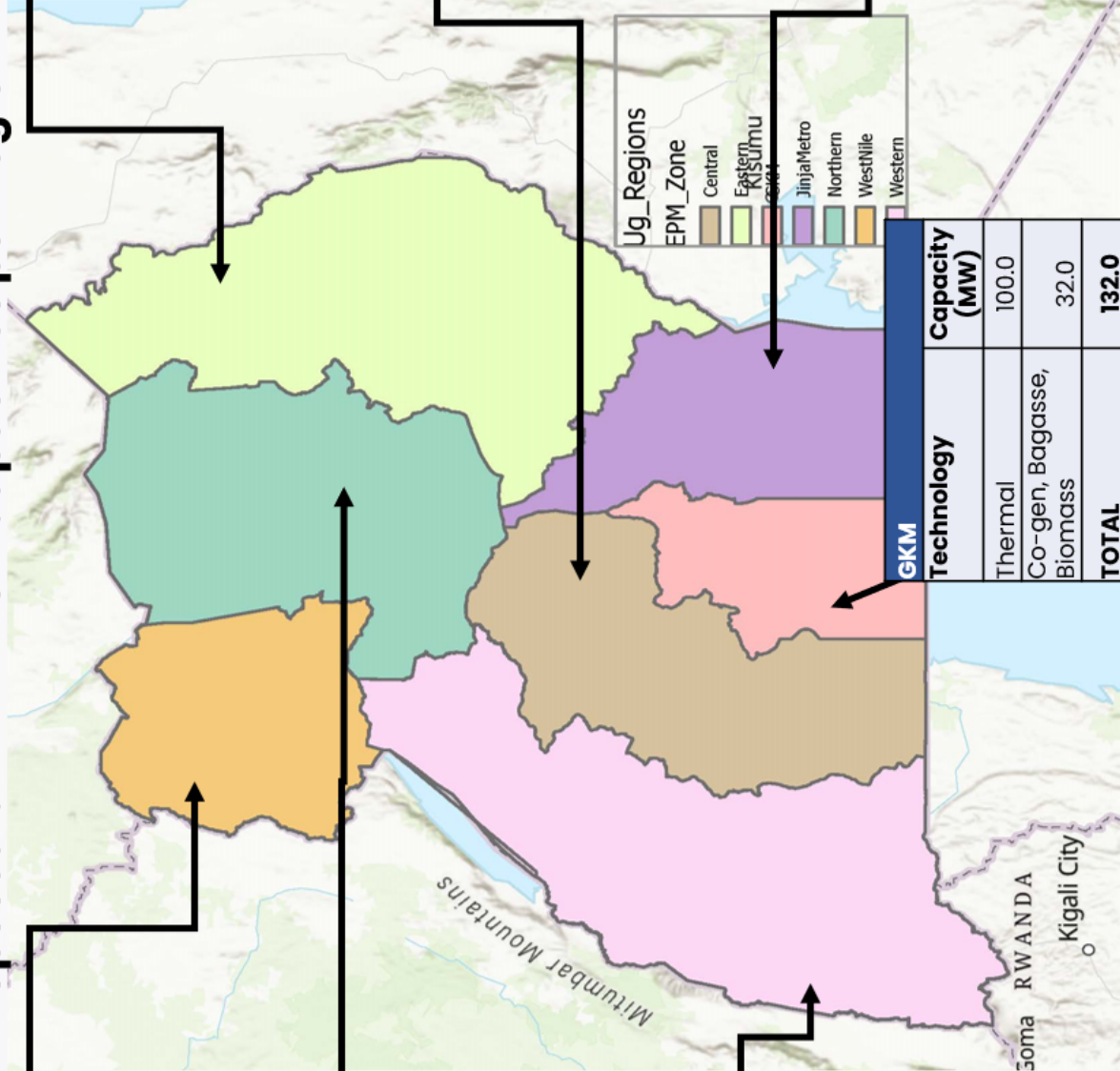
The generation mix by 2040 was further disaggregated by region to provide a detailed outlook of the installed generation capacity across the different geographical areas as shown in Figure 37 here under.

# Proposed GENERATION Capacities per Region

WEST NILE	
Technology	Capacity (MW)
Hydro	1,124.4
Geothermal	240
Solar/Wind	1,750.8
<b>TOTAL</b>	<b>3,115.2</b>

NORTH	
Technology	Capacity (MW)
Hydro	1,968.4
Solar/Wind	1,175.0
Co-gen, Bagasse, Biomass	45.4
Nuclear	4,000
<b>TOTAL</b>	<b>7,188.8</b>

WEST	
Technology	Capacity (MW)
Hydro	1,065.3
Thermal	2,318.7
Geothermal	1,310.0
Solar/Wind	517.0
Co-gen, Bagasse, Biomass	771.7
Nuclear	4,600
<b>TOTAL</b>	<b>10,582.7</b>



EAST	
Technology	Capacity (MW)
Hydro	170.8
Thermal	2,500
Solar/Wind	5,944.0
Co-gen, Bagasse, Biomass	14.4
Nuclear	8,400
<b>TOTAL</b>	<b>17,029.2</b>

CENTRAL	
Technology	Capacity (MW)
Hydro	0.7
Thermal	5,000.0
Solar/Wind	641.1
Co-gen, Bagasse, Biomass	265.6
Nuclear	7,200
<b>TOTAL</b>	<b>13,107.4</b>

JINJA METRO	
Technology	Capacity (MW)
Hydro	813.0
Solar/Wind	300.0
Co-gen, Bagasse, Biomass	183.6
<b>TOTAL</b>	<b>1,296.6</b>

Figure 37: Forecasted Generation Installed capacities per region by 2039/40

### 7.1.3. DEMAND FORECAST OF THE ENERGY POLICY 2023 –VISION 2040

The LCGTP Sector working group led by MEMD assumed an average load factor of 0.746, presenting approximately 38GW of the National peak Demand in 2040 with 100% electrification for this scenario.

Furthermore, Data centers have been assumed to contribute a load of 1,400MW and which are located the Northern and West-Nile Regions.

The demand was projected to grow from the existing National peak demand of 891.84MW (as of 2023/24) to meet the baseline demand targets presented in Table 78 below and extracted from the region-based demand breakdown indicated in Table 79 below.

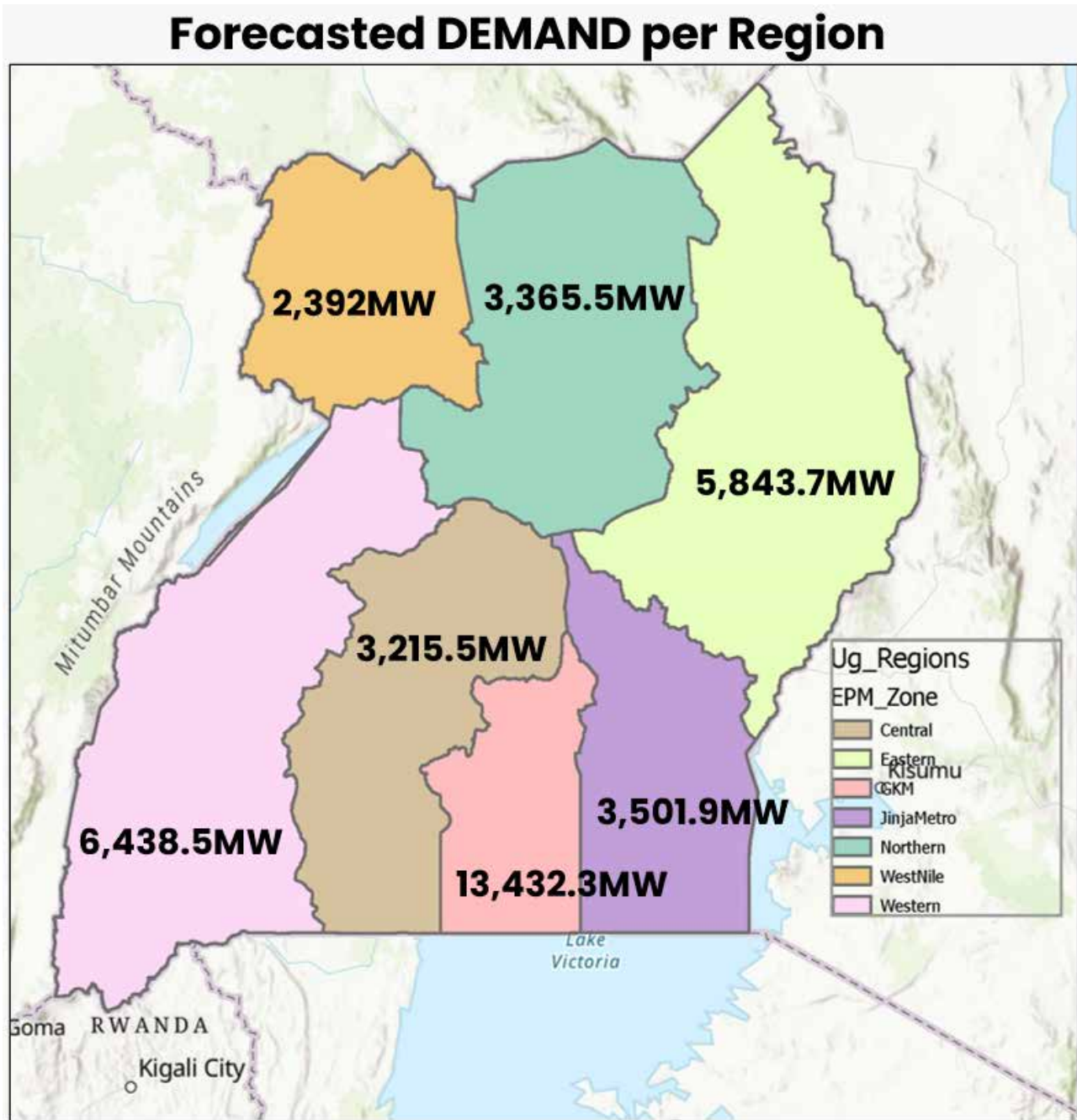
**Table 78: Demand Forecast for the Energy Policy 2023 – Vision 2040**

Financial Year	National Peak Demand (MW)
2029/30	7,734.92
2034/35	19,842.98
2039/40	38,189.39

**Table 79: Region based demand breakdown for the Energy Policy 2023 – Vision 2040**

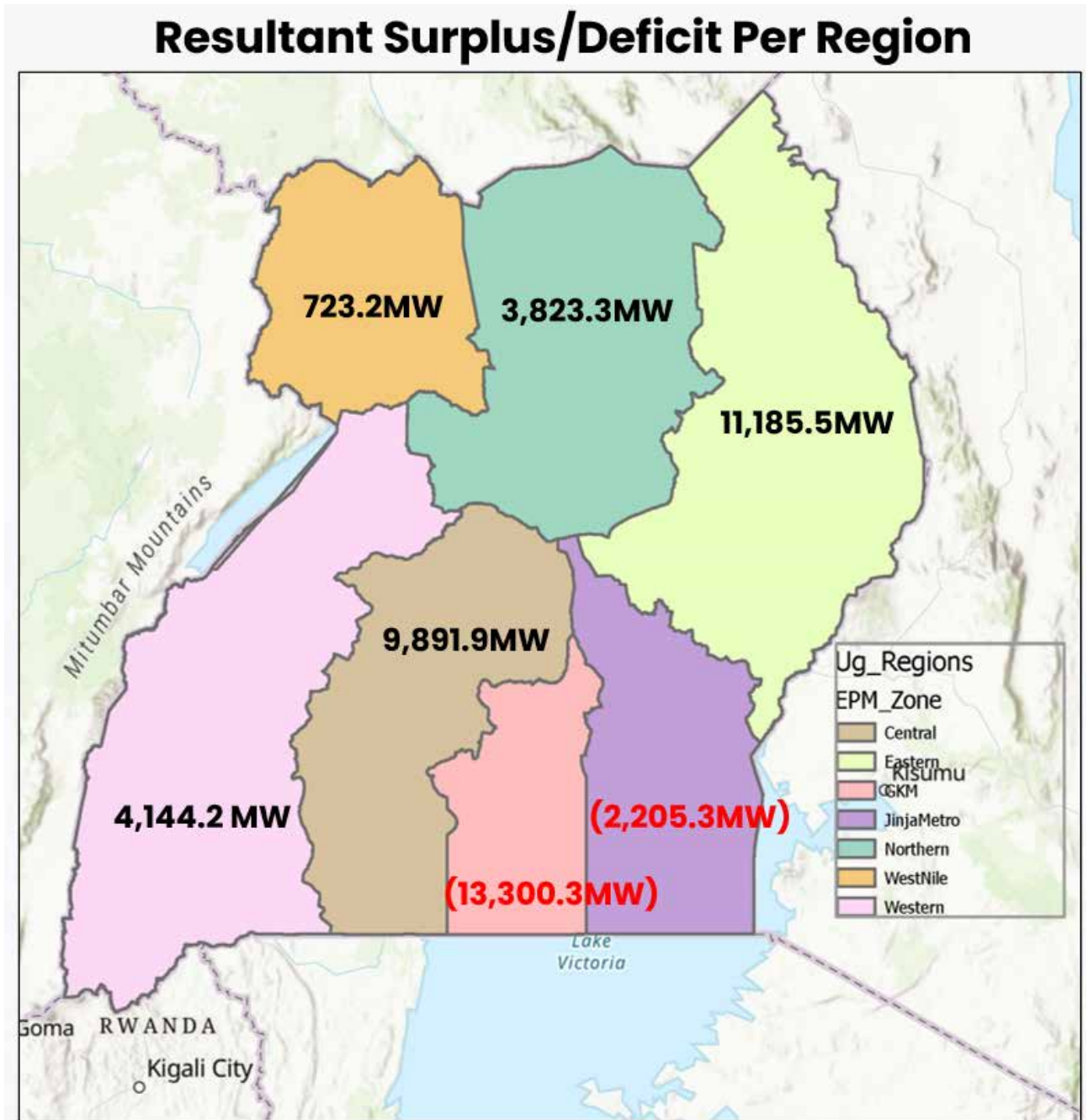
Zone	2029/2030	2034/2035	2039/2040
CENTRAL	531.19	1,427.95	3,215.46
EAST	1,015.56	2,616.83	5,843.74
GKM	3,502.27	8,790.49	13,432.26
JINJA_METRO	721.23	1,675.50	3,501.91
NORTH	509.65	1,452.14	3,365.47
WEST	1,100.56	2,867.76	6,438.52
WEST_NILE	354.46	1,012.30	2,392.04
<b>TOTALS</b>	<b>7,734.92</b>	<b>19,842.98</b>	<b>38,189.39</b>

Figure 38 below provides a pictorial representation of the region-based demand across the different geographical areas.



**Figure 38: Forecasted Demand per Region by 2039/40**

A comparison between the forecasted installed generation capacity and demand per region was conducted as illustrated in Figure 39 below. The analysis revealed deficits in the installed generation capacity relative to demand in the GKM and Jinja Metro regions, highlighting the need for additional evacuation infrastructure to supply power to these areas.



**Figure 39: Surplus/Deficit of Installed generation Capacity relative to Demand**

The export potential for this scenario was assumed as indicated in Table 80 below.

**Table 80: Projected exports for Energy Policy 2023 – Vision 2040 scenario**

Year	2024/2025	2025/26 – 2039/40
Kenya	100	4 - 100
Tanzania	40	40 - 180
Rwanda	60	60
DRC		20 - 100
South Sudan		45 - 260

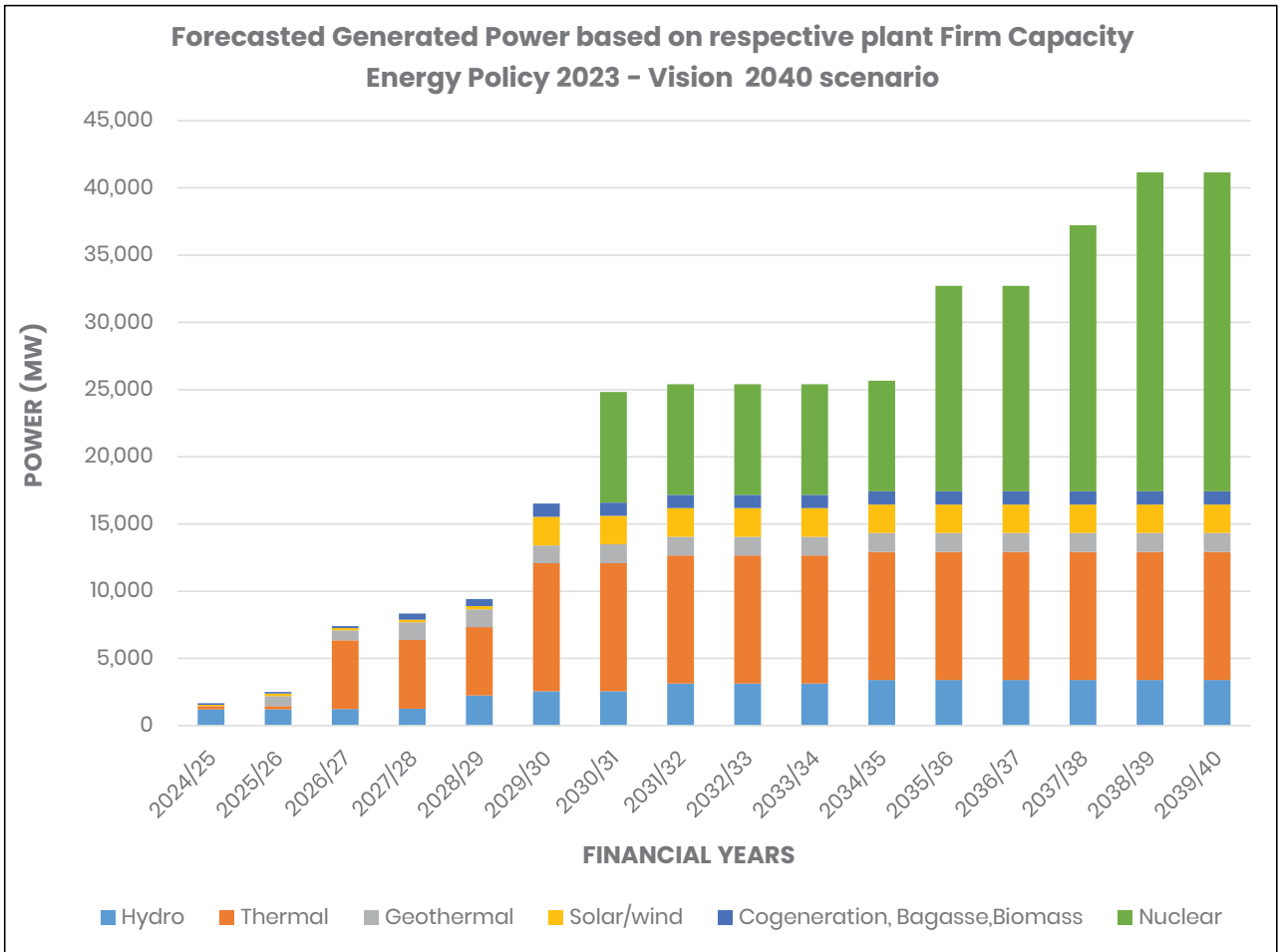
#### 7.1.4. DEMAND SUPPLY BALANCE OF ENERGY POLICY 2023- VISION 2040 SCENARIO

A demand–supply power balance was conducted to determine whether the generation capacity would meet the projected National peak demand and export requirements. It was carried out following two approaches briefly discussed below.

