LEAST COST ELECTRICITY EXPANSION PLAN 2020-2030

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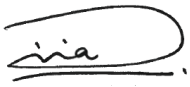
Approved By	Eng. Ziria Tibalwa Waako Chief Executive Officer	**Signature**	 Approved 2021.03.12 18:28:01 +03'00'
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EXECUTIVE SUMMARY

The Electricity Supply Industry Planning is a Vital Step in Resource Efficiency. This Least Cost Electricity Expansion Plan was developed to highlight the General Outlook of the Uganda Electricity Supply Industry.

The Plan covers the Demand Forecast, the Expected Source of Electricity Supply (Generation Capacity), the Demand-Supply Balance, Electricity Access as well as Transmission and Distribution Infrastructure Requirements to facilitate the Electricity Supply Industry Growth and Absorption of the Generation Capacity.

This 10-Year Least Cost Electricity Expansion Plan developed a Demand Forecast for a Base Case Scenario (Business as Usual) and High Case Scenario (with Industrial Growth and High Economic Growth).

Considering the Projected Demand and Generation Capacity which includes both Plants in operation, those under construction, and the committed Plants that are already Licensed by the Regulator, a Demand-Supply Balance was developed.

The average Demand Growth under the Base Case Scenario is 7.8% per year while the High Case Demand is 11.8% per year. The total demand increases from 767 MW to 1,644 MW from 2020 to 2030, total available Generation increased from 816 MW to 2,300 MW in the same period. The Demand-Supply Balance shows an excess in supply increasing from 49 MW in 2020 to 658 MW in the year 2030.

Considering the High Case Scenarios, the total Demand increased to 2,319 MW in 2030. This leads to a Lower Excess Supply starting from 10 MW in 2020 all through to a possible deficit of 18 MW in 2030 as detailed in **Table 1**.

Table 1: Demand-Supply Balance

		Projected demand		Balance (Excess Capacity)	
Year	**Available Supply (MW)**	**Base Case Demand (MW)**	**High Case Demand (MW)**	**Base Case (MW)**	**High Case (MW)**
A	**B**	**C**	**D**	**B-C**	**B-D**
2020	816	767	807	49	10
2021	1,185	827	889	358	296
2022	1,250	888	977	362	274
2023	1,310	953	1,076	357	234
2024	1,319	1,025	1,190	294	129
2025	1,662	1,108	1,324	554	338
2026	1,693	1,206	1,482	488	211
2027	2,281	1,308	1,657	973	625
2028	2,300	1,415	1,849	886	451
2029	2,300	1,524	2,069	776	232
2030	2,300	1,644	2,319	658	(18)

If the Industrial Parks (Kapeeka, Usukuru, Mbale, Jinja) do not materialize as expected with Limited Industrial Demand Growth, this will lead to less Optimal Electricity Demand.

The implications of the Excess Power Supply if not consumed in time may include:

I. Unsustainable Deemed Energy Obligations paid by either the Government through the National Treasury or the Consumer directly leading to increase in the Tariffs;
II. Poor Creditworthiness of the entire Electricity Supply Industry resulting in lack of Financial Sustainability, Dampened Investor Confidence for the

Medium Term which may lead to a cycle of a Supply shortfall in the future.

Considering the Plants that have already been Licensed that have Take-Or-Pay Clauses in their Licenses, the Deemed Energy Obligation for capacity not consumed in the next 5 (Five) years is shown in Table E. This cost shall be as high as USD 92Million in 2021 increasing to USD137Million in 2025. This is only in line with Cabinet's Decision that no additional Licenses are given with Deemed Energy Obligations.

Table E: Estimated Deemed Energy

Year	Deemed Energy (GWh)	Deemed Energy Costs (USD)
2021	1,907	92,485,992
2022	1,970	95,531,285
2023	2,310	112,022,223
2024	2,203	106,859,936
2025	2,830	137,255,626

Considering both the Base Case and the High Case Forecast of Demand, it is observed that if all planned Generation Projects are commissioned as assumed in the study, Uganda will face a challenge of Excess Generation Capacity if no additional mitigation measures are undertaken immediately. Uganda, therefore, needs to undertake interventions to Grow Demand in the Short to Medium Term. It is thus recommended that concerted effort is put on the following considerations:

a) Fast track the Power Evacuation Projects to avoid Deemed Energy Costs due to lack of Evacuation Lines.

b) Develop a Framework to facilitate Private Sector Investments in the Transmission Network for Power Evacuation Infrastructure.
c) Facilitate the Electricity Connection Policy (ECP) implementation to ensure that the backlog of household connections are all covered at the earliest time possible.
d) Where possible renegotiate payment obligations for projects to build a critical mass of cash flow in the next 4 to 6 years.
e) Consider Licensing Projects that will be commissioned only after 2025, to allow for absorption of the Projects already Licensed and Developed.
f) Develop an Industrial Park to enhance Industrial Growth which will increase demand in the end.
g) The Government of Uganda should continue to finance Transmission Infrastructure and Distribution with a low impact on the Tariff as detailed in Table 2.