##### 7.1.4.1. UNBALANCED DEMAND–SUPPLY OF ENERGY POLICY 2023 – VISION 2040 SCENARIO

The unbalanced demand-supply approach considered power generation from each plant based on the plant’s firm capacity, which was determined by the plant factor and installed capacity of the generation plant. The resulting total generation output was then compared against the projected demand to identify potential surpluses or deficits.

Figure 40 here under provides a graphical representation of the generated power based on plant firm capacity in the generation mix.

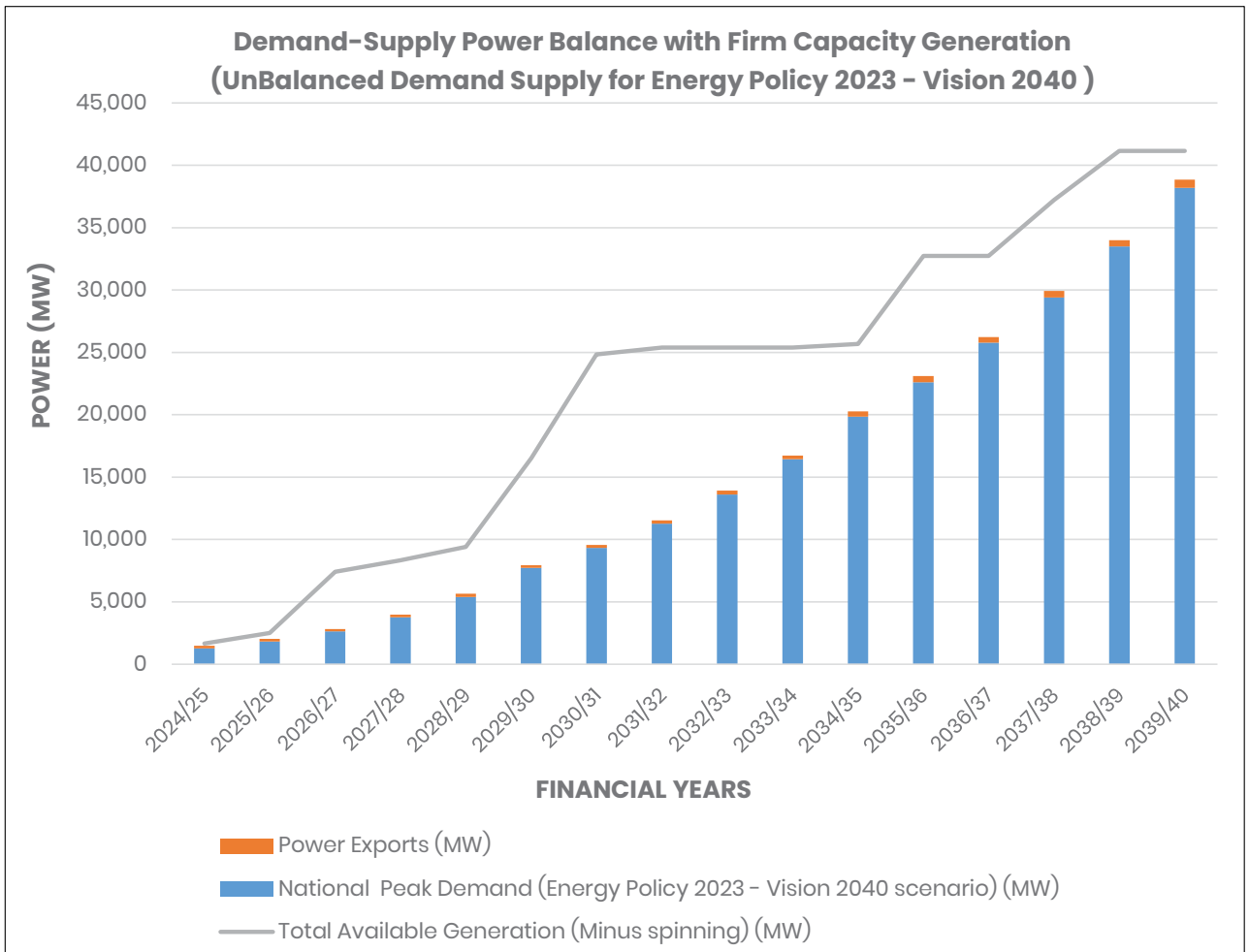


**Figure 40: Forecast generated power based on firm capacity**

The unbalanced Demand-Supply Power summarized as shown in Table 81 below and illustrated in Figure 41 here under.

**Table 81: Unbalanced Demand-Supply for Energy Policy 2023 – Vision 2040 scenario for the planning horizon**

Financial Years	Installed Capacity (MW)	Available Generation (minus spinning reserve) (MW)	Total National demand(MW)	Total Exports (MW)	Total National demand + Exports (MW)	Excess/Deficit For National Demand + Exports (MW)
2024/25	2,064.2	1,658.8	1,278.35	200	1,478.35	180.44
2025/26	2,749.1	2,517.1	1,832.36	200	2,032.36	484.79
2026/27	9,067.6	7,409.3	2,626.46	200	2,826.46	4,582.86
2027/28	10,275.9	8,341.3	3,764.72	200	3,964.72	4,376.56
2028/29	12,524.9	9,414.6	5,396.28	249.7	5,645.98	3,768.59
2029/30	26,910.1	16,515.7	7,734.92	197.4	7,932.32	8,583.42
2030/31	35,400.1	24,828.7	9,338.69	223.2	9,561.89	15,266.85
2031/32	36,251.8	25,399.9	11,274.99	252.5	11,527.49	13,872.45
2032/33	36,251.8	25,399.9	13,612.77	312.3	13,925.07	11,474.87
2033/34	36,251.8	25,399.9	16,435.26	302.3	16,737.56	8,662.38
2034/35	36,651.8	25,667.9	19,842.98	435.7	20,278.68	5,389.26
2035/36	43,851.8	32,723.9	22,619.03	485.7	23,104.73	9,619.21
2036/37	43,851.8	32,723.9	25,783.46	455.7	26,239.16	6,484.78
2037/38	48,451.8	37,231.9	29,390.60	525.2	29,915.80	7,316.14
2038/39	48,451.8	41,151.9	33,502.37	495.8	33,998.17	7,153.77
2039/40	52,451.8	41,151.9	38,189.39	671.3	38,860.69	2,291.25



**Figure 41: Unbalanced Demand-Supply for Energy Policy 2023 - Vision 2040 scenario**

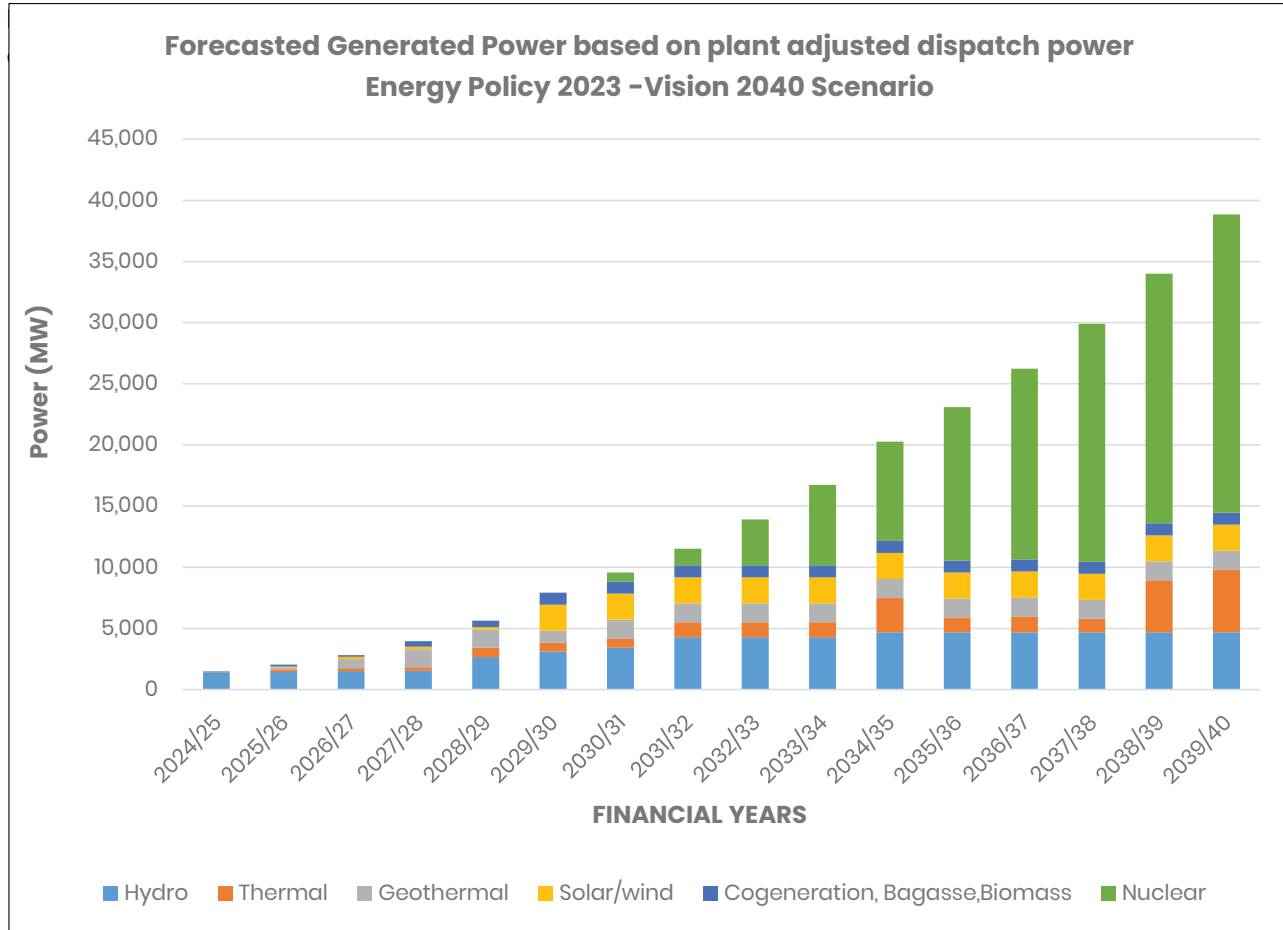
**Observations**

- Surplus generation capacity to meet any additional demand and exports range from 180.44MW in FY2024/25 to 15,266.85MW in FY2030/31. This indicates that on average a 1000MW load would be required to be added to the power grid each year to match the generation capacity.

To realise this, a clear development road map needs to be developed to explore demand growth opportunities.

**7.1.4.2. BALANCED DEMAND–SUPPLY OF ENERGY POLICY 2023 –VISION 2040 SCENARIO**

The balanced demand-supply approach involved adjusting the power output from generation plants proportionally to match the forecast demand. This ensured that for each year in the planning horizon, the total supply matched the projected demand, thereby eliminating potential surpluses or deficits.



**Figure 42: Forecast generated power based on adjusted dispatched power for Energy Policy 2023 – Vision 2040 Scenario**

The balanced Demand-Supply Power summarized as shown in Table 82 below and illustrated in Figure 43 here under.

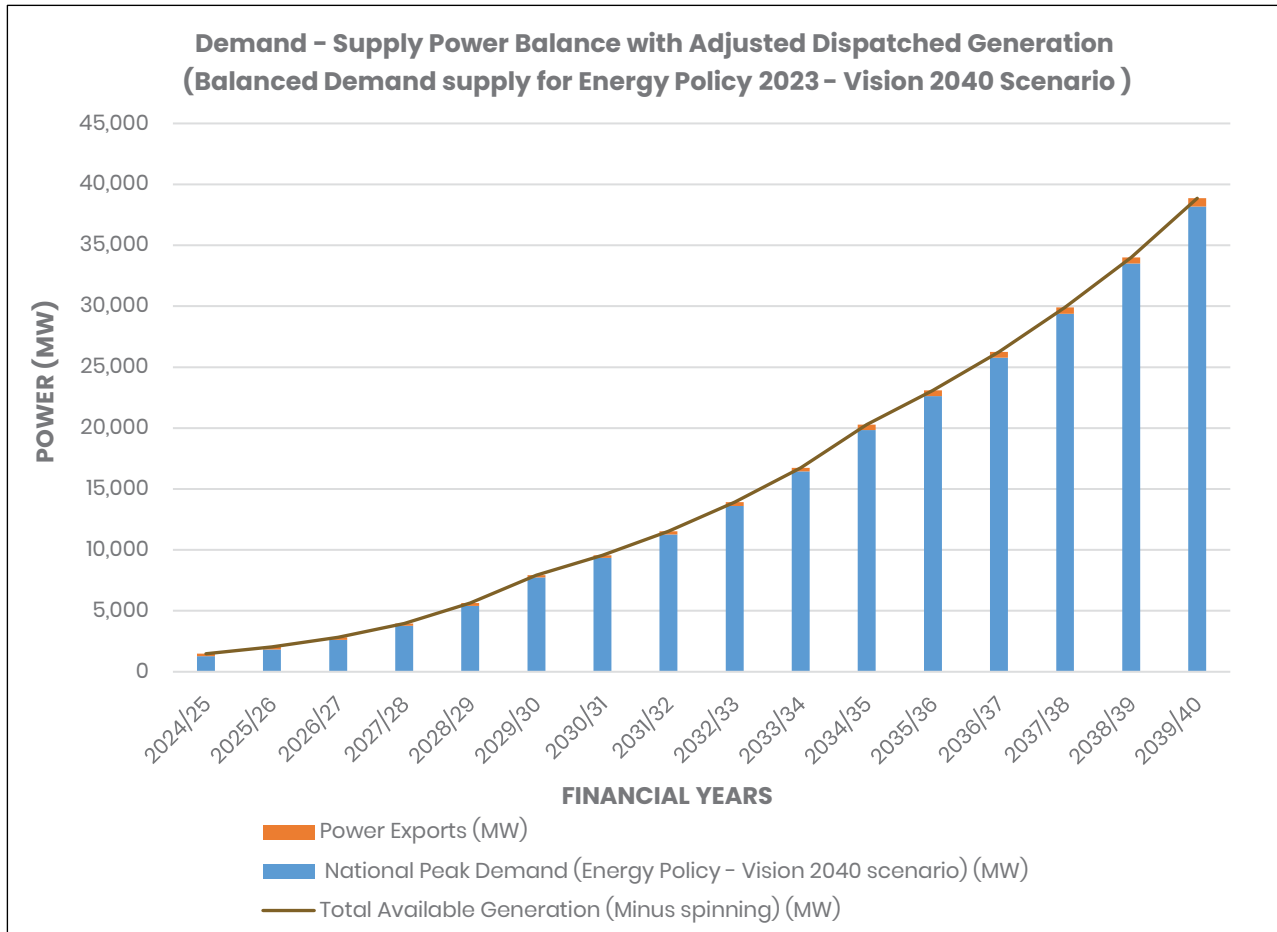
**Table 82: Balanced Demand-Supply for Energy Policy 2023 – Vision 2040 scenario for the planning horizon**

Financial Years	Installed Capacity (MW)	Available Generation (minus spinning reserve)(MW)	Total National demand (MW)	Total Exports (MW)	Total National demand + Exports (MW)	Excess/Deficit For National Demand + Exports (MW)
2024/25	2,064.2	1,478.35	1,278.35	200	1,478.35	0
2025/26	2,749.1	2,032.36	1,832.36	200	2,032.36	0
2026/27	9,067.6	2,826.46	2,626.46	200	2,826.46	0
2027/28	10,275.9	3,964.73	3,764.72	200	3,964.72	0
2028/29	12,524.9	5,645.98	5,396.28	249.7	5,645.98	0
2029/30	26,910.1	7,932.33	7,734.92	197.4	7,932.32	0
2030/31	35,400.1	9,561.89	9,338.69	223.2	9,561.89	0
2031/32	36,251.8	11,527.49	11,274.99	252.5	11,527.49	0
2032/33	36,251.8	13,925.07	13,612.77	312.3	13,925.07	0
2033/34	36,251.8	16,737.56	16,435.26	302.3	16,737.56	0
2034/35	36,651.8	20,278.68	19,842.98	435.7	20,278.68	0
2035/36	43,851.8	23,104.74	22,619.03	485.7	23,104.73	0
2036/37	43,851.8	26,239.16	25,783.46	455.7	26,239.16	0
2037/38	48,451.8	29,915.80	29,390.60	525.2	29,915.80	0
2038/39	48,451.8	33,998.18	33,502.37	495.8	33,998.17	0
2039/40	52,451.8	38,860.69	38,189.39	671.3	38,860.69	0

**Observations**

- No deficits or surpluses are observed in the balanced demand-supply, since the generation plants are dispatched in proportion to the demand.

The generation plants were dispatched following the merit order principle to minimize the overall cost of electricity supply. Consequently, the large hydro power plants, geothermal and nuclear power plants were prioritized in dispatch over thermal plants.



**Figure 43: Balanced Demand-Supply for Energy Policy 2023 – Vision 2040 scenario**

## 7.2. GRID INVESTMENT PLAN FOR ENERGY POLICY 2023 – VISION 2040 SCENARIO

The Grid Investment Plan under the Energy Policy 2023 – Vision 2040 scenario outlines the objectives, estimated costs and implementation timelines for the identified projects. It incorporates all projects included in the Business-As-Usual (BAU) scenario, along with additional projects necessary to achieve the targets set under the scenario. The projects are categorized into the following as follows:

- Power evacuation projects
- Grid re-investment projects
- System Expansion projects
- Regional projects.

### 7.2.1. SUMMARY OF FINANCIAL REQUIREMENTS BY THE YEAR 2040

The total cost of implementing all the projects outlined in the Grid Investment Plan under the Energy Policy 2023 – Vision 2040 scenario over the planning horizon is estimated at 22,073,432,570 USD. This amount includes 4,359,005,010 USD for projects carried over from the Business-As-Usual (BAU) scenario.

The summarized cost breakdown for Energy Policy 2023 – Vision 2040 scenario is shown in Table 83 below.

**Table 83: Summary of financial requirements for Energy Policy 2023 – Vision 2040 scenario**

Project Category	Estimated Cost (USD)
<b>BAU Investment Requirements</b>	4,359,005,010
CENTRAL REGION	2,492,230,679
EASTERN REGION	2,364,016,224
GKM AREA	5,570,326,366
JINJA METRO AREA	1,131,438,255
NORTHERN REGION	1,709,423,436
WESTERN REGION	2,520,600,798
WEST NILE REGION	1,926,391,801
<b>Total Grid Investment Requirement</b>	<b>22,073,432,570</b>

### 7.3 RECOMMENDATIONS

From the above studies and analysis, the following recommendations are made for consideration.

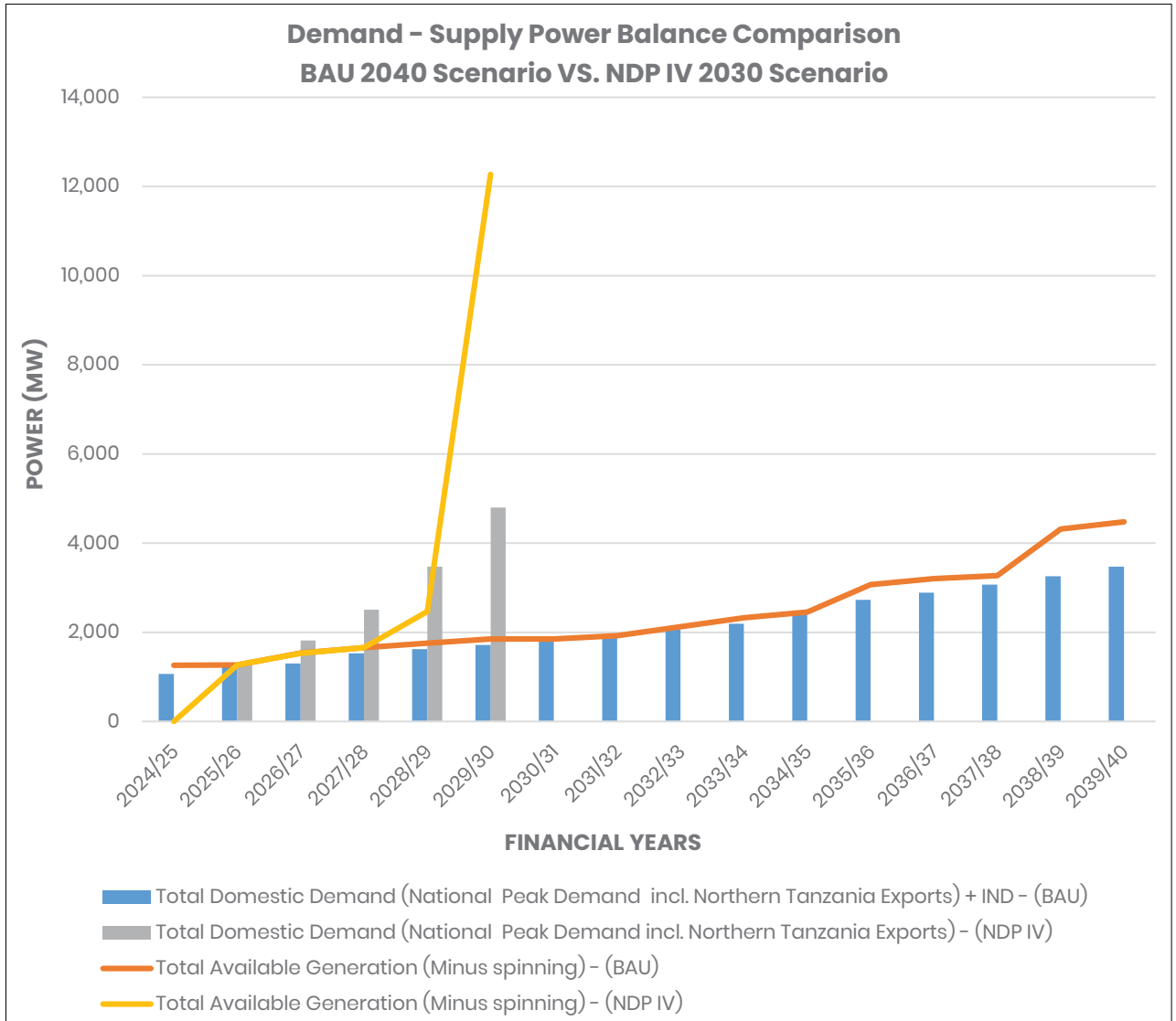
- There is need for support and development of industrial parks which are expected to act as demand drivers.
- Industrial Parks to be distributed, in the sparsely populated areas and spread in the various regions of the country.
- Data Centres to ideally be located closer to the generation facilities
- To target addition of 1000MW load addition each year throughout the planning period.
- For purposes of Grid Stability, the envisaged VRE penetration should encompass Battery Energy Storage Systems (BESS).
- Need to implement projects for new infrastructure around the GKM to construct 220kV and 400kV rings.
- Existing 132kV grid around GKM to be maintained and reinforced
- Need to expedite completion of the Electricity Generation Masterplan, and Electrification (Distribution) Masterplan to inform placement of the required Transmission Substations.
- Corridor sharing with utilities should be undertaken by other government agencies e.g. MoWT for Road reserves.

### 7.4. COMPARISON OF ALL SCENARIOS

The demand supply balance prognosis was compared as follows,

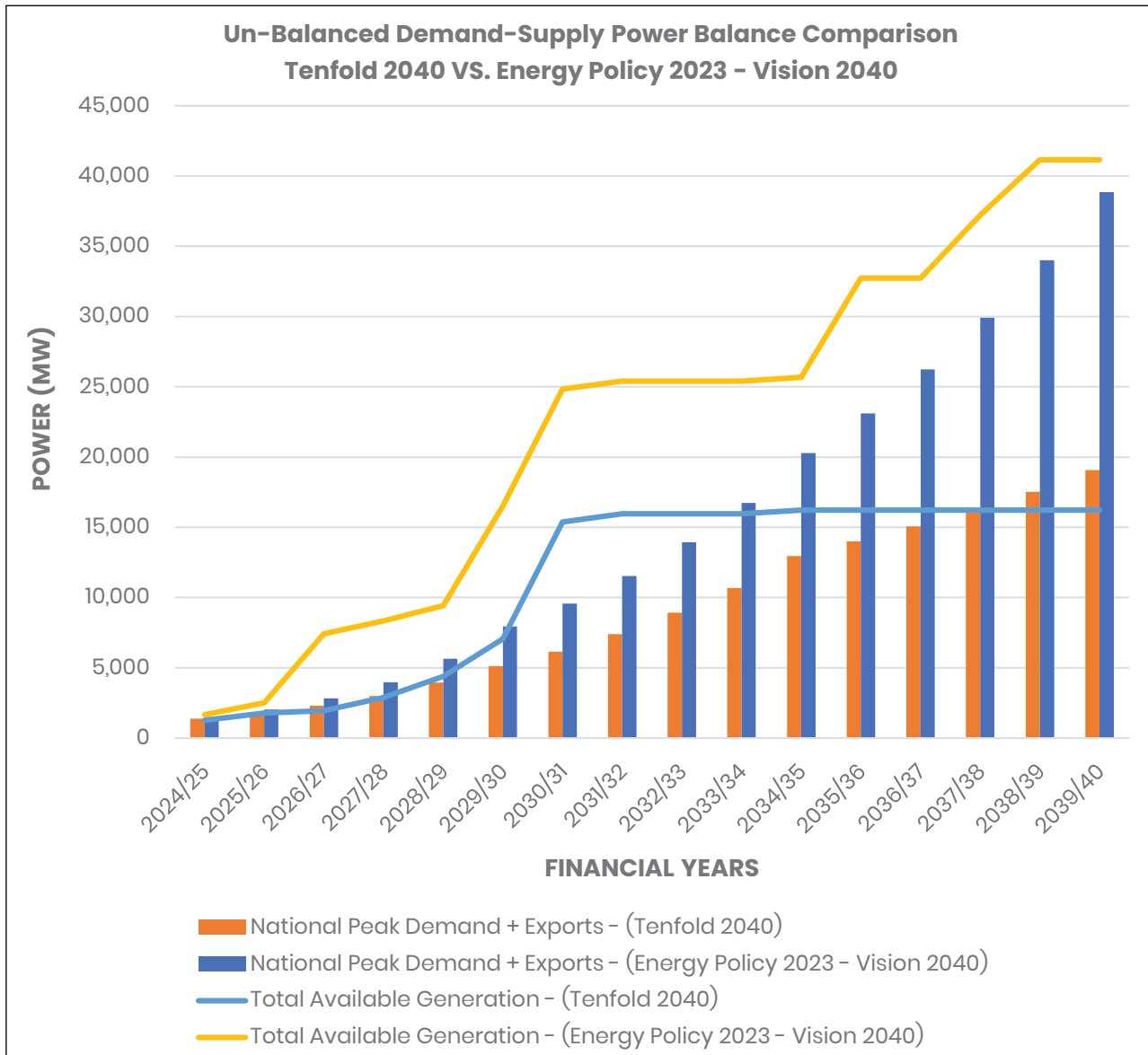
- The Demand-supply Power balance of the BAU scenario was compared against that of the NDP IV scenario.
- The unbalanced Demand-supply Power balance of the Tenfold scenario was compared against that of the Energy Policy 2023 – Vision 2040 scenario.

Figure 44 below provides the graphical comparison between BAU 2040 and NDP IV 2030 scenarios.

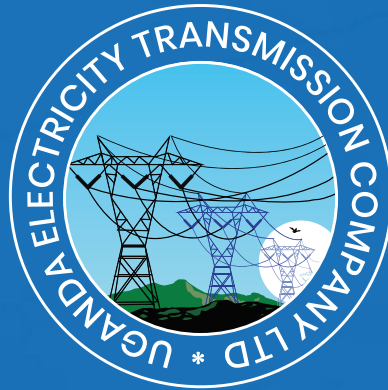


**Figure 44: Demand-Supply Power Balance Comparison of BAU and NDP IV scenarios**

Figure 45 below provides the graphical comparison of the Ten-fold 2040 and Energy Policy 2023-Vision 2040 scenarios.



**Figure 45: Unbalanced Demand-Supply Power Comparison of Tenfold 2040 and Energy Policy 2023 – Vision 2040 scenario**



# **RISK AND OPPORTUNITIES ANALYSIS**

## 8. RISK AND OPPORTUNITIES ANALYSIS

The general risks and opportunities identified across the various GDP scenarios—Business as Usual, NDP IV, Tenfold, and Energy Policy 2023 – Vision 2040 (52 GW)—are outlined below, along with corresponding mitigation measures related to GDP implementation in this section.

### 8.1. RISK ANALYSIS

These risks will be monitored and reported on all through the implementation period of the Grid Development plan.

The risk analysis was conducted for all the scenarios in the Grid Development plan using a 5x5 risk matrix as shown in Figure 46 below. The detailed analysis is presented in Table 84 here under.

Impact	Likelihood				
	Rare (1)	Unlikely (2)	Possible (3)	Likely (4)	Almost Certain (5)
Catastrophic (5)	Substantial Risk (5)	Substantial Risk (10)	Critical Risk (15)	Severe Risk (20)	Severe Risk (25)
Major (4)	Moderate Risk (4)	Substantial Risk (8)	Critical Risk (12)	Critical Risk (16)	Severe Risk (20)
Significant (3)	Moderate Risk(3)	Substantial Risk (6)	Substantial Risk (9)	Critical Risk(12)	Critical Risk (15)
Minor (2)	Tolerable Risk(2)	Moderate Risk (4)	Substantial Risk (6)	Substantial Risk (8)	Substantial Risk (10)
Insignificant (1)	Tolerable Risk(1)	Tolerable Risk (2)	Moderate Risk (3)	Moderate Risk (4)	Substantial Risk(5)

Figure 46: 5x5 Risk Matrix

**Table 84: Risk Analysis for all the scenarios of the Grid Development Plans.**

Risk	Risk Description	Inherent Risk Rating	Mitigation Measures	Residual Risk Rating	Action Plan
Budget constraints	Failure by Government to adequately commit and invest in the grid leading to delayed execution of investment projects	Critical Risk (12)	<ul style="list-style-type: none"> <li>- Timely presentation of priority projects to GoU for financing</li> </ul>	Substantial Risk (9)	Consider packaging projects under the IPT model to include funding for all requirements catered for under counterpart funding. (RAP, LRP, NEMA fees) or other private financing models
Failure to obtain financing for grid investments including land, studies and construction works	Failure to obtain alternative financing for grid investments including land, studies and construction works to meet future energy/power demands leading to delayed execution of investment projects	Critical Risk (16)	<ul style="list-style-type: none"> <li>(i) Attract private sector investments in transmission infrastructure</li> <li>(ii) Engagement with Government to convert debt to grants is ongoing.</li> <li>(iii) Conducting lessons learnt on all projects to ensure risks previously faced do not crystallize on new or ongoing projects.</li> </ul>	Critical Risk (12)	Engage the stakeholders to include competition in the private project funding models eg EPC+F and IPT  Consider packaging projects under the IPT model to include funding for all requirements catered for under counterpart funding. (RAP, LRP, NEMA fees) or other private financing models

Risk	Risk Description	Inherent Risk Rating	Mitigation Measures	Residual Risk Rating	Action Plan
Inadequate coordination with other government projects during implementation	Inadequate harmonization of plans with other utilities due to inadequate stakeholder interface and mismatch of execution timelines	Critical Risk (12)	<ul style="list-style-type: none"> <li>- Stakeholder consultations</li> <li>- Liaise with NPA for alignment with national priorities</li> <li>- Coordinate generation plants with evacuation lines</li> <li>- Align plans with national policies</li> <li>- Use scenario-based planning</li> <li>- Engage agencies on their plans and requirements from UETCL</li> </ul>	Moderate Risk (3)	conduct follow-up meetings with the different government agencies, to harmonize the plans.
Direct Procurements using unsolicited contractors with commercial terms	Direct Procurements using unsolicited contractors with commercial terms undermine competitive bidding processes, disrupt GDP-aligned project schedules and causes procurement delays, ultimately affecting value for money, timely project execution and may lead to debt crisis.	Critical Risk (16)	<ul style="list-style-type: none"> <li>- Compliance with PPDA Act</li> <li>- Detailed evaluation of proposed contractors before award of contracts</li> </ul>	Critical Risk (12)	<ul style="list-style-type: none"> <li>- Generation of monthly contract management reports to monitor the performance of the contractors</li> </ul>

Risk	Risk Description	Inherent Risk Rating	Mitigation Measures	Residual Risk Rating	Action Plan
An Excess/deficit in generation	Mismatch between load growth and generation development	Critical Risk (12)	<ul style="list-style-type: none"> <li>- Continuous monitoring of load growth patterns and adjusting forecasts</li> <li>- Improved coordination to align generation expansion with load growth</li> <li>- Regular updates of the Power Sector Development Plans by MEMD</li> </ul>	Substantial Risk (8)	
Low power demand	Insufficient power demand due to low industrialization, high tariffs, and low coverage leading to high transmission losses and deemed energy charges	Substantial Risk (9)	<ul style="list-style-type: none"> <li>- Expand grid to potential load centers</li> <li>- Ensure Power Purchase Agreements (PPAs) exclude deemed energy clauses</li> </ul>	Substantial Risk (6)	(i) Advocate for the use of electric vehicles starting with procuring electric company vehicles.



Risk	Risk Description	Inherent Risk Rating	Mitigation Measures	Residual Risk Rating	Action Plan
<p>Hostile or uncooperative project host communities</p>	<p>Lack of support from project host communities due to adverse impacts on homes and livelihoods</p>	<p>Critical Risk (16)</p>	<ul style="list-style-type: none"> <li>- Enhance community engagement during RAP implementation</li> <li>- Advocate for government policies that support infrastructure development</li> <li>- Implement community development programs</li> <li>- Maintain close interaction with communities and RAP teams</li> <li>- Strengthen community support programs</li> </ul>	<p>Substantial Risk (9)</p>	<p>Implement community development programs</p>



Risk	Risk Description	Inherent Risk Rating	Mitigation Measures	Residual Risk Rating	Action Plan
Low power demand	Insufficient power demand due to low industrialization, high tariffs, and low coverage leading to high transmission losses and deemed energy charges	Substantial Risk (9)	<ul style="list-style-type: none"> <li>- Expand grid to potential load centers</li> <li>- Ensure Power Purchase Agreements (PPAs) exclude deemed energy clauses</li> </ul>	Substantial Risk (6)	(ii) Conduct CSR activities that enhance electricity consumption in the different communities such providing affordable electric pressure cookers to encourage cooking using electricity
Disruption by new emerging technologies	This potentially increasing skills/ knowledge gaps due to changing technologies and incompatibility with existing systems	Substantial Risk (9)	<ul style="list-style-type: none"> <li>- Adopt extensively proven technologies (opportunity)</li> <li>- Provide operation and maintenance training for new equipment</li> </ul>	Substantial Risk (6)	(i) Carry out grid reinforcement projects to upgrade old technologies. (ii) Explore waivers from PPDA for critical infrastructure to use direct procurements to ensure compatibility.