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Table 2: Investment Requirement to Absorb the Planed Generation for 2020-2030

Sub Category	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total Cost (Shs '000)	Commited Funding (Shs '000)	Funding Gap (Shs '000)
UETCL	**490,739,401**											**490,739,401**	**212,228,300**	**278,511,101**
Evacuation														
Sub Category	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**Total Cost USD (X1000)**	**Commited Funding USD (X1000)**	**Funding Gap USD (X1000)**
UETCL	831,298	58,635	34,111	46,208	23,685	9,391	0	3,265	11,194	104,114	51,301	1,173,203	1,191,115	-17,912
Distribution	74,700	74,600	73,400	69,700	69,900	53,400	0	0	0	0	0	415,700	0	415,700
REA	2,796	0	0	0	0	0	0	0	0	0	0	13,980	13,980	0
Sub-Total	**908,794**	**133,235**	**107,511**	**115,908**	**93,585**	**62,791**	**0**	**3,265**	**11,194**	**104,114**	**51,301**	**1,602,883**	**1,205,095**	**397,788**
	Expansion													
UETCL	423,990	137,664	31,988	31,364	21,726	47,482	77,225	50,592	60,699	66,239	58,404	1,007,374	704,091	303,283
Distribution	146,010	136,250	131,700	118,000	92,400	69,200	115,593	115,593	115,593	115,593	115,593	1,271,527	-	1,271,527
REA	101,386	101,386	67,591	67,591	67,591	67,591	78,856	78,856	78,856	78,856	78,856	675,909	484,309	191,600
Sub-Total	**671,386**	**375,300**	**231,279**	**216,955**	**181,717**	**184,273**	**271,675**	**245,042**	**255,149**	**260,688**	**252,854**	**2,954,809**	**1,188,400**	**1,766,409**
	Re-investment													
UETCL	106,652	178,126	68,384	0	0	0	0	0	0	0	0	353,163	163946.5836	189,216
Distribution	47,200	26,500	23,800	30,800	44,100	54,900	37,883	37,883	37,883	37,883	37,883	416,717	-	416,716.67
Sub-Total	**153,852**	**204,626**	**92,184**	**30,800**	**44,100**	**54,900**	**37,883**	**37,883**	**37,883**	**37,883**	**37,883**	**769,879**	**163,947**	**605,933**
	Regional Interconnection													
UETCL	43,840	22,618	20,298	480	48,855	37,096	56,940	148,397	138,345	94,777	93,034	704,681	520839.765	**183,842**
Subtotal	43,840	22,618	20,298	480	48,855	37,096	56,940	148,397	138,345	94,777	93,034	**704,681**	**520,840**	**183,842**
Grand Total	**1,777,873**	**735,780**	**451,272**	**364,143**	**368,257**	**339,060**	**366,498**	**434,587**	**442,571**	**497,462**	**435,072**	**6,032,252**	**3,078,281**	**2,953,972**

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1.1 INTRODUCTION

The Government of Uganda has over the years developed Planning Documents for the Electricity Supply Industry (ESI). In 2013, the Electricity Regulatory Authority developed the First Least Cost Expansion Plan (LCEP). The LCEP was developed in line with the Authority's Functions Section 10(l), to advise the Minister regarding the need for Electricity Supply Industry Projects.

The Authority updates the LCEP annually to consider growth and developments in the Electricity Supply Industry including new technologies. This Plan presents the 7th series of the LCEP covering the period 2020 to 2030.

1.2 Background

Uganda's Electricity Supply Industry is run under a Liberalized Setup, following its Liberalization in 1997 and the Enactment of the Electricity Act, 1999. Liberalization and Enactment of the Electricity Act, 1999, Mandated the unbundling of the Uganda Electricity Board, which was a Monopoly, managing Generation, Transmission, Distribution, Sale, Import, and Exportation of Uganda's Electricity. Legally, Uganda's Electricity Supply Industry is Regulated under the Electricity Act, 1999, Chapter 45 of the Laws of Uganda, the Energy Policy, the National Environment Act, Chapter 153, and the Statutory Instruments and Guidelines issued by the Electricity Regulatory Authority (ERA).

Uganda's Electricity Generation Capacity has grown over the years from about 872.2 MW in 2012 to the current 1,254.2 MW (with 5.9 MW on Off-Grid) by December 2019. This capacity is projected to increase by over 1,000 MW in the next 2 years following the commissioning of the Karuma Hydro Power Project (600 MW) and other Projects implemented by

Independent Power Producers (IPPs). On the Transmission side, the Network has expanded from about 1,553.6 km in 2012 to 2,889.8 km as of December 2019 (3,223km as of December 2020). Uganda recorded a Maximum System Peak Demand of 723.8 MW in December 2019.

In terms of Electricity Access, the Uganda Bureau of Statistics in its 2016/17 National House Hold Survey reported access to Clean Energy for lighting at 24% on the National Grid while 27% Off-Grid, Rooftops, and Solar Lanterns and Home Systems.

The Government of Uganda commissioned the Electricity Connection Policy (ECP) (2018 – 2027) in October 2018 to Accelerate Access to Electricity and provide Cleaner Energy for Ugandans. The ECP targets Accelerating Access to 60% by 2027, after which it will be revised to enable the achievement of the 80% Vision 2040 connection target and, thereafter, universal coverage. The demand for Electricity Consumption in Uganda remains low and among the lowest in Africa with Annual Average Electricity Consumption of 100kWh per capita.

For a Country to have an Adequate and Reliable Electricity Supply match its demand, it calls for a deliberate effort in harmonized planning and development of the additional Electricity Generation Capacity of the Country, based primarily on National Natural Resources. This planning should cover the entire value chain starting from Electricity Generation to the final End-User Consumer. It's along with this objective that this Least Cost Electricity Expansion Plan was developed covering the period 2020 to 2030.

1.3 Objectives of the Plan

The overall objective of this 10-Year Plan (2020-2030) is to review Forecast Assumptions of the Electricity Supply Industry in view of developing the Least Cost Electricity Expansion Plan. The specific objectives are to:

a) Update the Load Forecast Assumptions putting into consideration the observed changes and review of key factors influencing the ESI;
b) Estimate Long Run and Short-Run Generation output for allocation of Peak Capacity Costs.
c) Review and update the Power System Simulation data including Plant types, system constraints, and costs; and
d) Establish Power System Investments needs for its sustainability.

1.4 Planning for the Electricity Supply Industry (ESI)

Uganda's ESI is structured into Three Main Segments; Generation, Transmission, and Distribution. Over the years, various plans have been developed to streamline the Industry; while putting into consideration the Government's targets on improving industrialization and access to Clean Energy.

Since 2010, the Government of Uganda (GoU) developed and published a 25-year comprehensive "Power Sector Investment Plan". Uganda's National Development Plans (NDP I, NDP II, and NDP III) and Uganda's Vision 2040 aimed at meeting "the Energy Needs of the Ugandan population for Social and Economic Development in an Environmentally Sustainable Manner"[1,2]. Rural Electrification Strategies and plans have been developed to accelerate rural electrification.

[1] MEMD The Uganda Energy Policy, 2002;
[2] MEMD Uganda's Sustainable Energy For All (SE4ALL) Initiative Action Agenda, 2015

In 2013, the Cabinet of Uganda gave the Rural Electrification Agency (REA) a Leadership role in Electrifying the country through 13 (Thirteen) Energy Service Territories. Some of these Energy Service Territories have concessions in place, such as with UMEME Limited, Bundibugyo Electricity Cooperative Society, Pader-Abim Community Multipurpose Electric Cooperative Society, Uganda Electricity Distribution Company Limited, Kilembe Investments Limited, West Nile Rural Electricity Company, and Kalangala Infrastructure Services. Others have Private Off-Grid Schemes as Power Suppliers.

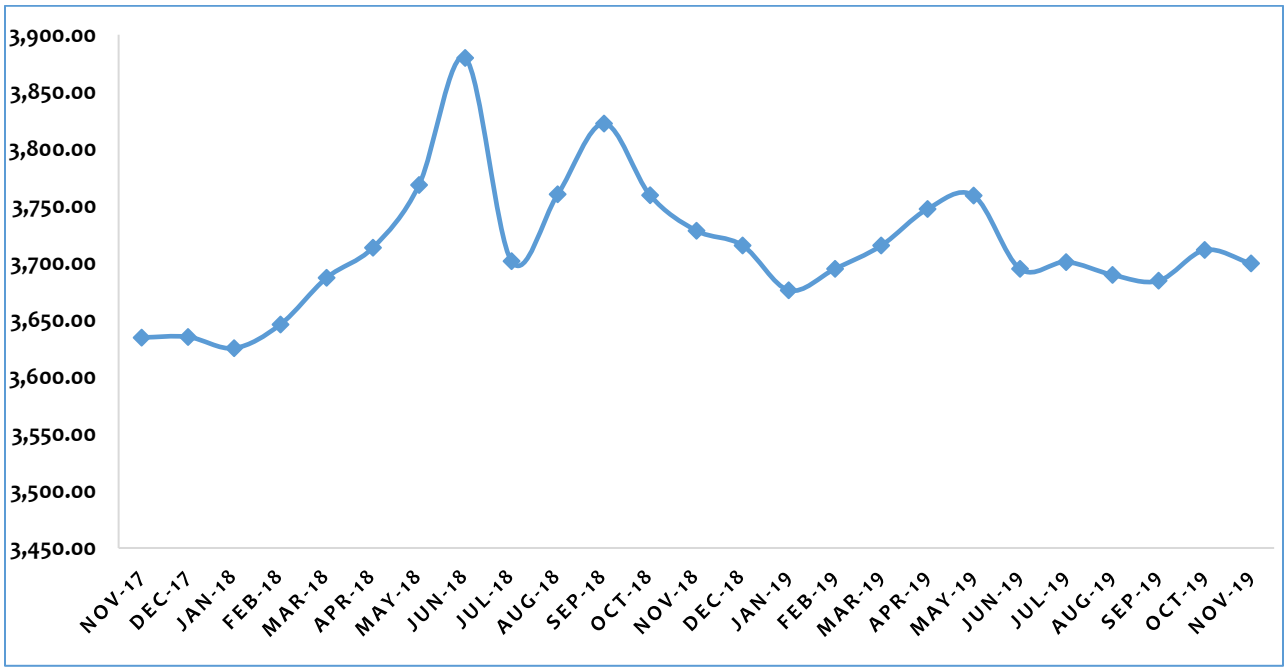
2 MACRO-ECONOMIC MOVEMENTS

Uganda's Electricity Supply Industry is greatly influenced by Macro-Economic changes. These include the Consumer Price Index (CPI), the US Dollar Producer Price Index (US PPI), Exchange Rate of the Shilling (Shs) to Foreign Currencies, and International Fuel Prices. Every year, ERA sets Base Tariffs which are then adjusted every quarter in line with the changes in the Macro-Economic Factors.

2.1 Exchange Rate

During the Period November 2017 to November 2019, there was an appreciation of the Ugandan Shilling against the USD. The Exchange Rate at end of November 2019 was Ush 3,699.5/USD compared to Ush 3,728.21/USD at the end of November 2018. The trend of the Exchange Rate for the period under review is shown in Figure 1. This movement represents a 0.77% appreciation of the Shilling against the USD at end of November 2019.

Figure 1: Exchange Rate of the Uganda Shilling against USD Movement for November 2017 to November 2019.



Source: **Bank of Uganda**

For the period under review, the highest Exchange Rate between the Shilling and the Dollar peaked at Ush 3,758.9/USD was registered in May 2019 and while the Lowest Rate was in January 2019 at Ush 3,672.11/USD.