Risk	Risk Description	Inherent Risk Rating	Mitigation Measures	Residual Risk Rating	Action Plan
Delays in land acquisition	Delayed acquisition of land for transmission line projects due to speculation, compensation disputes, and legal issues	Critical Risk (16)	<ul style="list-style-type: none"> <li>- Deploy dedicated RAP implementation teams</li> <li>- Conduct continuous verification of line routes before implementation</li> <li>- Engage government to revise land laws</li> <li>- Promote easement registration over full land acquisition</li> <li>- Ensure timely release of funds for RAP implementation</li> <li>- Expedite dispute resolution</li> <li>- Develop a RAP framework</li> </ul>	Critical Risk (12)	<ul style="list-style-type: none"> <li>(i) Engage government to revise land laws</li> <li>(ii) Explore constructing underground substations like those in Japan</li> <li>(iii) Explore constructing substations in storeyed buildings</li> <li>(iv) Explore running underground cables through the utilisation of the utility routes next to the road network</li> </ul>
Delayed approvals for projects due to numerous stakeholder guidelines	Possible delay in obtaining approvals for projects due to numerous stakeholder guidelines from NEMA, CGV, Financiers, among others	Critical Risk (16)	<ul style="list-style-type: none"> <li>- Early engagement with key stakeholders</li> <li>- Timely submission of applications and follow-ups</li> </ul>	Critical Risk (12)	<ul style="list-style-type: none"> <li>(i) Establish a fixed timeline for approvals with clear accountability</li> </ul>

Risk	Risk Description	Inherent Risk Rating	Mitigation Measures	Residual Risk Rating	Action Plan
<p>Delayed approvals for projects due to numerous stakeholder guidelines</p>	<p>Possible delay in obtaining approvals for projects due to numerous stakeholder guidelines from NEMA, CGV, Financiers, among others</p>	<p>Critical Risk (16)</p>	<ul style="list-style-type: none"> <li>- Early engagement with key stakeholders</li> <li>- Timely submission of applications and follow-ups</li> </ul>	<p>Critical Risk (12)</p>	<ul style="list-style-type: none"> <li>(iii) Conduct regular inter-departmental coordination meetings</li> <li>(iv) Develop a central tracking system for approvals</li> </ul>
<p>Delays in starting project implementation</p>	<p>Delayed project commencement due to stringent conditions precedent set by various stakeholders, delay in financial close for projects, delay in receipt of RAP funds, RAP/land acquisition challenges, and funder requirements and procurement bottlenecks</p>	<p>Critical Risk (16)</p>	<ul style="list-style-type: none"> <li>- Strengthen collaboration with MoFPED and financiers</li> <li>- Improve procurement tracking and corrective action</li> <li>- Initiate early land acquisition and permit applications</li> </ul>	<p>Critical Risk (12)</p>	<ul style="list-style-type: none"> <li>(i) Implement a strict procurement timetable with penalties for non-compliance</li> <li>(ii) Train project managers on risk-based planning</li> <li>(iii) Create a contingency budget for urgent start-up needs</li> <li>(iv) Strengthen legal frameworks for faster dispute resolution</li> </ul>

Risk	Risk Description	Inherent Risk Rating	Mitigation Measures	Residual Risk Rating	Action Plan
<p>Delayed completion of projects</p>	<p>Delayed execution and completion of projects due to design/scope changes, contractor non-compliance, and weak contract management</p>	<p>Critical Risk (16)</p>	<ul style="list-style-type: none"> <li>- Allocate sufficient time for project design analysis</li> <li>- Engage competent consultants</li> <li>- Conduct thorough design reviews</li> <li>- Strengthen design review and supervision</li> <li>- Monitor project progress against plans</li> <li>- Establish Project Steering Committees for decision-making</li> <li>- Include penalty clauses in contracts for delays</li> <li>- Conduct contractor background checks</li> <li>- Develop high-standard project specifications</li> <li>- Hire experienced contractors</li> <li>- Provide training in procurement and contract management</li> </ul>	<p>Critical Risk (12)</p>	<ul style="list-style-type: none"> <li>(i) Adopt project management software for real-time tracking</li> <li>(ii) Strengthen contractual clauses for performance</li> <li>(iii) Build weather-related and contingency buffers into project schedules</li> <li>(iv) Enhance stakeholder communication to address issues early</li> </ul>

Risk	Risk Description	Inherent Risk Rating	Mitigation Measures	Residual Risk Rating	Action Plan
Low staff levels	Inadequate staff to manage multiple projects simultaneously	Critical Risk (16)	<ul style="list-style-type: none"> <li>- Recruit additional staff</li> <li>- Engage consultants for supervision and project management</li> <li>- Establish Project Implementation Units</li> <li>- Utilize technical departments for project support</li> </ul>	Substantial Risk (9)	<ul style="list-style-type: none"> <li>(i) Secure budget approvals for critical hires</li> <li>(ii) Develop clear career progression pathways</li> <li>(iii) Strengthen recruitment processes to be faster and more transparent</li> <li>(iii) Enhance training and development programs for specialized skills</li> </ul>
Vandalism	Vandalism of transmission infrastructure	Critical Risk (16)	<ul style="list-style-type: none"> <li>- Use steel tubular poles instead of steel lattice towers</li> <li>- Use AAAC conductors less prone to vandalism</li> <li>- Advocate for scrap market regulation</li> <li>- Engage local leaders for security support</li> <li>- Conduct community sensitization campaigns</li> </ul>	Critical Risk (12)	<ul style="list-style-type: none"> <li>(i) Strengthen community engagement to foster ownership of public assets</li> <li>(ii) Introduce reward/whistleblower systems for reporting vandalism</li> </ul>

Risk	Risk Description	Inherent Risk Rating	Mitigation Measures	Residual Risk Rating	Action Plan
Emerging projects that are not included in the GDP	Implementation of projects outside the GDP	Critical Risk (16)	<ul style="list-style-type: none"> <li>- Continuously engage relevant government ministries and agencies</li> <li>- Share UETCL GDP with power sector players to align sector investments</li> </ul>	Substantial Risk (6)	<ul style="list-style-type: none"> <li>(i) Develop a formal mechanism for annual GDP revisions and evaluations</li> <li>(ii) Create a central registry for all projects (planned or emerging)</li> <li>(iii) Adopt flexible budgeting with contingency allocations</li> </ul>
Rationalization of government agencies	Merging of sector entities (UETCL, UEDCL, UEGCL, REA) leading to business continuity risks could delay deliverables under the GDP	Critical Risk (12)	<ul style="list-style-type: none"> <li>(i) Stakeholder engagements with Government</li> <li>(ii) Continued communication with staff on any updates</li> </ul>	Substantial Risk (6)	<ul style="list-style-type: none"> <li>(i) Engage the ministry to Provide for staff redeployment or retraining options</li> <li>(ii) Strengthen communication and change management</li> <li>(iii) Ensure continuity of the implementation strategies for the GDP.</li> </ul>

Risk	Risk Description	Inherent Risk Rating	Mitigation Measures	Residual Risk Rating	Action Plan
Insecurity at some of the project sites	Insecurity risks affecting project sites	Critical Risk (16)	<ul style="list-style-type: none"> <li>- Address security concerns in social and environmental studies</li> <li>- Implement security measures and surveillance at all UETCL sites</li> </ul>	Substantial Risk (6)	Develop crisis response and resilience strategies at national and local levels

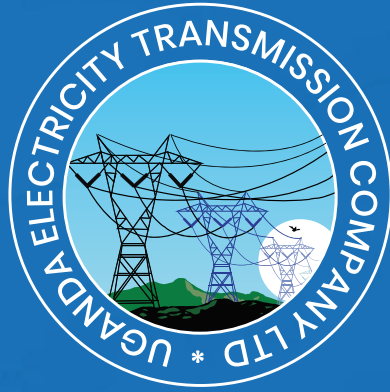
Note: The likelihood of these risks manifesting is almost certain for the 52000MW scenario.

## 8.2. OPPORTUNITIES ANALYSIS

UETCL has identified some opportunities to facilitate the delivery of its mandate. These are presented in the table below.

**Table 85: Opportunities Analysis**

Opportunities	Benefits
<ul style="list-style-type: none"> <li>• Generation Surplus</li> </ul>	<p>In the short term, the generation capacity attributed to the un dispatched thermal power plants presents an opportunity for enhanced security of supply and energy trade. In the medium term as more generation comes online, this opportunity will be further exploited.</p>
<ul style="list-style-type: none"> <li>• Securing funding for new investments:</li> </ul>	<p>The availability of funding from GoU and various agencies on concessional terms opens a window for UETCL to execute its planned investments.</p>
<ul style="list-style-type: none"> <li>• Regional power trade</li> </ul>	<p>The ongoing implementation of the regional interconnection projects presents a greater opportunity for regional energy exchange and trade.</p>
<ul style="list-style-type: none"> <li>• A large project Portfolio (More power generation, transmission, distribution):</li> </ul>	<p>The growing portfolio of power projects under implementation will deliver a robust grid infrastructure for a more reliable, stable and flexible power system</p>
<ul style="list-style-type: none"> <li>• Available and cheaper Hydro-Electric potential.</li> <li>• Expanding Optic Fibre network</li> <li>• Expansion and capacity development.                             <ul style="list-style-type: none"> <li>❖ Increasing Rural Electrification and industrialization</li> <li>❖ Potential for domestic and regional demand for electricity.</li> </ul> </li> <li>• Good Economic growth</li> </ul>	<p>These will Widen the revenue base</p>



# STAKEHOLDERS

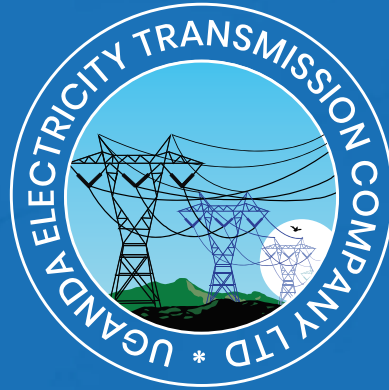
## 9. STAKEHOLDERS

Due to the nature of the projects and the environment in which UETCL operates, identification of key stakeholders is a prerequisite for the successful implementation of this Grid Development Plan. Table 86 presents some of the stakeholders and their roles.

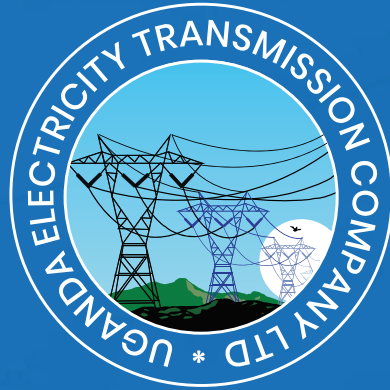
**Table 86: Stakeholders**

Stakeholder	Role
Government of Uganda (GoU), Ministries (MEMD, MoFPED, OPM, among others)	<ul style="list-style-type: none"> <li>• Sector policy and strategies</li> <li>• Provide counterpart funding for activities like RAP implementation</li> <li>• Power sector contribution to GoU wider objectives</li> <li>• Source for funding from development partners</li> <li>• Provide data on future rural electrification projects to facilitate their implementation.</li> </ul>
Distributors (UEDCL & others)	<ul style="list-style-type: none"> <li>• Power sales Agreements (PSA's)</li> <li>• Wheeling Agreements (WA's)</li> <li>• Provide data regarding consumers</li> </ul>
Electricity Regulatory Authority (ERA)	<ul style="list-style-type: none"> <li>• Issue licenses</li> <li>• Approve budgets</li> <li>• Approve bulk supply tariff</li> </ul>
Civil Aviation Authority (CAA)	<ul style="list-style-type: none"> <li>• Approval of tower heights close to airports &amp; airstrips</li> </ul>
Regional utilities	<ul style="list-style-type: none"> <li>• Power Exchange Agreements</li> </ul>
Generation Companies (UEGCL, Independent Power Producers (IPP))	<ul style="list-style-type: none"> <li>• Generate and sell power under Power Purchase Agreements</li> </ul>
Funding agencies	<ul style="list-style-type: none"> <li>• Project identification</li> <li>• Project appraisal</li> <li>• Approval of financing</li> <li>• Project supervision</li> </ul>
Government Valuer	<ul style="list-style-type: none"> <li>• Approval of RAP costs and budget</li> <li>• Provision of properties compensation amounts.</li> </ul>
Public	<ul style="list-style-type: none"> <li>• Way leaves acquisition</li> <li>• Land acquisition</li> </ul>
Local Leaders	<ul style="list-style-type: none"> <li>• Wayleaves acquisition</li> </ul>
National Environment and Management Authority (NEMA)	<ul style="list-style-type: none"> <li>• Approval of ESIA report</li> <li>• Ensuring compliance with environmental conservation guidelines</li> </ul>
National Forestry Authority (NFA)	<ul style="list-style-type: none"> <li>• Approval of ESIA report</li> <li>• Wayleaves acquisition</li> </ul>

Uganda Wildlife Authority (UWA)	<ul style="list-style-type: none"> <li>• Approval of ESIA report</li> <li>• Wayleaves acquisition</li> </ul>
Uganda Investment Authority (UIA)	<ul style="list-style-type: none"> <li>• Information on upcoming demand</li> </ul>
National Planning Authority (NPA)	<ul style="list-style-type: none"> <li>• Harmonize national planning</li> </ul>
Infrastructure Utilities	<ul style="list-style-type: none"> <li>• UNRA (Uganda National Road Authority).</li> <li>• NWSC (National Water Sewage Corporation)</li> <li>• PAU (Petroleum Authority of Uganda)</li> <li>• UNOC (Uganda National Oil Company)</li> <li>• These provide data on their respective infrastructure plan.</li> </ul>
Security Organs	<ul style="list-style-type: none"> <li>• Provide security in the fight against vandalism</li> </ul>
Independent Power Transmitters (IPTs)	<ul style="list-style-type: none"> <li>• Build, operate and/or maintain the high voltage transmission infrastructure under transmission service agreement.</li> </ul>



# APPENDICES



# **A.1 UETCL TRANSMISSION LINES**

## A.1.1. EXISTING TRANSMISSION LINES

Existing Transmission line	Nominal Voltage (kV)	Route Length (km)/Coverage	No. of circuits	Circuit Length (km)	No. of structures	Type	In service date	Line Age (yrs)	Line Rating (MVA) per circuit	Conductor Type
Namanve – Kampala North	132	12.6	1	12.6	37	Steel tower	31-Dec	1954	71	147
Bujagali – Tororo	132	116.2	2	232.4	207	Steel tower	31-Dec	1954	71	78
Tororo – Kenya	132	10.6	2	21.2	28	Steel tower	31-Dec	1954	71	78
Nalubaale – Namanve	132	56.3	1	56.3	169	Steel tower	31-Dec	1954	71	147
Kampala North – Namungoona	132	4.48	1	4.48	20	Steel tower	31-Dec	1959	71	79.1
Namungoona – Mutundwe	132	4.98	1	4.98	16	Steel tower	31-Dec	1959	71	79.1
Kampala North – Mutundwe	132	8.9	1	8.9	36	Steel tower	31-Dec	1959	71	
Nkongge – Rugonjo	132	99.6	1	99.6	529	wooden	31-Dec	1963	62	63.1
Rugonjo – Nkenda	132	40.9	1	40.9	229	wooden	31-Dec	1963	62	63.1
Kabulasoke – Nkongge	132	78.5	1	78.5	422	wooden	31-Dec	1963	62	109
Kabulasoke – Masaka West	132	59.5	1	59.5	338	wooden	31-Dec	1963	66	63.1
Mutundwe – Kabulasoke	132	84.5	1	84.5	476	wooden	31-Dec	1963	66	109
Nalubaale – Lugazi	66	35.2	1	35.2	104	Steel tower	31-Dec	1963	66	10.6
Tororo – Opuyo (Decommissioned 2025)	132	141	1	141	0	wooden	31-Dec	1963	62	0
Masaka West – Kyaka	132	84.5	1	84.5	262	Steel tower	31-Dec	1994	62	73.8
Masaka West – Mbarara North	132	130.5	1	130.5	407	tower	31-Dec	1995	62	151.6
Lugogo – Kampala North	132	5.5	2	11	25	Steel tower	31-Dec	1997	62	73.2
Lugogo – Mutundwe	132	10.4	2	20.8	46	Steel tower	31-Dec	1997	31	180

Existing Transmission Line	Nominal Voltage (kV)	Route Length (km)/Coverage	No. of circuits	Circuit Length (km)	No. of structures	Type	In service date	Line Age (yrs)	Line Rating (MVA) per circuit	Conductor Type
Nalubaale- Lugogo	132	68.8	2	137.6	243	Steel tower	31-Dec	1998	30	180.6
Bujagali - Nalubaale	132	8.4	2	16.8	35	Steel tower	31-Aug	2011	28	205.8
Kawanda - Mutundwe	132	17.3	2	34.6	72	Steel tower	15-Aug	2012	28	457
Bujagali - Kawanda	220	72	2	144	212	Steel tower	15-Aug	2012	27	205.8
Lugogo - Mutundwe Loop In Loop Out to Queensway	132	0.3	2	0.6		Underground cable	31-May	2017	14	
Fort Portal-Hoima	220	169.5	2	339	451	Steel tower	14-Aug	2018	7	380
Underground cable at Masaka West	132	0.3	1	0.3		Underground cable	19-Dec	2018	13	
Mbarara South-Mirama-Border	220	66	2	132	211	Steel tower	07-Dec	2018	7	400
Isimba-Bujagali	132	42	2	84	145	Steel tower	26-Nov	2018	6	270
Nkenda-Fort Portal	220	56.5	2	113	152	Steel tower	14-Aug	2018	8	380
Kawanda-Masaka	220	137	2	274	352	Steel tower	19-Dec	2018	13	380
Mbarara-Nkenda	132	160	2	320	459	Steel tower	19-Feb	2019	7	130
Kawanda-Kapeeka	132	52	1	52	543	Wooden	19-Mar	2019	7	109
LILO Mukono	132	4.2	2	8.4	17	Steel tower	04-Jul	2019	7	257
LILO Iganga	132	9.7	4	38.8	68	Steel tower	08-Dec	2019	6	257
Opuyo-Mbale	132	107.2	2	214.4		Steel tower	25-Nov	2020	1	130
Opuyo - Lira	132	115.5	2	231	607	Steel tower	16-Apr	2020	6	130

Existing Transmission Line	Nominal Voltage (kV)	Route Length (km)/Coverage	No. of circuits	Circuit Length (km)	No. of structures	Type	In service date	Line Age (yrs)	Line Rating (MVA) per circuit	Conductor Type
LILO Namanve South	132	5	2	10	27	Steel tower	26-Jan	2021	6	257
Opuyo-Moroto	132	160.2	2	320.4	623	Steel tower	09-Jul	2021	7	125
Karuma – Kawanda	400	248	2	496	639	Steel tower	28-Nov	2021	5	1300
Karuma-Olwiyo	400	54.64	2	110	154	Steel tower	27-Jun	2022	4	
Karuma – Kole - Lira	132	75.5	2	151	246	Steel tower	23-Dec	2022	4	
Namanve South – Luzira	132	15	2	30	59	Steel tower	18-Jan	2023	3	257
Kole-Gulu	132	67.25	2	134.5	207	Steel tower	19-Nov	2023	3	
Gulu-Agago(Achwa)	132	83	2	166	254	Steel tower	18-Nov	2023	2	
Mutundwe - Entebbe	132	23.8	2	47.6	73	Steel tower	16-May	2023	4	
Gulu-Olwiyo	132	57.08	2	114.16		Steel tower	24-Apr	2024	2	
Nebbi-Arua	132	60	2	120		Steel tower	28-Jul	2024	2	
T-off Muzizi (From Fort-Portal Hoima Line)	132	0.2438	1	0.2438	1	Steel tower	25-Jul	2024	2	
T-off Xsabo Solar(From Kabulasoke -Nkongwe Line)	132	0.94	1	0.94	1	Wooden	31-May	2024	2	
Mirama – Kabale	132	88.5	2	177	294	Steel tower	21-Dec	2024	1	
Olwiyo – Nebbi	132	102.11	2	204.22		Steel tower	28-Jul	2024	1	
Mbale-Tororo	132	34	2	68		Steel tower	05-Jun	2025	2	
Total		3,146.12		5,417.42						