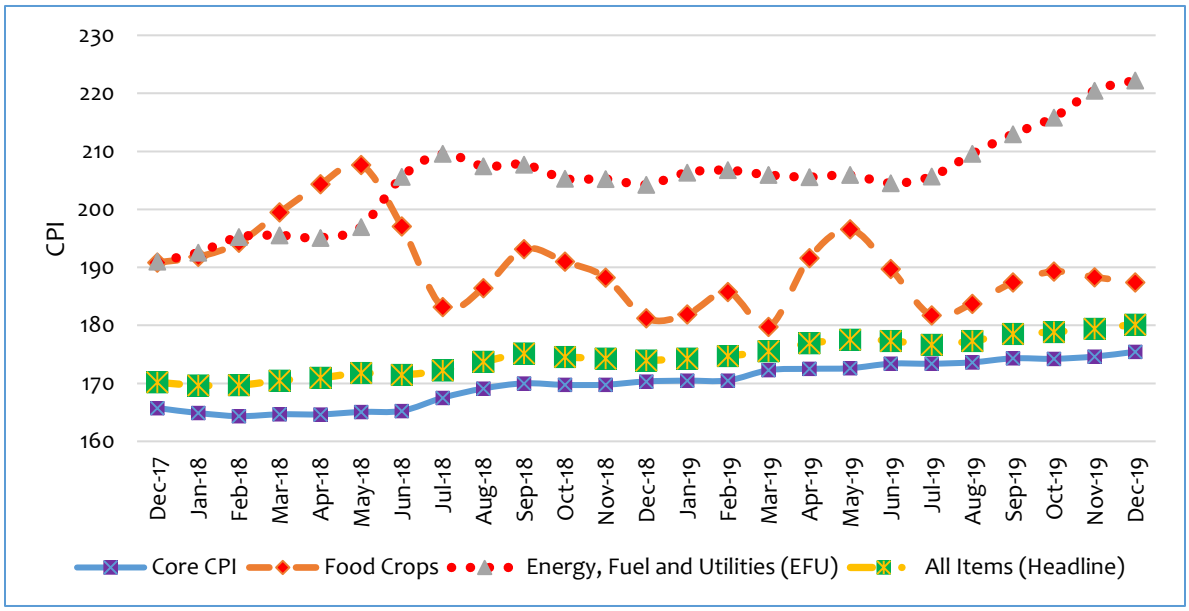
As shown in Figure 1, there was a depreciation of the Shilling against the Dollar starting January 2019 to May 2019 on account of strong net Dollar Demand from offshore investors, manufacturing, and oil firms. In the latter part of the year, the Shilling largely strengthened against the Dollar owing to strong inflows from offshore investors, exports, and Non-Governmental Organizations Transfers.

2.2 Inflation

The Annual Core Consumer Price Index (CPI) for the month ending December 2019 was 175.45 compared to 170.33 in December 2018 representing an increase of 3%. The increase was mainly driven by higher food crop prices and increased inflation in the energy, fuel, and utility prices (see Figure 2).

The Annual Core Inflation is projected to remain within the Central Bank's Medium Target of 5% despite an upside assessment of risks to inflation including unpredictable weather patterns, food crop prices, and capital inflow volatility that put pressure on the Exchange Rate.

Figure 2: Movements in Consumer Price Indices

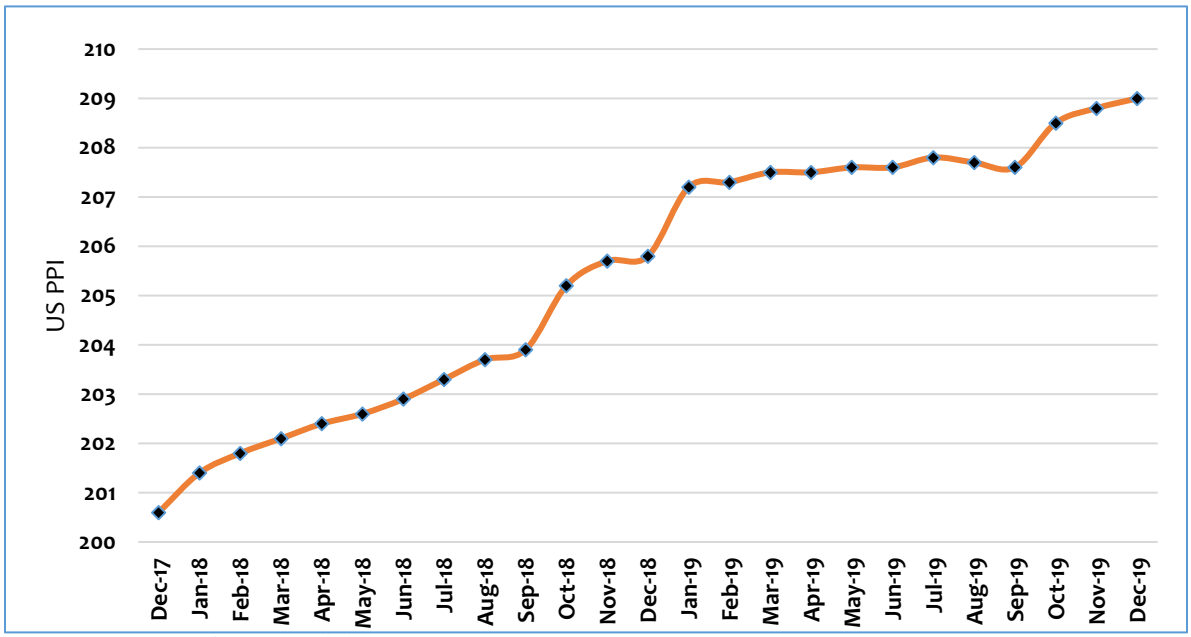


Source: UBOS

2.3 Producer Price Index (PPI)

The US PPI increased from 205.8 in December 2018 to 209.0 in December 2019, representing a 1.56% increment.

Figure 3: Movements in US Producer Price Indices



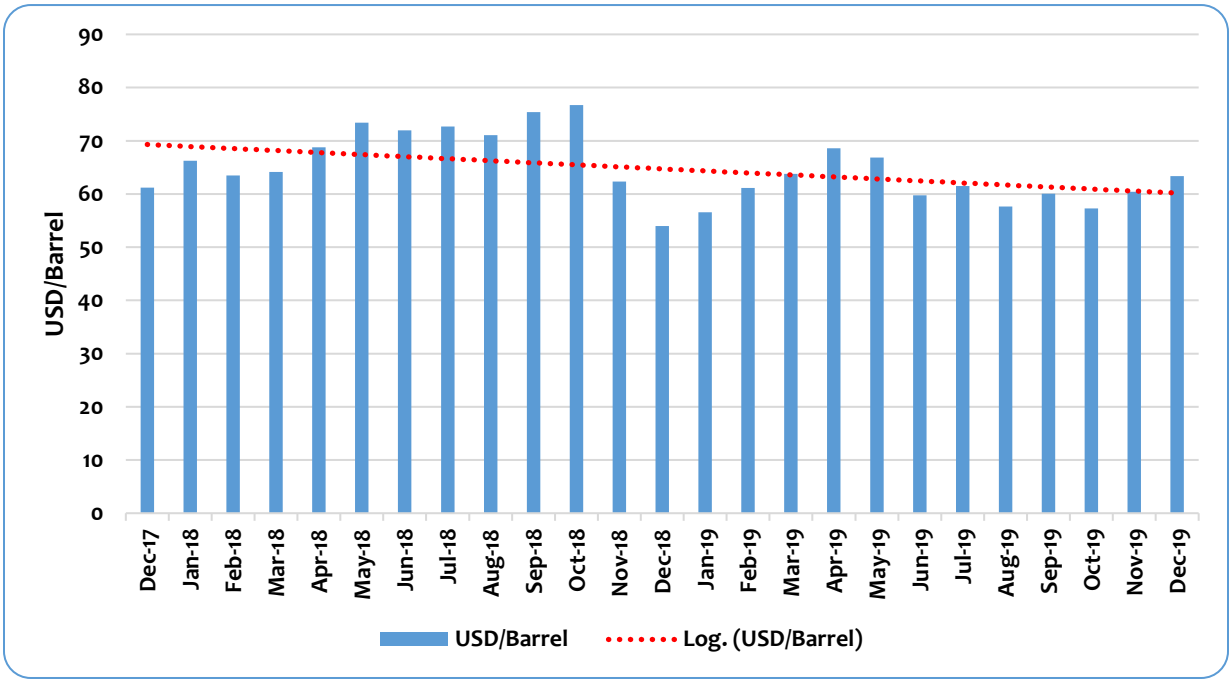
Source: US Bureau of Labor Statistics

2.4 Crude Oil Prices

The Generation Mix of Uganda includes Energy Dispatched from Thermal Plants. Uganda has 2 (Two) Thermal Power Plants; Jacobsen and Electro-max with both Plants relying on Heavy Fuel Oil (HFO) imports. Therefore, changes in Oil Prices on the International Market affect the Generation Costs of these Thermal Power Plants.

Movements in the Prices of Crude Oil on the International Market over the reporting period are presented in Figure 4. The Oil Prices remained relatively stable through the months of 2019 at an average Price of USD60.8 per Barrel.

Figure 4: Movements in the International Prices of Crude Oil



***Source: Index Mundi*[3]**

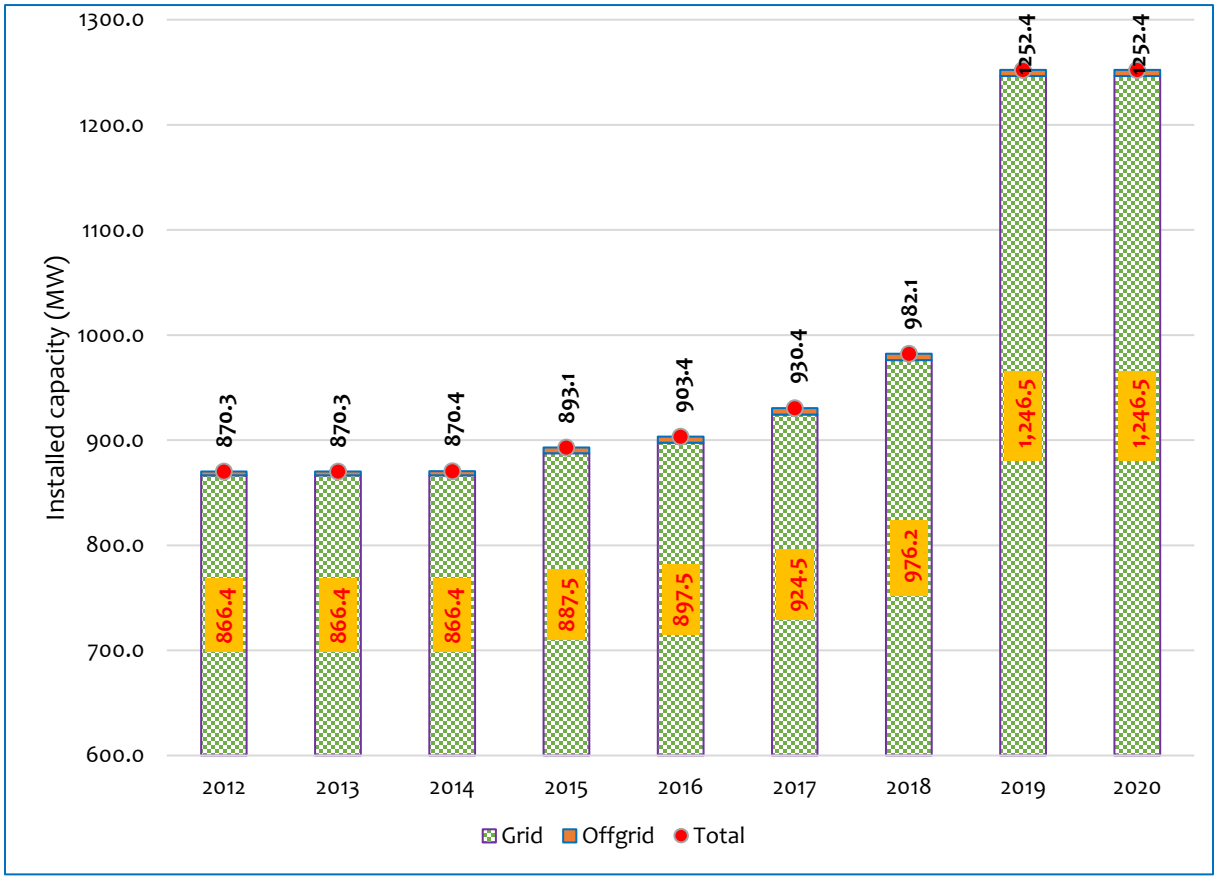
2.5 Energy Generation and Installed Capacity