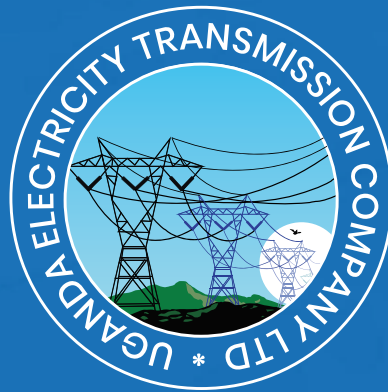
## A.1.2. PLANNED TRANSMISSION LINES

Planned Lines	FY 2025/26 – 2039/40							Expected Commissioning year
	Nominal Voltage (kV)	Route Length (km)	No. of circuits	Circuit Length (km)	Type	Period:		
Matuga – Kasana	132	42.5	1	42.5	Wooden poles	2025/26		
6km Underground Cable LILO from Hoima – Fort Portal transmission line to Kabadie Industrial Park SS	220	6	2	12	Underground cable	2025/26		
Buloba branch point (Mdwe-Kbsk) – Buloba Substation	132	0.8	2	1.6	Steel tower	2025/26		
New Mukono Substation – Mukono Substation	132	0.3	2	0.6	Steel tower	2025/26		
New Mukono Substation – New Mukono branch point (Southern trunk line)–Nble-Lggo	132	0.4	2	0.8	Steel tower	2025/26		
Kawaadla branch point – Kawaadla Substation	132	0.1	2	0.2	Steel tower	2025/26		
Buloba branch point (Kwnd-Mska) – Buloba Substation	220	0.9	4	3.6	Steel tower	2025/26		
New Mukono branch point (Bujg-Kwnd) – New Mukono Substation	220	4.2	4	16.8	Steel tower	2025/26		
1km 132kV LILO from Tororo – Lessos transmission line to Sukulu Phosphate SS	132	0.5	2	1	Steel tower	2025/26		
Bujagali – Tororo	220	131.2	2	262.4	Steel tower	2026/27		
400kV Wobulenzi to New Masaka	400	151	2	302	Steel tower	2028/29		
Masaka – Mbarara	400	134	2	268	Steel tower	2027/28		
Hoima – Kinyara	220	45	2	90	Steel tower	2027/28		
Kinyara – Kafu	220	47	2	94	Steel tower	2027/28		
1km 132kV LILO from OwenFalls – Mukono transmission line to Njeru SS	132	1	1	1	Steel tower	2027/28		
Moroto – Moroto Industrial /Katikekile	132	29.2	2	58.4	Steel tower	2027/28		

Period:		FY 2025/26 – 2039/40					
Planned Lines	Nominal Voltage (kV)	Route Length (km)	No. of circuits	Circuit Length (km)	Type	Expected Commissioning year	
Olwiyi – Bibia – Border	400	150	2	300	Steel tower	2028/29	
1km 220kV LILO from Tororo – Lessos transmission line to Sukulu Phosphate SS	220	1	2	2	Steel tower	2027/28	
Mirama – Nsongezi	132	37.3	2	74.6	Steel tower	2028/29	
Masaka – Mutukula	400	92	2	184	Steel tower	2028/29	
Nakasongola – Kaweweta – Kapeka	132	123	2	246	Steel tower	2028/29	
Wobulezi – Kapeeka	220	37	2	74	Steel tower	2028/29	
359km 132kV Upgrade of Mutundwe – Buloba – Kabulasoke – Masaka and Kabulasoke – Nkongwe – Rugonjo – Nkenda	132	359	1	359	Steel tower	2028/29	
47 km 132kV Kabale – Nyakagyeme Transmission line	132	47	2	94	Steel tower	2028/29	
Nagongogera – SGR Tororo Traction SS	132	6.7	2	13.4	Steel tower	2028/29	
Nagongera – to SGR Buwoola SS	132	39.4	2	78.8	Steel tower	2028/29	
Iganga SS – SGR Iganga Traction SS	132	1.9	2	3.8	Steel tower	2028/29	
LILO from Nalubaale – Lugogo T/L to SGR Nyenga/Jijina SS	132	1.3	2	2.6	Steel tower	2028/29	
LILO from Nalubaale – Lugogo T/L to SGR Namanve SS	132	6.8	2	13.6	Steel tower	2028/29	
Nkenda – Mpondwe	400	72.5	2	145	Steel tower	2029/30	
Nakasongola-Kasana	132	78	2	156	Steel tower	2029/30	
Tororo – Karuma	400	345	2	690	Steel tower	2029/30	
1km 132kV LILO from Namanve – Kampala North transmission line to Ntinda SS	132	1	1	1	Steel tower	2029/30	
Mbale – Bulambuli – Kween	132	76	2	152	Steel tower	2029/30	
Adjumani – Arua	132	150	2	300	Steel towers	2029/30	

Period:		FY 2025/26 – 2039/40					
Planned Lines	Nominal Voltage (kV)	Route Length (km)	No. of circuits	Circuit Length (km)	Type	Expected Commissioning year	
Buloba-Entebbe-Gaba-Luzira (40km 132kV Buloba - Entebbe Transmission Line, 45km 132kV Entebbe - Gaba Transmission Line and 8km 132kV Ggaba - Luzira Transmission Line)	132	93	2	186	Steel tower	2029/30	
Arua - Oraba	132	70	2	140	Steel tower	2029/30	
Kiba Interconnection Project (10km 400kV Kiba - Nile HPPs Switching Station)	400	10	2	20	Underground cable	2030/31	
Oriang - Nile HPPs Switching Station	400	10	2	20	Underground Cable	2030/31	
10km 132kV LILO from Bujagali - Iganga transmission line to Masese SS	132	10	2	20	Steel tower	2030/31	
LILO from Bujagali-Kawanda transmission line to Busiika	220	20	2	40	Steel tower	2030/31	
Ayago Interconnection Project (Nile HPP 400kV Switching station; 2km 400kV Ayago - Nile HPPs Switching Station Underground Cable; 10km Nile HPPs Switching Station - T- Ayago 400kV Underground Cable, T-Ayago 400kV Switching station)	400	12	2	24	Underground cable	2031/32	
New Mbarara - Kasese - DR Congo	400	160	2	320	Steel	2031/32	
2km 132kV LILO from Masaka - Mbarara transmission line to Akageti substation	132	2	1	2	Steel tower	2031/32	
0.5km 132kV LILO from Mbarara - Nkenda transmission line to Kasese Industrial Park SS	132	0.5	2	1	Steel tower	2032/33	
2km 220kV LILO from Bujagali - Tororo transmission line to Jinja Industrial Park SS	220	2	2	4	Steel tower	2032/33	
5km 132kV LILO from Mbarara - Nkenda transmission line to Ishaka Industrial Park SS	132	5	2	10	Steel tower	2032/33	

Planned Lines	FY 2025/26 – 2039/40						
	Nominal Voltage (kV)	Route Length (km)	No. of circuits	Circuit Length (km)	Type	Expected Commissioning year	
400 kV Buyende – Jinja Industrial (Operated at 220kV)	220	80	2	160	Steel towers	2032/33	
400 kV Buyende – Nakasongola (Operated at 132kV)	132	130	2	260	Steel towers	2032/33	
400kV Buyende – Opuyo (Operated at 132kV)	132	90	2	180	Steel towers	2032/33	
400kV Buyende – Tororo (Operated at 132kV)	132	130	2	260	Steel towers	2032/33	
1km 132kV LILO from Nalubaale – Lugogo transmission line to Lugazi SS	132	1	2	2	Steel	2034/35	
13km 132kV LILO from Masaka – Kyaka transmission line to Rakai SS	132	13	2	26	Steel towers	2034/35	
Kapeeka – kiboga– Mubende –Nkonge	132	211	2	422	Steel towers	2034/35	
Agago/Achwa – Kitgum – Bibia East	132	160	2	320	Steel towers	2034/35	
Kabale – Kisoro	132	60	2	120	Steel towers	2037/38	
Kabale – Ishaka	132	95	2	190	Steel towers	2038/39	
Arua – Aru – Duruba	132	15	2	30	Steel towers	2030/31	
Uhuru Falls Interconnection Project (38km 400kV Uhuru – Olwiyo)	400	38	2	76	Underground cable	2038/39	
Bulambuli – Moroto	132	130	2	260	Steel towers	2039/40	
Kitgum – Moroto	132	220	2	440	Steel towers	2039/40	
Bibia – Adjumani	132	50	2	100	Steel towers	2039/40	
Kapeeka– Kiboga – Hoima	220	150	2	300	Steel tower	2039/40	
220kV Transmission line from 220/132kV Mbarara SS to 400/220kV Mbarara SS	220	5.5	2	11	Steel tower	2039/40	
400kV New Mbarara – UG/RW Border	400	70	2	140	Steel tower	2039/40	
Total		4262.00		8128.70			



# **A2. UETCL SUBSTATION TRANSFORMATION CAPACITY AND REACTIVE COMPENSATION**

A.2.1. EXISTING SUBSTATION TRANSFORMATION CAPACITY

SUBSTATION	TRANSFORMER	MAKE/TYPE	DATE	YEAR OF MANUFACTURE	Min MVA	Max MVA	VOLTAGE RATIO (KV)	NOMINAL TAP	IMPEDANCE VOLTAGE AT NOMINAL TAP	NOOF TAPS	CONNECTION SYMBOL	EARTHING RESISTANCE	Load loss	No-load loss	Exciting Current
<b>CENTRAL REGION</b>															
KAWANDA	Transformer 4	Shandong Taikai		2018	250	250	220/132/33	9	0.155	17	YNd11		474.5	56.2	0.03
KAWANDA	Transformer 5		28th Nov	2021	651	651	400/220								
KAWANDA	Transformer 6		28th Nov	2021	651	651	400/220								
SPARES (KAWA-NDA)	Spare TX1			2018	0	0	220/132								
SPARES (KAWA-NDA)	Spare TX2			2018	250	250	220/132								
SPARES (KAWA-NDA)	Spare TX3			2018	250	250	220/132								
MUKONO	Transformer 1	QRE		2019	50	63	132/33	5	0.12	17	YNyn0d11		215.5	32	0.08
MUKONO	Transformer 2	QRE		2019	50	63	132/33	5	0.12	17	YNyn0d11		215.5	32	0.08
MUKONO	Transformer 3	QRE		2019	50	63	132/33	5	0.12	17	YNyn0d11		215.5	32	0.08
MUTUNDWE	Transformer 1	Elektro Putere		1991	32	40	132/33	5	0.136	17	YNyn0(d)				
MUTUNDWE	Transformer 2	ABB		1995	32	40	132/33	5	0.135	17	YNyn0				

SUBSTATION	TRANSFORMER	MAKE/TYPE	DATE	YEAR OF MANUFACTURE	Min MVA	Max MVA	VOLTAGE RATIO (KV)	NOMINAL TAP	IMPEDANCE VOLTAGE AT NOMINAL TAP	NOOF TAPS	CONNECTION SYMBOL	EARTHING RESISTANCE	Load loss	No-load loss	Exciting Current
MUTUNDWE	Transformer 3	ABB Powertech		2003	15	20	132/11	5	0.0964	17	YNyn0 (d)	7.94Ohms (25deg Celsius)			
MUTUNDWE	Transformer 4	ABB Powertech		2003	15	20	132/11	5	0.0954	17	YNyn0 (d)	7.94Ohms (25deg Celsius)			
NAMANVE	Transformer 1	Crompton Greaves		2007	32	40	132/33	5	0.1152	17	YNyn0d1				
NAMANVE	Transformer 2	Crompton Greaves		2007	32	40	132/33	5	0.1152	17	YNyn0d1				
NAMANVE	Transformer 3	Crompton Greaves		2008	32	40	132/33	5	0.1152	17	YNyn0d1				
NAMANVE SOUTH	Transformer 1	QRE		2017	50	63	132/33	5	0.12	17	YNyn0d11		219	312	0.08
NAMANVE SOUTH	Transformer 2	QRE		2017	50	63	132/33	5	0.12	17	YNyn0d11		219	312	0.08
NAMANVE SOUTH	Transformer 3	QRE		2017	50	63	132/33	5	0.12	17	YNyn0d11		219	312	0.08
QUEENSWAY	Transformer 1	Aichi Electric		2016	32	40	132/33	5	0.135	17	YNyn0d11		122	17	
QUEENSWAY	Transformer 2	Aichi Electric		2016	32	40	132/33	5	0.135	17	YNyn0d11		122	17	
QUEENSWAY	Transformer 3	Aichi Electric		2016	32	40	132/33	5	0.135	17	YNyn0d11		122	17	
KABULASOKE	Transformer 1	Technical Associates		2018	20	25	132/33	5	0.09782	17	YNyn0		69.5	14	
ENTEBBE	Transformer 1		Aug	2018	60	80	132/33								
ENTEBBE	Transformer 2		Aug	2018	60	80	132/33								

SUBSTATION	TRANSFORMER	MAKE/TYPE	DATE	YEAR OF MANUFACTURE	Min MVA	Max MVA	VOLTAGE RATIO (kV)	NOMINAL TAP	IMPEDANCE VOLTAGE AT NOMINAL TAP	NOOF TAPS	CONNECTION SYMBOL	EARTHING RESISTANCE	Load loss	No-load loss	Exciting Current	
LUZIRA	Transformer 1		Jan	2023	32	40	132/33									
LUZIRA	Transformer 2		Jan	2023	32	40	132/33									
LUZIRA	Transformer 3		Jan	2023	32	40	132/33									
LUGOGO	Transformer 1	ABB Kraft		1997	32	40	132/11	7	0.1021	17	YNyn0	21 Ohms				
LUGOGO	Transformer 6	ABB		1998	32	40	132/33	5	0.136	17	YNyn0					
LUGOGO	Transformer 3	ABB		1998	32	40	132/33	5	0.136	17	YNyn0					
LUGOGO	Transformer 5	Elektro Putere-Romania		1991	32	40	132/11	7	0.1078	17	YNyn0 (d)	21 Ohms				
KAMPALA NORTH	Transformer 3	ABB		2019	32	40	132/33				YNyn0d11					
KAMPALA NORTH	Transformer 5	EMCO Transformers		2006	32	40	132/11	7	0.09618	17	YNyn0 (d)		103.8	22.6	0.6	
KAMPALA NORTH	Transformer 6	EMCO Transformers		2006	32	40	132/11	7	0.0963	17	YNyn0 (d)		104	23	0.6	
KAMPALA NORTH	Transformer 2	Crompton Greaves		2011	32	40	132/33	5	0.134331	17	YNyn0d1					
KAPEEKA	Transformer 1	Peebles Hack-bridge		1936	32	40	132/33	9	0.12	17	YNyn0 (d)					
KAPEEKA	Transformer 2	Jiangsu Huapeng	09 Jul	2019	32	40	132/33	10	0.0905	19	YNyn0(d11)		137038	22741	0.09	
KAWAALA	Transformer no 5	Hawker Siddeley-Brush		1972	15	20	132/11	7	0.098	17	Yy0d1					

Substation	Transformer	Make/Type	Date	Year of Manufacture	Min MVA	Max MVA	Voltage Ratio (kV)	Nominal Tap	Impedance Voltage at Nominal Tap	Noof Taps	Connection Symbol	Earthing Resistance	Load loss	No-load loss	Exciting Current
KAWANDA	Transformer 1	Tobisha		2019	32	40	132/33	5	0.1417	17	YNyn0dll				
KAWANDA	Transformer 2	Crompton Greaves		2009	32	40	132/33	5	0.1417	17	YNyn0dll				
KAWANDA	Transformer 3	KONCAR	09 Jul	2019	32	40	132/33	9	0.1119	17	YNyn0dll		112.245	25.599	0.12
WESTERN REGION															
HOIMA	Transformer 1	Shandong Taikai		2018	32	40	132/33	5	0.136	17	YNyn0dll		10.121	14.3	
HOIMA	Transformer 2	Shandong Taikai		2018	32	40	132/33	5	0.136	17	YNyn0dll		10.109	13.3	
FORTPORTAL	Transformer 1	Crompton Greaves		2016	32	40	132/33	5	0.0944	21	YNyn0		69.5	14	
FORTPORTAL	Transformer 2				0	0									
KAHUNGYE/RUGONJO	Transformer 1	Jiangsu Huapeng		2010	20	20	132/33	9	0.0916	17	YNyn0+dll		35.557	15.745	0.09
KAHUNGYE/RUGONJO	Transformer 2	Jiangsu Huapeng		2010	20	20	132/33	9	0.0916	17	YNyn0+d12		35.567	15.755	0.09
MASAKA WEST	Transformer 1	Elektro Putere		1991	15	20	132/33	5	0.0944	17	YNyn (d)				
MASAKA WEST	Transformer 2	ABB		2007	20	20	132/33	5	0.0943	17	YNyn0+dll		69.29	16.84	
MASAKA WEST	Transformer 3	Shandong Taikai		2018	125	125	220/32	9	0.155	17	YNadll		267.7	38.2	0.05
MASAKA WEST	Transformer 4	Shandong Taikai		2018	125	125	220/32	9	0.155	17	YNadll		253.8	37.8	0.05

SUBSTATION	TRANSFORMER	MAKE/TYPE	DATE	YEAR OF MANUFACTURE	Min MVA	Max MVA	VOLTAGE RATIO (kV)	NOMINAL TAP	IMPEDANCE VOLTAGE AT NOMINAL TAP	NOOF TAPS	CONNECTION SYMBOL	EARTHING RESISTANCE	Load loss	No-load loss	Exciting Current
MBARARA NORTH	Transformer 1	Crompton Parkinson		1963	15	15	132/33	5	0.1012	17	YNynD11				
MBARARA NORTH	Transformer 2	Technical Associates	Jun	2025	32	40	132/33				YNynD11				
MBARARA NORTH	Transformer 2	ABB		2007	15	20	132/33	5	0.0945	17	YNynD+d		69.29	17.05	0.11
MBARARA SOUTH	Transformer 1	Crompton Greaves		2018	50.4	60	132/220	13	0.1245	25	YNynD11				
MBARARA SOUTH	Transformer 2			2018	250	250	220/132								
NKENDA	Transformer 1	Elektro Putere		1991	15	20	132/33	5	0.0944	17	YNyn (d)				
NKENDA	Transformer 2	EMCO India		2003	15	20	132/33	5	0.0977	17	YNy0(d)				
NKENDA	Transformer 2	Crompton Greaves		2016	32	40	132/33	9	9.782	21	YNyn0 (d)		69.5	14	
NKENDA	Transformer 3		Mar	2025	60	80	132/33				YNyn0 (d)				
NKONGE	Transformer 1	Pauwels Trafo		1993	10	10	132/33	5	0.905	17	YNyn0 (d)				
NKONGE	Transformer 2	Ferranti		1970	7.5	7.5	132/33								
MIRAMA	Transformer 1		21- Dec	2024	40	60	220/132/33								
KABALE	Transformer 1		Dec	2024	32	40	132/33								
KABALE	Transformer 2		Dec	2024	32	40	132/33								



Substation	Transformer	Make/Type	Date	Year of Manufacture	Min MVA	Max MVA	Voltage Ratio (kV)	Nominal Tap	Impedance Voltage at Nominal Tap	Noof Taps	Connection Symbol	Earthing Resistance	Load loss	No-load loss	Exciting Current
MUZIZI	Transformer 1		Jul	2024	15	20	132/33								
MUZIZI	Transformer 2		Jul	2024	15	20	132/33								
EASTERN REGION															
BUJAGAU	Transformer 1	EMCO		2016	250	250	220/132/33	9	0.1449	17	YNcOdII		485	44	
BUJAGAU	Transformer 2	EMCO		2016	250	250	220/132/33	9	0.1449	17	YNcOdII		484.9	43.8	
IGANGA	Transformer 1	QRE	Dec	2017	32	40	132/33	9	0.1172	17	YnynOdII		1412	23.3	0.06
IGANGA	Transformer 2	QRE	Dec	2017	32	40	132/33	9	0.1172	17	YnynOdI2		141.5	23.2	0.06
LUGAZI	Transformer 1	ABB		2007	14	14	66/11	5	0.09	17	DynII		48.15	11.3	0.12
LUGAZI	Transformer 2	ABB		2007	14	14	66/11	5	0.09	17	DynII		48.04	11.32	0.12
TORORO	Transformer 4	Crompton Greaves		2006	32	40	132/33	5	0.0944	17	YNynOdI0				
TORORO	Transformer 1	Hawker Siddeley Brush		1985	32	40	132/33	5	0.1	17	YNynOdII				
TORORO	Transformer 3	Zest Weng		2019	60	80	132/33	5	0.0961	17	YNynOdII		245	52	0.3
TORORO	Transformer 2	Hawker Siddeley Brush		1988	15	20	132/33	5	0.1018	17	YNyn0				
NORTHERN REGION															

SUBSTATION	TRANSFORMER	MAKE/TYPE	DATE	YEAR OF MANUFACTURE	Min MVA	Max MVA	VOLTAGE RATIO (kV)	NOMINAL TAP	IMPEDANCE VOLTAGE AT NOMINAL TAP	NOOF TAPS	CONNECTION SYMBOL	EARTHING RESISTANCE	Load loss	No-load loss	Exciting Current
LIRA	Transformer 1	Hackbridge Hewitic-Easun		1974	15	20	132/33	9	0.0982	17	YNyn0dll			17.05	
LIRA	Transformer 2	ABB		2007	15	20	132/33	5	0.0939	17	YNyn0dll		69.42	16.84	0.11
IMBALE (MOBILE SUBSTATION)	Transformer 1	SIEMENS	25 Nov	2020	50	50	132/33/11	5	0.1554	17	YNyn0				
OPUYO	Transformer 1	KONCAR	09 Jul	2019	32	40	132/33	9	0.112	17	YNyn0(dll)		106.395	29.782	0.12
OPUYO	Transformer 2	KONCAR	09 Jul	2019	0	0	132/33	9	0.1119	17	YNyn0dll		112.245	25.599	0.12
MOROTO	Transformer 1	Jiangsu Huapeng	09 Jul	2019	32	40	132/33	10	0.0905	19	YNyn0(dll)		137.038	22.741	0.09
MOROTO	Transformer 2	Jiangsu Huapeng	09 Jul	2019	0	0	132/33	10	0.0905	19	YNyn0(dll)		137.038	22.741	0.09
KARUMA	Transformer 1		28- Nov	2021	252	315	400/32								
KARUMA	Transformer 2		28- Nov	2021	252	315	400/32								
KARUMA	Transformer 3		27 Jun	2022	20	20	132/33								
KARUMA	Transformer 4		27 Jun	2022	20	20	132/33								
OLWIYO	Transformer 1		27 Jun	2022	15	20	132/33								
OLWIYO	Transformer 2		27 Jun	2022	15	20	132/33								
AGAGO	Transformer 1		18 Nov	2023	32	40	132/33								

Substation	Transformer	Make/Type	Date	Year of Manufacture	Min MVA	Max MVA	Voltage Ratio (kV)	Nominal Tap	Impedance Voltage at Nominal Tap	Noof Taps	Connection Symbol	Earthing Resistance	Load loss	No-load loss	Exciting Current	
AGAGO	Transformer 2		18 Nov	2023	32	40	132/33									
KOLE	Transformer 1		17 Nov	2023	32	40	132/33									
KOLE	Transformer 2		17 Nov	2023	32	40	132/33									
GULU	Transformer 1		17 Nov	2023	32	40	132/33									
GULU	Transformer 2		17 Nov	2023	32	40	132/33									
NEBBI	Transformer 1		31 Jul	2024	32	40	132/33									
NEBBI	Transformer 2		31 Jul	2024	32	40	132/33									
ARUA	Transformer 1		31 Jul	2024	32	40	132/33									
ARUA	Transformer 2		31 Jul	2024	32	40	132/33									
					TOTAL MVA	7145.5										

## A.2.2. PLANNED SUBSTATION TRANSFORMATION CAPACITY

Period:		2025-2040					
SUBSTATION AND SWITCHING STATIONS	TRANSFORMER	EXPECTED COMMISSIONING YEAR	MIN MVA	MAX MVA	VOLTAGE RATIO		
<b>CENTRAL REGION</b>							
MUTUNDWE UPGRADE							
	Transformer 1	2027/28	32	40	132/11kV		
	Transformer 2	2027/28	32	40	132/11kV		
Moved from Kawanda	Transformer 3	2027/28	32	40	132/33kV		
	Transformer 4	2034/35	60	80	132/33kV		
	Transformer 5	2034/35	60	80	132/33kV		
LUGOGO UPGRADE							
	Transformer 1	2034/35	60	80	132/11kV		
	Transformer 2	2034/35	60	80	132/11kV		
KASANA							
	Transformer 1	2025/26	15	20	132/33kV		
Upgrade	Transformer 2	2026/27	32	40	132/33kV		
Upgrade	Transformer 3	2029/30	32	40	132/33kV		
Upgrade	Transformer 4	2029/30	32	40	132/33kV		
MATUGGA							
		2025/26			132kV		
KAPEKA							
Upgrade	Transformer 1	2027/28	32	40	132/33kV		
	Transformer 3	2027/28	60	80	220/132kV		
	Transformer 4	2027/28	60	80	220/132kV		
	Transformer 5	2027/28	50	63	132/33kV		
	Transformer 6	2027/28	50	63	132/33kV		
	Transformer 7	2027/28	50	63	132/33kV		
KAWANDA							

Period:		2025–2040					
SUBSTATION AND SWITCHING STATIONS	TRANSFORMER	EXPECTED COMMISSIONING YEAR	MIN MVA	MAX MVA	VOLTAGE RATIO		
Upgrade	Transformer 3	2027/28	60	80	132/33kV		
Upgrade	Transformer 4	2027/28	60	80	132/33kV		
WOBULENZI							
	Transformer 1	2028/29	250	250	400/220kV		
	Transformer 2	2028/29	250	250	400/220kV		
NAKASONGOLA							
	Transformer 1	2029/30	32	40	132/33kV		
	Transformer 2	2029/30	32	40	132/33kV		
NEW MUKONO							
	Transformer 1	2025/26	200	200	220/132kV		
	Transformer 2	2025/26	200	200	220/132kV		
	Transformer 3	2025/26	200	200	220/132kV		
BULOBA							
	Transformer 1	2025/26	125	125	220/132kV		
	Transformer 2	2025/26	125	125	220/132kV		
	Transformer 3	2025/26	32	40	132/33kV		
	Transformer 4	2025/26	32	40	132/33kV		
KAWAALA UPGRADE							
	Transformer 1	2025/26	32	40	132/33kV		
	Transformer 2	2025/26	32	40	132/33kV		
	Transformer 3	2025/26	32	40	132/33kV		
	Transformer 4	2025/26	15	20	132/11kV		
MOBILE SUBSTATION (KMAIP)							
	Transformer 1	2025/26	15	20	132/33/11kV		
GABA							
	Transformer 1	2029/30	32	40	132/33kV		
	Transformer 2	2029/30	32	40	132/33kV		

Period:		2025-2040					
SUBSTATION AND SWITCHING STATIONS	TRANSFORMER	EXPECTED COMMISSIONING YEAR	MIN MVA	MAX MVA	VOLTAGE RATIO		
KABULASOKE							
Upgrade	Transformer 1	2028/29	32	40	132/33kV		
Upgrade	Transformer 2	2028/29	32	40	132/33kV		
KAWEWETA							
	Transformer 1	2029/30	32	40	132/33kV		
	Transformer 2	2029/30	32	40	132/33kV		
NTINDA							
	Transformer 1	2029/30	32	40	132/33kV		
	Transformer 2	2029/30	32	40	132/33kV		
LUGAZI							
	Transformer 1	2034/35	32	40	132/33kV		
	Transformer 2	2034/35	32	40	132/33kV		
BUSIIKA							
	Transformer 1	2030/31	60	80	220/33kV		
	Transformer 2	2030/31	60	80	220/33kV		
WESTERN REGION							
MASAKA WEST							
Upgrade	Transformer 1	2028/29	60	80	132/33kV		
Upgrade	Transformer 2	2028/29	60	80	132/33kV		
NEW MASAKA							
	Transformer 1	2028/29	250	250	400/220/33kV		
	Transformer 2	2028/29	250	250	400/220/33kV		
MBARARA SOUTH UPGRADE							
Upgrade	Transformer 1	2027/28	125	125	220/132kV		
upgrade	Transformer 2	2027/28	125	125	220/132kV		
NEW MBARARA							
	Transformer 1	2031/32	250	250	400/220/33kV		

Period:		2025–2040					
SUBSTATION AND SWITCHING STATIONS	TRANSFORMER	EXPECTED COMMISSIONING YEAR	MIN MVA	MAX MVA	VOLTAGE RATIO		
MBARARA NORTH UPGRADE	Transformer 2	2031/32	250	250	400/220/33kV		
AKAGETI	Transformer 2	2027/28	32	40	132/33kV		
FORT PORTAL	Transformer 1	2031/32	32	40	132/33kV		
	Transformer 2	2031/32	32	40	132/33kV		
Upgrade	Transformer 1	2029/30	60	80	220/132kV		
Upgrade	Transformer 2	2029/30	60	80	220/132kV		
MIRAMA							
Relocation from Mbarara South	Transformer 1	2027/28	0	0	220/132kV		
Relocation from Nkenda	Transformer 2	2026/27	0	0	132/33kV		
Relocation from Mbarara North	Transformer 3	2026/27	0	0	132/33kV		
	Transformer 4	2027/28	32	40	132/33kV		
HOIMA							
Upgrade	Transformer 1	2027/28	60	80	220/132/33kV		
Upgrade	Transformer 2	2027/28	60	80	220/132/33kV		
NKENDA							
Upgrade	Transformer 2	2027/28	60	80	132/33kV		
Upgrade	Transformer 4	2029/30	250	250	220/132/33kV		
Upgrade	Transformer 5	2029/30	250	250	220/132/33kV		
NSONGEZI							
	Transformer 1	2028/29	32	40	132/33kV		
	Transformer 2	2028/29	32	40	132/33kV		
KAFU							
	Transformer 1	2027/28	250	250	400/220/33kV		
	Transformer 2	2027/28	250	250	400/220/33kV		

Period:		2025-2040						
SUBSTATION AND SWITCHING STATIONS	TRANSFORMER	EXPECTED COMMISSIONING YEAR	MIN MVA	MAX MVA	VOLTAGE RATIO			
KINYARA	Transformer 3	2027/28	32	40	220/33kV			
	Transformer 4	2027/28	32	40	220/33kV			
KABAALE	Transformer 1	2027/28	60	80	220/33kV			
	Transformer 2	2027/28	60	80	220/33kV			
LYANDA/MUZIZI	Transformer 1	2029/30	250	250	220/132kV			
	Transformer 2	2029/30	250	250	220/132kV			
	Transformer 3	2025/26	60	80	132/33kV			
	Transformer 4	2025/26	60	80	132/33kV			
	Transformer 5	2025/26	60	80	132/33kV			
NKONGE	Transformer 3	2029/30	60	80	220/132/33kV			
	Transformer 4	2029/30	60	80	220/132/33kV			
	Transformer 5	2029/30	32	40	132/33kV			
	Transformer 1	2028/29	32	40	132/33kV			
	Transformer 2	2028/29	32	40	132/33kV			
MUBENDE	Transformer 1	2034/35	32	40	132/33kV			
	Transformer 2	2034/35	32	40	132/33kV			
RAKAI	Transformer 1	2034/35	60	80	132/33kV			
	Transformer 2	2034/35	60	80	132/33kV			
ISHAKA INDUSTRIAL PARK	Transformer 1	2032/33	60	80	132/33kV			
	Transformer 2	2032/33	60	80	132/33kV			

Period:		2025–2040					
SUBSTATION AND SWITCHING STATIONS	TRANSFORMER	EXPECTED COMMISSIONING YEAR	MIN MVA	MAX MVA	VOLTAGE RATIO		
KIBOGA	Transformer 1	2034/35	32	40	132/33kV		
	Transformer 2	2034/35	32	40	132/33kV		
	Transformer 3	2039/40	125	125	220/132kV		
	Transformer 4	2039/40	125	125	220/132kV		
KASESE INDUSTRIAL PARK	Transformer 1	2032/33	60	80	132/33kV		
	Transformer 2	2032/33	60	80	132/33kV		
	Transformer 3	2031/32	250	250	400/220kV		
	Transformer 4	2031/32	250	250	400/220kV		
NYAKAGYEME	Transformer 1	2028/29	32	40	132/33kV		
	Transformer 2	2028/29	32	40	132/33kV		
KISORO	Transformer 1	2037/38	32	40	132/33kV		
	Transformer 2	2037/38	32	40	132/33kV		
EASTERN REGION							
BUJAGALI	Transformer 3	2025/26	250	250	220/132/33kV		
MASESE	Transformer 1	2030/31	60	80	132/33kV		
	Transformer 2	2030/31	60	80	132/33kV		
JINJA INDUSTRIAL PARK	Transformer 1	2032/33	60	80	220/33kV		
	Transformer 2	2032/33	60	80	220/33kV		
NJERU INDUSTRIAL PARK	Transformer 1	2027/28	32	40	132/33kV		

Period:		2025-2040					
SUBSTATION AND SWITCHING STATIONS	TRANSFORMER	EXPECTED COMMISSIONING YEAR	MIN MVA	MAX MVA	VOLTAGE RATIO		
Upgrade	Transformer 2	2030/31	60	80	132/33kV		
Upgrade	Transformer 3	2030/31	60	80	132/33kV		
BUYENDE SWITCHING STATION							
		2032/33			400kV		
TORORO							
Upgrade	Transformer 1	2027/28	60	80	132/33kV		
Upgrade	Transformer 2	2031/32	60	80	132/33kV		
Upgrade	Transformer 3	2027/28	125	125	220/132kV		
Upgrade	Transformer 4	2027/28	125	125	220/132kV		
TORORO BORDER							
	Transformer 1	2029/30	250	250	400/220/33kV		
	Transformer 2	2029/30	250	250	400/220/33kV		
KWEEN							
	Transformer 1	2029/30	50	60	132/33kV		
	Transformer 2	2029/30	50	60	132/33kV		
MBALE INDUSTRIAL PARK							
	Transformer 1	2027/28	60	80	132/33kV		
	Transformer 2	2027/28	60	80	132/33kV		
	Transformer 3	2027/28	60	80	132/33kV		
MBALE MOBILE SS							
	Transformer 2	2026/27	50	50	132/33kV		
MBALE							
	Transformer 1	2029/30	60	80	132/33kV		
BULAMBULI							
	Transformer 1	2029/30	60	80	132/33kV		
	Transformer 2	2029/30	60	80	132/33kV		
SUKULU PHOSPHATE							

Period:		2025–2040					
SUBSTATION AND SWITCHING STATIONS	TRANSFORMER	EXPECTED COMMISSIONING YEAR	MIN MVA	MAX MVA	VOLTAGE RATIO		
OSUKULU	Transformer 1	2025/26	60	80	132/33kV		
	Transformer 2	2025/26	60	80	132/33kV		
KATIKEKILE	Transformer 3	2027/28	60	80	220/33kV		
	Transformer 4	2027/28	60	80	220/33kV		
	Transformer 5	2027/28	60	80	220/33kV		
NAGONGERA	Transformer 1	2027/28	32	40	132/33kV		
	Transformer 1	2027/28	32	40	132/33kV		
BUWOOLA	Transformer 1	2028/29	32	40	132/33kV		
	Transformer 2	2028/29	32	40	132/33kV		
NORTHERN REGION	Transformer 1	2028/29	32	40	132/33kV		
	Transformer 2	2028/29	32	40	132/33kV		
OLWIYO	Transformer 1	2028/29	250	250	400/132kV		
	Transformer 2	2028/29	250	250	400/132kV		
KITGUM	Transformer 1	2029/30	32	40	132/33kV		
	Transformer 2	2029/30	32	40	132/33kV		
ADJUMANI	Transformer 1	2034/35	32	40	132/33kV		
	Transformer 2	2034/35	32	40	132/33kV		
	Transformer 1	2029/30	32	40	132/33kV		

Period:		2025-2040					
SUBSTATION AND SWITCHING STATIONS	TRANSFORMER	EXPECTED COMMISSIONING YEAR	MIN MVA	MAX MVA	VOLTAGE RATIO		
BIBIA	Transformer 2	2029/30	32	40	132/33kV		
	Transformer 1	2028/29	100	100	400/132kV		
	Transformer 1	2028/29	100	100	400/132kV		
	Transformer 2	2028/29	32	40	132/33kV		
	Transformer 3	2028/29	32	40	132/33kV		
ARU							
	Transformer 1	2030/31	32	40	132/33kV		
	Transformer 2	2030/31	32	40	132/33kV		
NILE HPP							
	N/A	2030/31	N/A	N/A	400kV		
T-AYAGO							
	N/A	2031/32	N/A	N/A	400kV		
LIRA							
Upgrade	Transformer 1	2034/35	32	40	132/33kV		
Upgrade	Transformer 2	2034/35	32	40	132/33kV		
<b>TOTAL MVA</b>				<b>13,369.00</b>			

## A.2.3. EXISTING REACTORS ON THE UETCL NETWORK

Substation	Reactor	Make	Connection Type	Year Of Manufacture	Rating (Mvar)	Rated Voltage (kV)	Phs Reactance (Ohms/Phase)	Total Loss (kW)
<b>CENTRAL REGION</b>								
LUGOGO								
	Reactor 1	ABB	Series reactor	2009	40	33	0.533 pu	69.205
	Reactor 5	ABB	Series reactor	2009	40	33	0.530 pu	70.891
KAMPALA NORTH								
	Reactor 5	ABB	Series reactor	2017	40	33	0.535 pu	69.205
	Reactor 6	ABB	Series reactor	2009	40	33	0.534 pu	70.891
KAWANDA								
	Reactor 4	Beijing Power Eqpt. Grp. Co. Ltd.	Shunt reactor (YN0)	2015	15	33	72.6	
KAWANDA								
	Reactor 1	Shandong Takai	Shunt reactor (YN0)	2019	35	400	5063.2	33.2
	Reactor 2	Shandong Takai	Shunt reactor (YN0)	2019	35	400	5044.4	36.1
<b>WESTERN REGION</b>								
MASAKA WEST								
	Reactor 3	Beijing Power Eqpt. Grp. Co. Ltd.	Shunt reactor (YN0)	2015	15	33	72.6	
	Reactor 4	Beijing Power Eqpt. Grp. Co. Ltd.	Shunt reactor (YN0)	2015	15	33	72.6	
MBARARA NORTH								
	Reactor 1	Beijing Power Eqpt. Grp. Co. Ltd.	Shunt reactor (YN0)	2015	15	33	72.6	