Uganda currently has a Total Installed Capacity of 1,252.4 MW of which 5.9 MW is Off-Grid Systems and 1,246.5[4] MW on the National Grid, and the Installed Capacity is Projected to grow by over 800 MW upon the commissioning of Karuma HPP (600 MW) and other independent Power-Producing Projects. A total of 7 (Seven) Power Generating Plants with a Total Installed Capacity of 270.3 MW achieved Commercial Operations in 2019. The list of Electricity Generating Plants in Uganda is presented in Appendix 1.

[3] *http://www.indexmundi.com/commodities/?commodity=crude-oil&months=60*

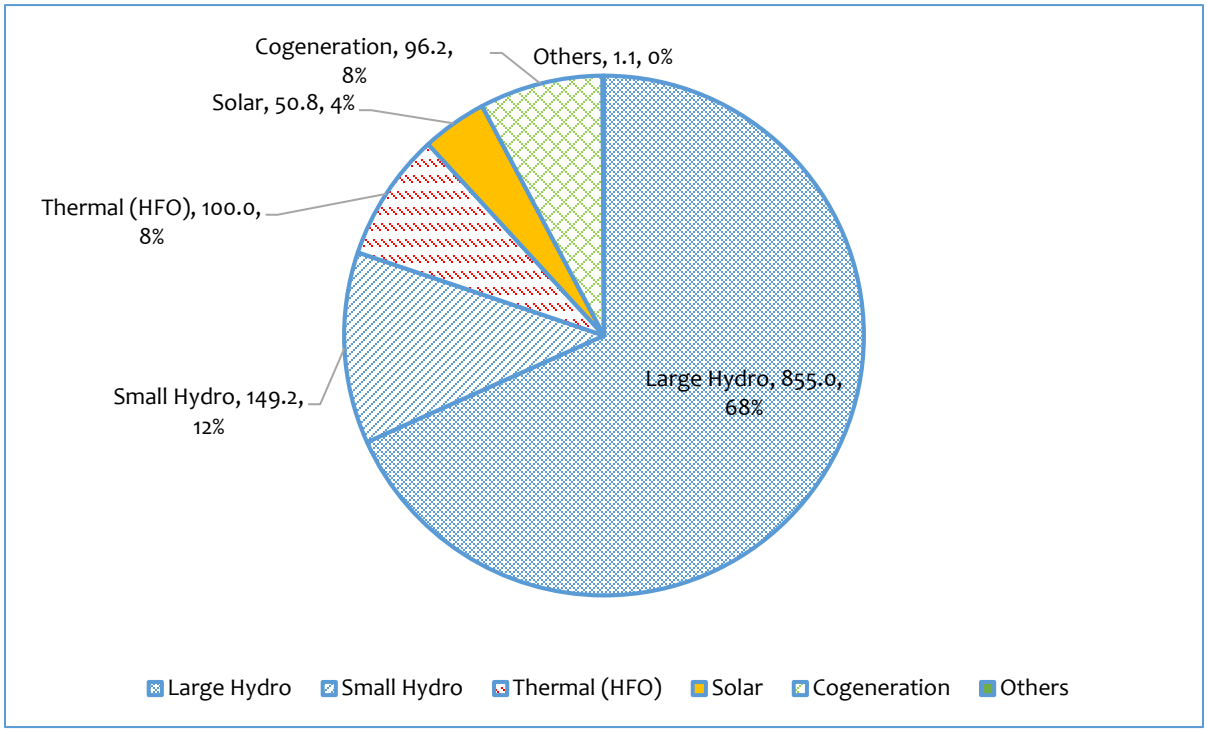
[4] The Authority is considering moving 8MW of the thermal to the West Nile Service Territory as offgrid

Figure 5: Generation Installed Capacity (MW)



By technology, ***Figure 6*** shows that 1004.2 MW (80%) of the Total Installed Capacity is Hydro of which 149.2 MW is from Small Hydropower Projects (<20 MW) and 855.0 MW is from Large Hydropower Projects; which include the Eskom Complex (Nalubaale and Kira), Bujagali Hydropower Plant, Isimba Hydropower Plant, and Achwa Hydropower Plant. Uganda has commissioned Four Solar PV Plants over the period 2017 and 2019 with a Total Installed Capacity of 50 MW. Other existing technologies contributing to the Installed Capacity include Thermal (100.0 MW) and Bagasse/Cogeneration (96.2 MW).