Substation	Reactor	Make	Connection Type	Year Of Manufacture	Rating (Mvar)	Rated Voltage (kV)	Phs Reactance (Ohms/Phase)	Total Loss (kW)
MBARARA SOUTH	Reactor 2	Beijing Power Eqpt. Grp. Co. Ltd.	Shunt reactor (YN0)	2015	15	33	72.6	
	Reactor 1	CG Power and Ind. Solns. Ltd.	Shunt reactor (YN)	2015	10	220	4702.86	
	Reactor		Shunt reactor (YN)	2023	10	220		
MIRAMA								
NKENDA								
	Reactor 1	CG Power and Ind. Solns. Ltd.	Shunt reactor (YN0)	2014	15	132	1220.67	
<b>NORTHERN REGION</b>								
OPUYO								
KARUMA	Reactor 1	CG Power and Ind. Solns. Ltd.	Shunt reactor (YN0)	2014	15	132	1220.67	
	Reactor 1	Shandong Takai	Shunt reactor (YN0)	2019	40	400		
TOTAL					395			



## A.2.4. PLANNED REACTORS ON THE UETCL NETWORK

SUBSTATION	REACTOR	MAKE	CONNECTION TYPE	EXPECTED YEAR	MVAR RATING	RATED VOLT-AGE (kV)	PHS REACTANCE (Ohms/phase)	TOTAL LOSS (kW)
NORTHERN REGION								
ARUA								
	Reactor 1			2024/25	20	132		
KARUMA								
	Reactor 1			2029/30	150	400		
	Reactor 2			2029/30	150	400		
WESTERN REGION								
FORTPORTAL								
	Reactor 1			2025/26	40	132		
HOIMA								
				2027/28	20	220		
KINYARA								
				2027/28	40	220		
NKENDA								
	Reactor 1			2029/30	165	220		
	Reactor 12			2029/30	60	220		
KASESE								
	Reactor 1			2034/35	100	400		
KABALE								

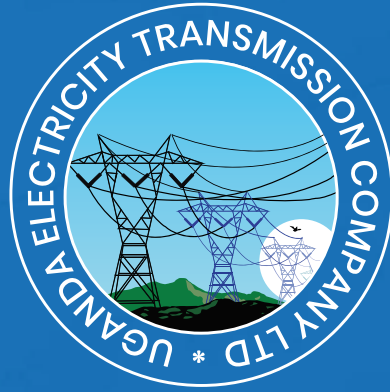
SUBSTATION	REACTOR	MAKE	CONNECTION TYPE	EXPECTED YEAR	MVAR RATING	RATED VOLTAGE (kV)	PHS REACTANCE (Ohms/phase)	TOTAL LOSS (kW)
EASTERN REGION	Reactor 1			2027/28	20	132		
TORORO BORDER								
	Reactor 1			2029/30	150	400		
	Reactor 2			2029/30	150	400		
CENTRAL REGION								
KAFU	Reactor 1			2027/28	20	220		
	Reactor 2			2027/28	40	400		
<b>TOTAL</b>					<b>1125</b>			

## A.2.5. EXISTING CAPACITOR BANKS ON THE UETCL NETWORK

SUBSTATION	CAPACITOR BANK	BANK SIZE (MVAR)	RATED VOLTAGE (kV)	YEAR OF INSTALLATION
<b>CENTRAL REGION</b>				
LUGOGO	CAP BANK 1	10	33	1999/2000
KAPEEKA	CAP BANK 1	2	33	2018/19
<b>MUKONO NORTH</b>				
	CAP BANK 1	12.144	33	2018/19
	CAP BANK 2	12.144	33	2018/19
	CAP BANK 3	12.144	33	2018/19
<b>MUTLUNDWE</b>				
	CAP BANK 1	10	33	2004/5
<b>NAMANVE</b>				
	CAP BANK 1	16	33	2010/11
	CAP BANK 2	16	33	2010/11
	CAP BANK 3	16	33	2010/11
<b>NAMANVE SOUTH</b>				
	CAP BANK 1	12.144	33	2018/19
	CAP BANK 2	12.144	33	2018/19
	CAP BANK 3	12.144	33	2018/19
<b>WESTERN REGION</b>				
<b>MASAKA WEST</b>				
	CAP BANK 1	10	33	2008/9
<b>MBARARA NORTH</b>				
	CAP BANK 1	10	33	2008/9
<b>NKENDA</b>				
	CAP BANK 1	10	33	2004/5
<b>EASTERN REGION</b>				
<b>IGANGA</b>				
	CAP BANK 1	16.5	33	2018/19
	CAP BANK 2	16.5	33	2018/19
<b>TOTAL</b>		<b>205.864</b>		

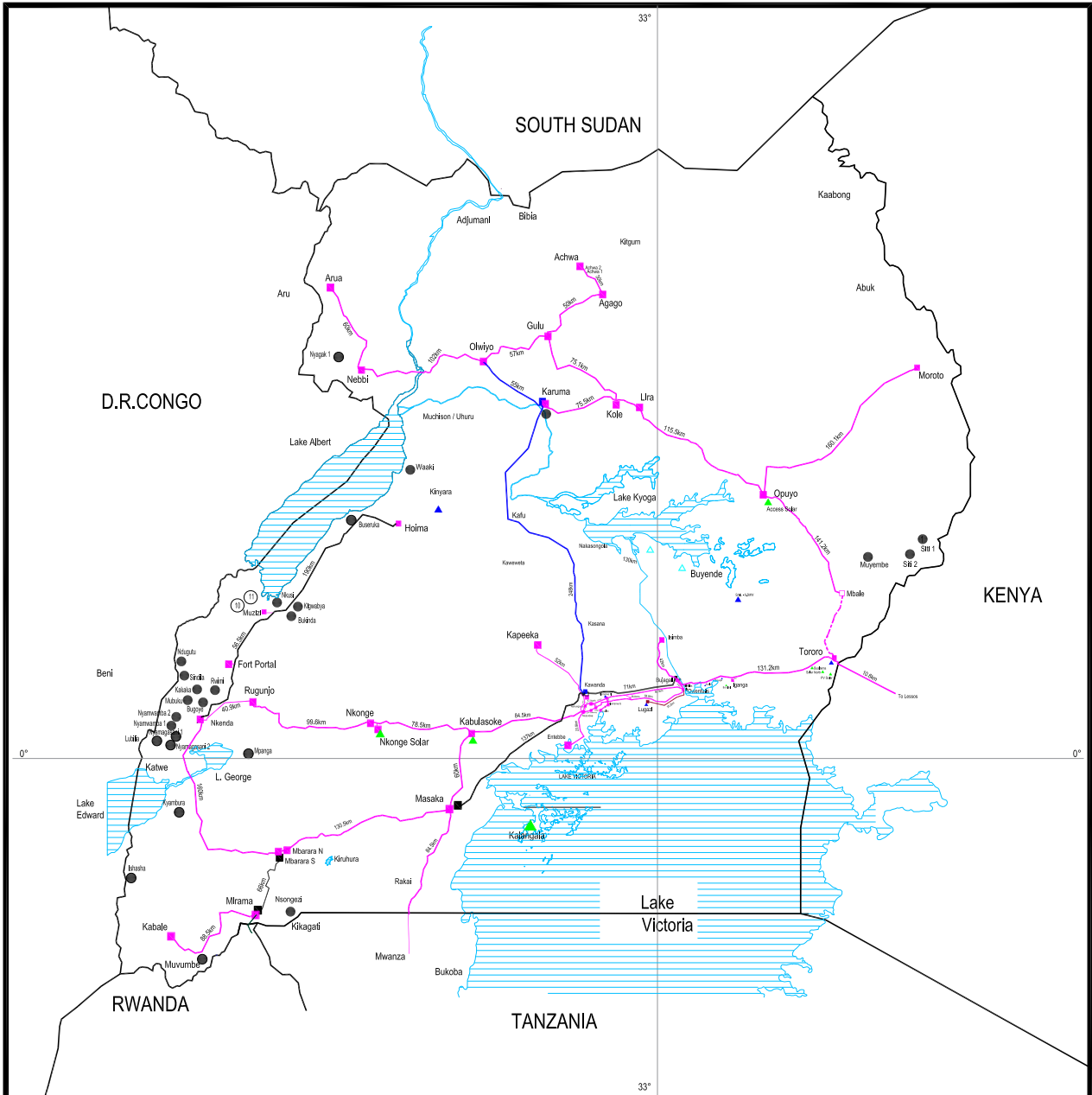
**A.2.6. PLANNED CAPACITOR BANKS ON THE UETCL NETWORK**

SUBSTATION	CAPACITOR BANK	BANK SIZE (MVAR)	RATED VOLTAGE	YEAR OF COMMISSIONING
CENTRAL REGION				
MUTUNDWE				
	CAP BANK 1	15	11	2027/28
	CAP BANK 1	150	132	2024/25
KAWANDA				
	CAP BANK 1	150	132	2029/30
EASTERN REGION				
LUGAZI				
	CAP BANK 1	20	11	2027/28
SUKULU				
	CAP BANK 1	20	33	2024/25
MPALE				
	CAP BANK 1	140	132	2039/40
<b>TOTAL</b>		<b>495</b>		



# A3. MAPS

A.3.1. UGANDA POWER SYSTEM GRID 2024/25




Legend

- 400kV Transmission Line
- 220kV Transmission Line
- 132kV Transmission Line
- 66kV Transmission Line
- 400kV Substation
- 220kV Substation
- 132kV Substation
- 66kV Substation
- Generating Station - Hydro
- ▲ Generating Station - Bagasse/Diesel/Thermal
- ▲ Generating Station - Solar

T1	GDP Update	April 25	GDP
T2	Inclusion of Commissioned Mbarara-Kabale 132kV TL and Mbarara 132 / 33kV Substation	Feb 25	
T3	Inclusion of Mayuge Solar Plant	Sept 24	
T4	Inclusion of Commissioned Mbarara Solar 132 / 33kV Substation	Sept 24	
T5	Inclusion of Commissioned Mbarara 132 / 33kV Substation	Sept 24	
T6	Inclusion of Commissioned Olinyi - Nebbi - Anza 132kV TL, Nebbi & Anza 132 / 33kV Substations	Aug 24	
T7	Inclusion of Commissioned Gulu/Karamoja 132kV TL	May 24	
T8	Inclusion of Commissioned Gulu/Karamoja 132kV TL	Nov 23	
T9	Inclusion of Commissioned Kaka - Gulu 132kV TL, Kaka & Gulu 132 / 33kV Substations	Nov 23	
T10	Inclusion of Commissioned Mbarara-Etetebe 132kV TL	Nov 23	
T11	Inclusion of Commissioned Mbarara-Etetebe 132 / 33kV Substation	Nov 23	

NO.	REVISION	DATE	ORIGIN



**UGANDA ELECTRICITY TRANSMISSION COMPANY LIMITED**

Plot No. 10  
Nakasongola Road  
P.O. Box 7025, Nakasongola-Uganda

Tel: +256 41-4233 4334  
Fax: +256 41-3441 789  
Email: [enq@uetcl.com](mailto:enq@uetcl.com)  
Web: [www.uetcl.com](http://www.uetcl.com)

DATE: April 2025

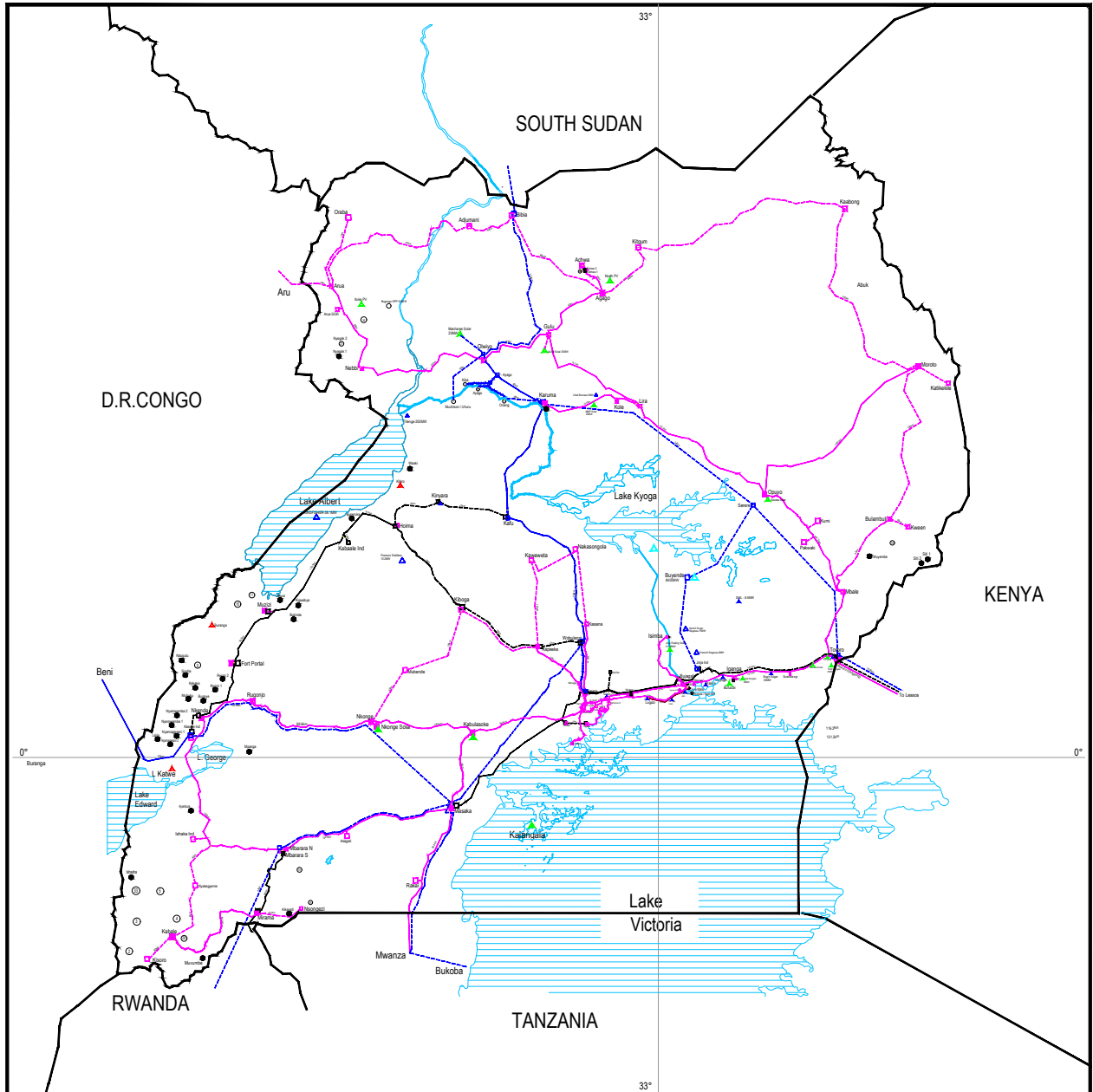
TITLE: UGANDA TRANSMISSION GRID MAP

NDP IV CASE (2030)

SCALE: NTS

DRAWING NO.:

A.3.2. UGANDA POWER SYSTEM PRESENT AND FUTURE NETWORKWORK



**Legend**

- - - - - Proposed 400kV Underground Cable
- - - - - Proposed 400kV Transmission Line
- — — — — Existing 400kV Transmission Line
- - - - - Proposed 220kV Transmission Line
- — — — — Existing 220kV (132kV) Transmission Line
- - - - - Proposed 132kV Transmission Line
- — — — — Existing 132kV Transmission Line
- - - - - Proposed 66kV Transmission Line
- — — — — Existing 66kV Transmission Line

- Proposed 400kV Substation
- Existing 400kV Substation
- Proposed 220kV Substation
- Existing 220kV Substation
- Proposed 132kV Substation
- Existing 132kV Substation
- Existing 66kV Substation
- Existing 66kV Substation

- Generating Station – Hydro
- ▲ Existing Generating Station – Bogasse / Thermal
- ▲ Proposed Generating Station – Bogasse / Thermal
- ▲ Proposed Generating Station - Solar
- ▲ Existing Generating Station - Solar
- ▲ Proposed Nuclear Power Plant
- ▲ Proposed Generating Station- Geothermal
- ▲ Proposed Generating Station- Wind
- Proposed Generating Station – Mini Hydro

2 Nyamabuye	21 Nyagak 3
3 Haisero	27 Achwa 3 / Agago
4 Kisisi	28 Kabale Peat
5 Nengo Bridge	33 Mitaano
9 Ngete	34 Okollo
10 Sogahi	
11 Muzizi	
14 Ruizi	
15 Sipi Falls	

- Proposed Generating Station – Large Hydro
- A Murchison / Uhuru D Oriang
- B Kiba
- C Ayago

13	Inclusion of Busika Substation and Butambuli Solar plant	Mar 25	GP/
12	Inclusion of Committed Mbarara Kibira 132kV TL and Mbarara 132 / 33kV Substation	Feb 25	
11	Inclusion of Mayuge Solar Plant	Sept 24	
10	Inclusion of Proposed Kihura and Byende Nuclear Power Plants	Sept 24	
10P	Inclusion of Committed Nange Scafe 132 / 33kV Substation	Sept 24	
08	Inclusion of Committed Muzizi 132 / 33kV Substation	Sept 24	
07	Inclusion of Committed Owye - Nebbi - Arua 120kV TL, Nebbi & Arua 132 / 33kV Substations	Aug 24	
06	Inclusion of Committed Gulu Olweya 120kV TL	May 24	
05	Inclusion of Committed Gulu Agago 120kV TL	Nov 23	
04	Inclusion of Committed Kiba - Gulu 120kV TL, Kiba & Gulu 132 / 33kV Substations	Nov 23	
03	Inclusion of Proposed Kibira Wapakayeme 120kV TL, Wapakayeme 132 / 33kV Substation	Nov 23	GP/
02	Inclusion of Committed Mutundwe Entebbe 120kV TL	Nov 23	
01	Inclusion of Committed Mutundwe Substation Ent & Entebbe 132 / 33kV Substation	Nov 23	
NO.	REVISION	DATE	DRGN