Figure 6: Generation by Technology (2020)



Source: ERA

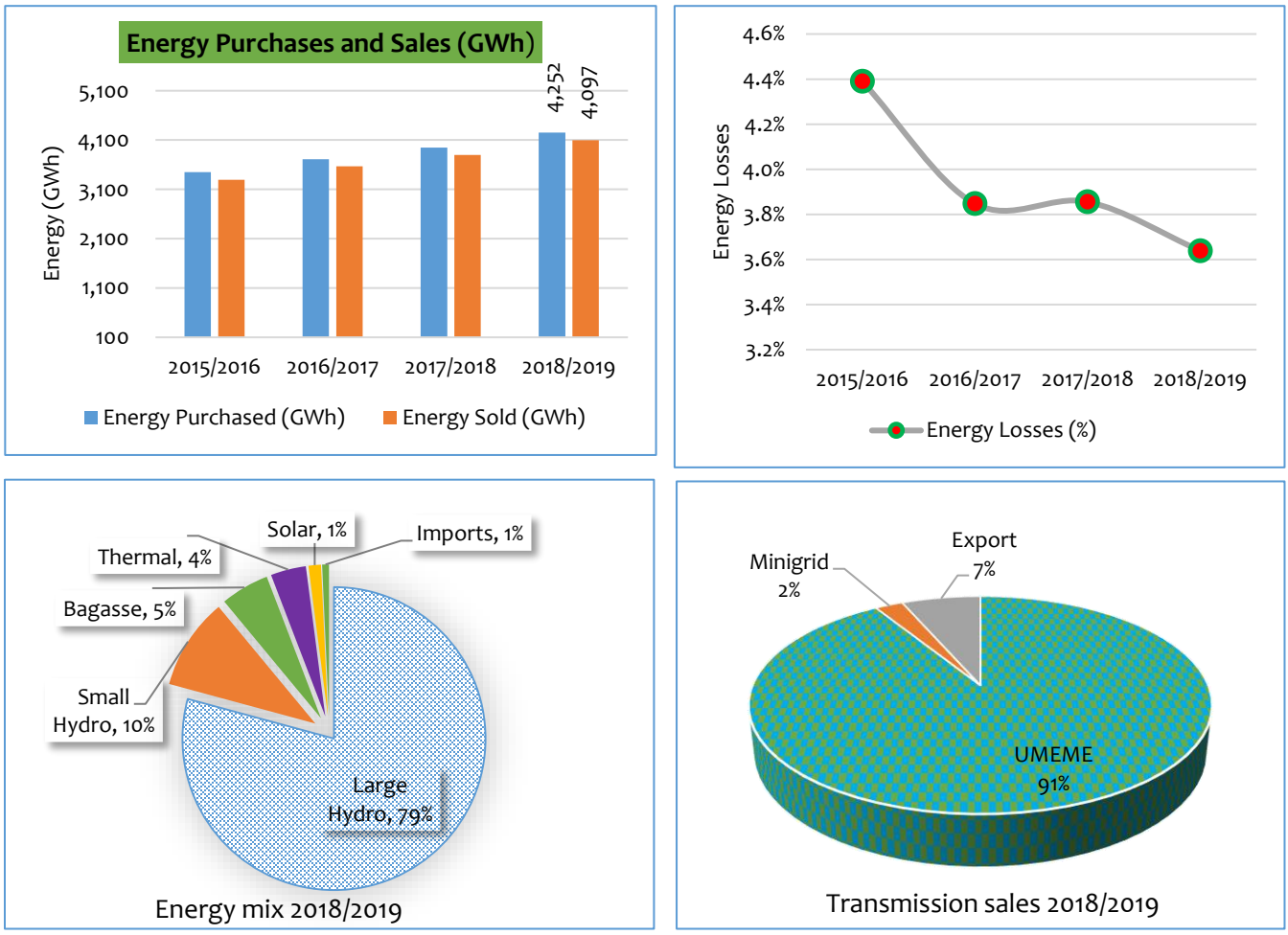
2.6 Electricity Transmission

Uganda employs a Single Buyer Model with the Uganda Electricity Transmission Company (UETCL) as the only utility Licensed to carry out Bulk Electricity Purchases, Sales, Import, and Export.

UETCL Energy Sales grew by 8% in 2019 from 3,925GWh to 4,252GWh with the growth attributable to increased demand especially from the Industrial Customers at Distribution and increase in Exports. The Transmission Losses Reduced by about 0.2% in 2019 as compared to the status in 2018. By source of which Transmission sold Energy, 90% of the Energy Sales were to Umeme Limited, 3% to other Local Distribution Utilities and the 7% Exported to neighboring countries.

In terms of Technology, 91% of the Energy Purchased during 2019 was from Hydro, 4% from Bagasse (Cogeneration), 2% from Thermal, 2% from Solar with Imports constituting less than 1%.