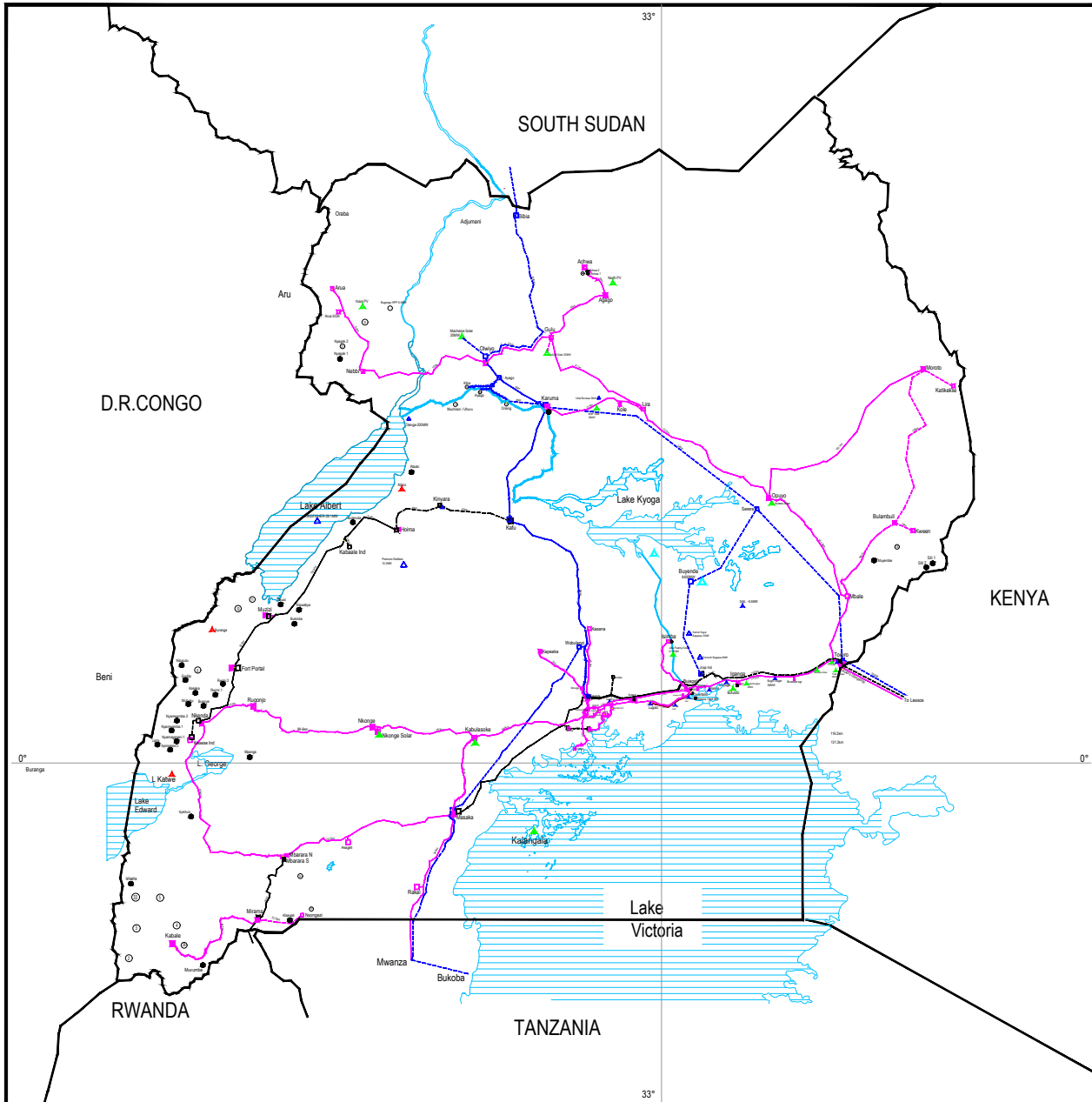
**UGANDA ELECTRICITY TRANSMISSION COMPANY LIMITED**

Plot No. 10  
Hannington Road  
P.O. Box 1026, Kampala Uganda

Tel: +256 41 4233 4234  
Fax: +256 41 344 788  
Email: name@uetcl.com  
Website: www.uetcl.com

DATE	Mar 2025	TITLE	
DRAWN	rbm	<b>UGANDA TRANSMISSION GRID MAP</b> Business As Usual 2040 Scenario	
CHECKED	AA		
APPROV.	D.E.O		
SCALE	NTS	DRAWING NO.	
ORIGINAL			


A.3.3. NATIONAL DEVELOPMENT PLAN SCENARIO (NDP)



Legend

- Proposed 400kV Underground Cable
- Proposed 400kV Transmission Line
- Existing 400kV Transmission Line
- Proposed 220kV Transmission Line
- Existing 220kV (132kV) Transmission Line
- Proposed 132kV Transmission Line
- Existing 132kV Transmission Line
- Proposed 66kV Transmission Line
- Existing 66kV Transmission Line
- Proposed 400kV Substation
- Existing 400kV Substation
- Proposed 220kV Substation
- Existing 220kV Substation
- Proposed 132kV Substation
- Existing 132kV Substation
- Existing 66kV Substation
- Existing 66kV Substation
- Generating Station – Hydro
- Existing Generating Station – Bagasse / Thermal
- Proposed Generating Station – Bagasse / Thermal
- Proposed Generating Station - Solar
- Existing Generating Station - Solar
- Proposed Nuclear Power Plant
- Proposed Generating Station-Geothermal
- Proposed Generating Station- Wind
- Proposed Generating Station – Mini Hydro
- 2 Nyamabuye
- 3 Haisero
- 4 Kisisi
- 5 Nengo Bridge
- 9 Ngete
- 10 Sogahi
- 11 Muzizi
- 14 Ruizi
- 15 Sipi Falls
- Proposed Generating Station – Large Hydro
- A Murchison / Uhuru D Oriang
- B Kiba
- C Ayago
- 19 Nsongezi
- 21 Nyagak 3
- 27 Achwa 3 / Agago
- 28 Kabale Peat
- 33 Mitaoono
- 34 Okollo

13	GDP updates	Mar 23	GDP
12	Inclusion of Commissioned Mirama Kabale 132kV TL and Mirama 132 / 33kV Substation	Feb 25	
11	Inclusion of Mnyaga Solar Plant	Sept 24	
10	Inclusion of Proposed Kirura and Buyende Nuclear Power Plants	Sept 24	
09	Inclusion of Commissioned Nungwa Solar 132 / 33kV Substation	Sept 24	
08	Inclusion of Commissioned Mutumba 132 / 33kV Substation	Sept 24	
07	Inclusion of Commissioned Olywo - Nebbi - Arua 132kV TL, Nebbi & Arua 132 / 33kV Substations	Aug 24	
06	Inclusion of Commissioned Gulu Olywo 132kV TL	May 24	
05	Inclusion of Commissioned Gulu Agago 132kV TL	Nov 23	
04	Inclusion of Commissioned Kile - Gulu 132kV TL, Kile & Gulu 132 / 33kV Substations	Nov 23	
03	Inclusion of Proposed Kabale Nyakagayeme 132kV TL, Nyakagayeme 132 / 33kV Substation	Nov 23	GDP
02	Inclusion of Commissioned Mutumba Entebbe 132kV TL	Nov 23	
01	Inclusion of Commissioned Mutumba Substation Ent & Entebbe 132 / 33kV Substation	Nov 23	



**UGANDA ELECTRICITY TRANSMISSION COMPANY LIMITED**

Plot No. 10  
Harrington Road  
P.O. Box 1925, Kampala-Uganda

Tel: +256 41 4333 4334  
Fax: +256 41 3441 793  
Email: uetcl@uetcl.com  
Website: www.uetcl.com

DATE: Mar 2025

TITLE: UGANDA TRANSMISSION GRID MAP  
NDP IV (2030) Scenario

SCALE: NTS

DATE: Mar 2025

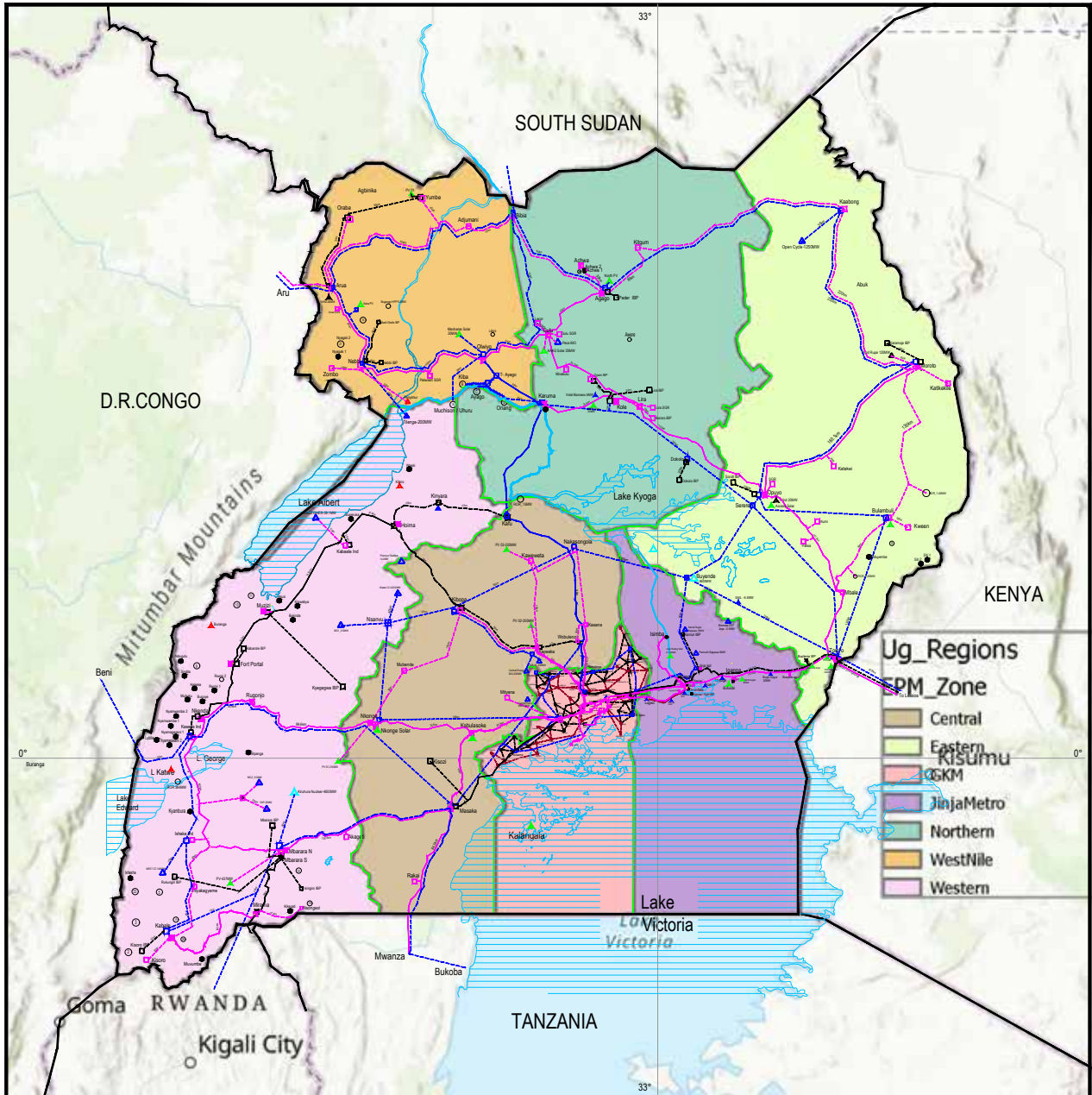
DRAWN: mbm

CHECKED: A.A.

APPROVED: D.E.O.

ORIGINAL

A.3.4. TENFOLD 2040 SCENARIO



**Legend**

- Proposed 400kV Underground Cable
- Proposed 400kV Transmission Line
- Existing 400kV Transmission Line
- Proposed 220kV Transmission Line
- Existing 220kV (132kV) Transmission Line
- Proposed 132kV Transmission Line
- Existing 132kV Transmission Line
- Proposed 66kV Transmission Line
- Existing 66kV Transmission Line

- Proposed 400kV Substation
- Existing 400kV Substation
- Proposed 220kV Substation
- Existing 220kV Substation
- Proposed 132kV Substation
- Existing 132kV Substation
- Existing 66kV Substation
- Existing 66kV Substation

- Generating Station – Hydro
- Existing Generating Station – Bagasse / Thermal
- Proposed Generating Station – Bagasse / Thermal
- Proposed Generating Station - Solar
- Existing Generating Station - Solar
- Proposed Nuclear Power Plant
- Proposed Generating Station - Geothermal
- Proposed Generating Station - Wind
- Proposed Generating Station – Mini Hydro
- Proposed Generating Station – Large Hydro

1	Nyamabuye	19	Nsongezi
2	Haisessero	21	Nyagak 3
3	Kisisi	27	Achwa 3 / Agago
4	Nengo Bridge	28	Kabale Peat
5	Ngete	33	Mitaano
9	Sogahi	34	Okollo
10	Muzizi		
14	Ruizi		
15	Sipi Falls		

A	Murchison / Uhuru	D	Oriang
B	Kiba		
C	Ayago		

13	Inclusion of Energy Policy 2023 (2,418 MW)	Mar 25	GDP
12	Inclusion of Committed Mirama Kabale 132kV TL and Mirama 132 / 33kV Substation	Feb 25	
11	Inclusion of Nanyuki Solar Plant	Sept 24	
10	Inclusion of Proposed Kiruna and Byeride Nuclear Power Plants	Sept 24	
09	Inclusion of Committed Nsongezi Solar 132 / 33kV Substation	Sept 24	
08	Inclusion of Committed Muzizi 132 / 33kV Substation	Sept 24	
07	Inclusion of Committed Owoye - Nebbi - Arua 132kV TL, Nebbi & Arua 132 / 33kV Substations	Aug 24	
06	Inclusion of Committed Gulu Owoye 132kV TL	May 24	
05	Inclusion of Committed Muzizi 132 / 33kV Substation	Nov 23	
04	Inclusion of Committed Kiba - Gulu 132kV TL, Kiba & Gulu 132 / 33kV Substations	Nov 23	
03	Inclusion of Proposed Kabale Nyakayeme 132kV TL, Nyakayeme 132 / 33kV Substation	Nov 23	GDP
02	Inclusion of Committed Mitundwe Enebbale 132kV TL	Nov 23	
01	Inclusion of Committed Mitundwe Substation Ckt & Enebbale 132 / 33kV Substation	Nov 23	

NO.	REVISION	DATE	ORIGIN

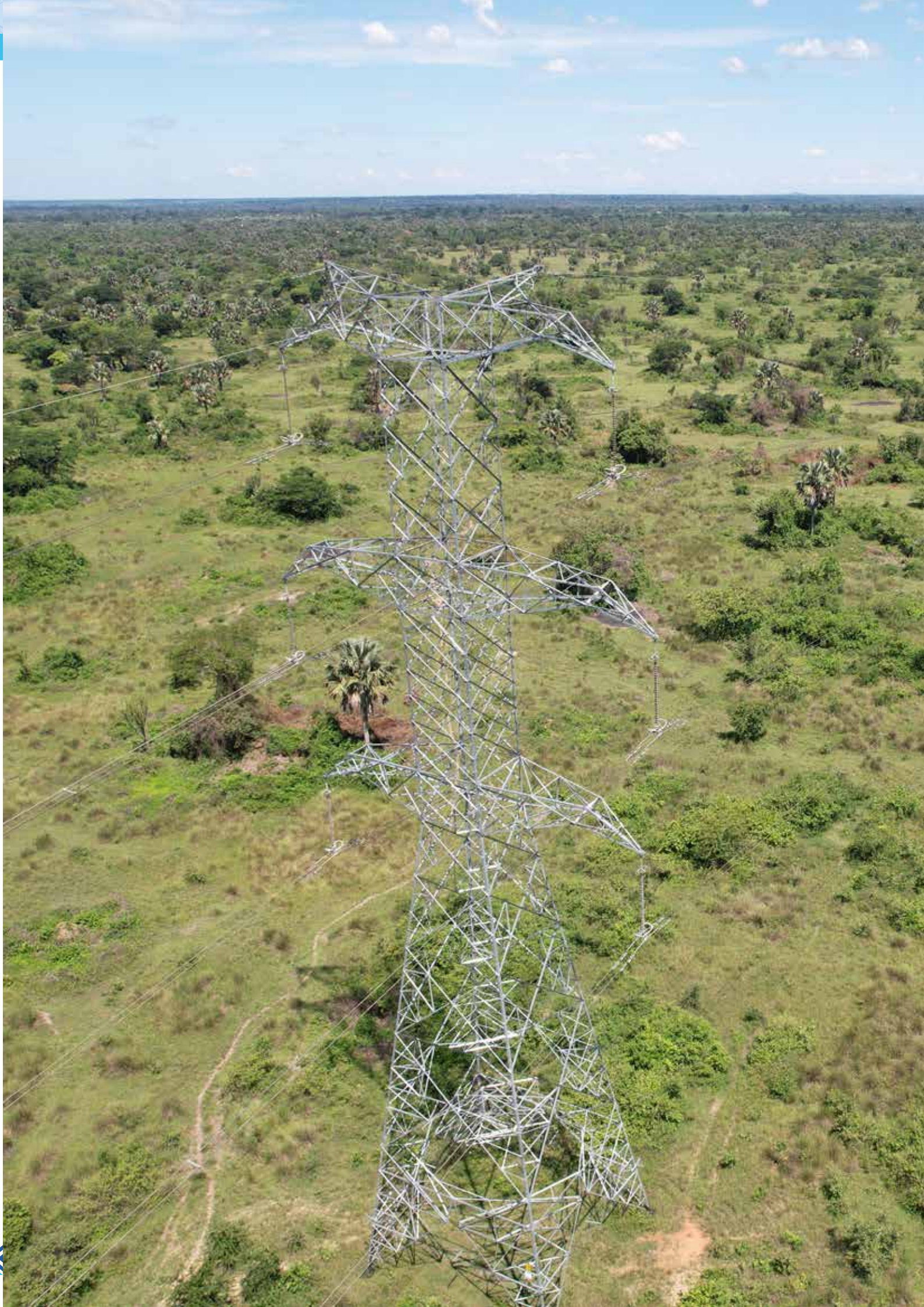
**UGANDA ELECTRICITY TRANSMISSION COMPANY LIMITED**

Plot No. 10  
Harrowing Road  
P.O. Box 7625, Kampala Uganda

Tel: +256 41 4233 4234  
Fax: +256 41 3441 788  
Email: name@uetcl.com  
Website: www.uetcl.com

DATE	Mar 2025	TITLE	UGANDA TRANSMISSION GRID MAP
DRAWN	mbm		Tenfold 220W 2040 Scenario
CHECKED	AA		
APPROV.	D.E.O.		
SCALE	NTS	DRAWING NO.	
ORIGINAL			











**UETCL**  
Transmitting for Transformation

**Uganda Electricity  
Transmission Company Limited**  
Plot No.10, Hannington Road  
P.O Box 7625, Kampala, Uganda  
Tel: +256-417 802 000, +256-314 802 000



 [www.uetcl.go.ug](http://www.uetcl.go.ug)