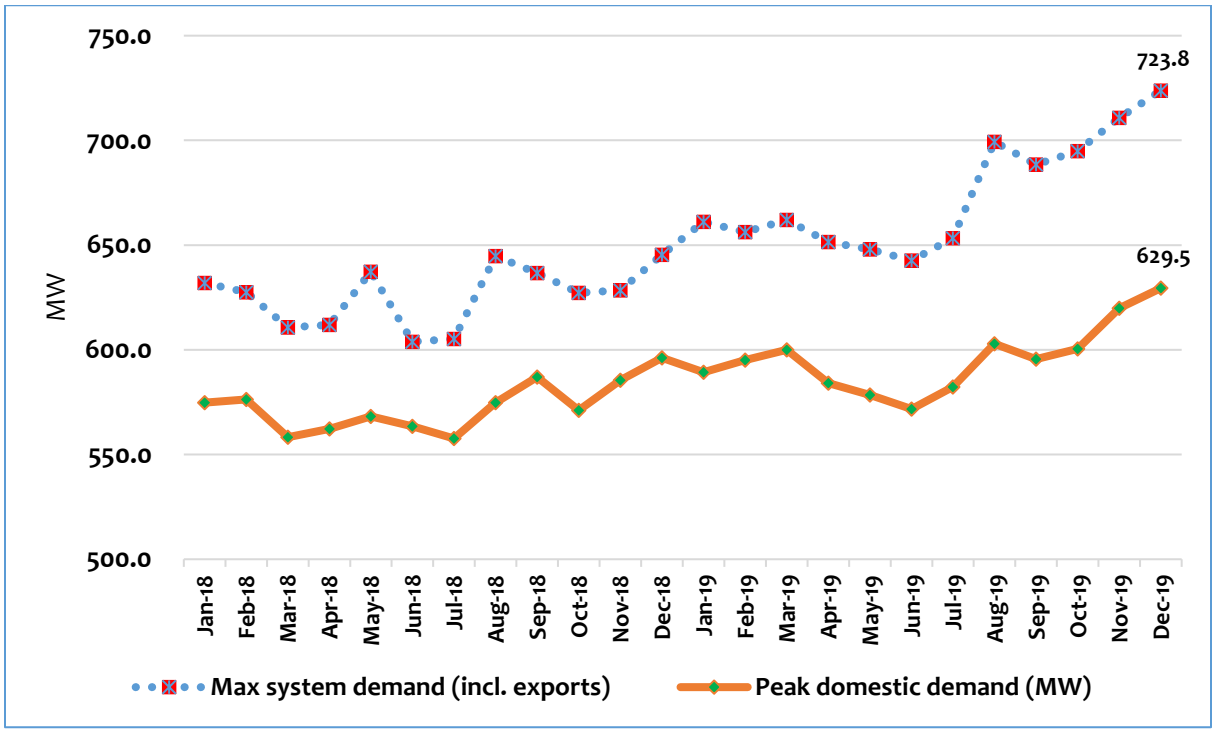
Figure 7: Distribution of UETCL Energy Purchases and Sales



There were 320 Kilometers (km) added to the Transmission Network in 2019, thereby increasing the Total Transmission Length from 2,569.8kms in 2018 to 2889.8kms by the end of 2019. The Transmission Network has 22 Primary Substations.

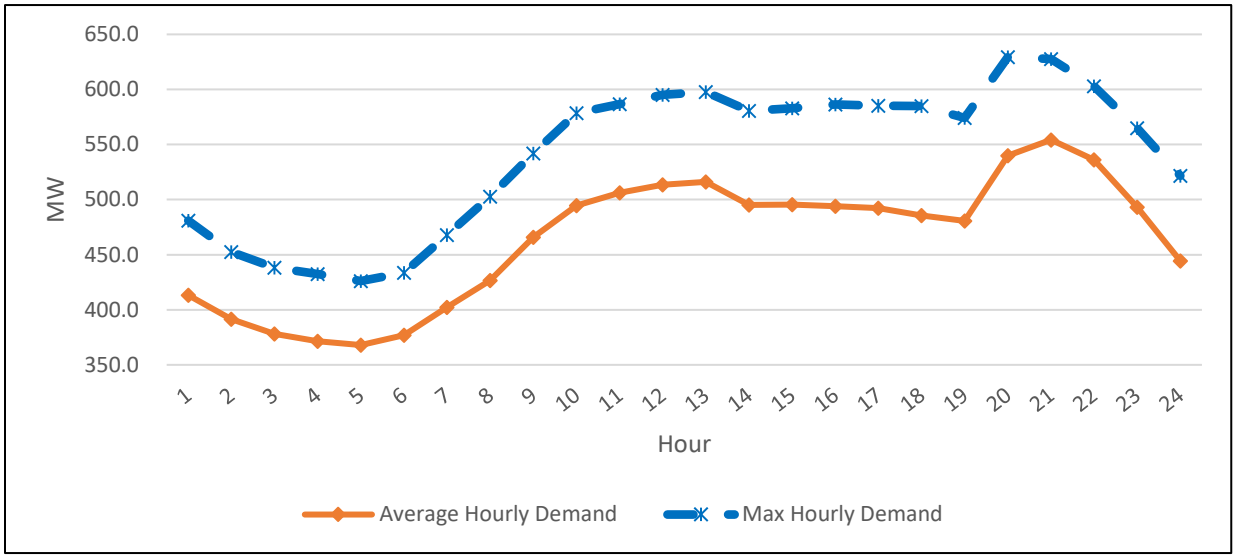
The Annual Peak Demand in 2019 occurred in December 2019, standing at 723.8 MW as compared to 645.4 MW observed during December 2018 giving an Annual Growth of about 12%. ***Figure 8: Peak System Demand (MW)*****Figure 8 and 9** show the trend of Peak Demand and the daily load curve respectively.

Figure 8: Peak System Demand (MW)



Source: UETCL

Figure 9: Daily Load Curve for 2019 (MW)



Source: UETCL

2.7 Electricity Distribution

At the end of December 2019; Uganda had a total of 1.56 million Customers on the Network (Grid and Off-Grid) of which 1.44 million Customers (92%) were on the Umeme Limited-Service Territory.

The Uganda Electricity Distribution Company (UEDCL) operates Eight Service Territories including Central North Service Territory (CNST), Eastern Service Territory (EST), Mid-West Service Territory (MWST), North East Service Territory (NEST), North-North West Service Territory (NNWST), Southern Service Territory (SST), Southern West Service Territory (SWST), and North Western Service Territory (NWST).

The other Distribution Utilities in Uganda with Independent Service Territories of operation include Pader-Abim Community Multipurpose Electric Co-operative Society Limited (PACMECS), Bundibugyo Energy Cooperative Society (BECS), Kyegegwa Rural Electricity Cooperation

Society (KRECS), and Kilembe Investment Limited (KIL). Kalangala Infrastructure Services (KIS) and the West Nile Rural Electrification Company (WENRECO) operate Off-Grid Systems in the Kalangala and West Nile Regions of Uganda respectively.

Table 3: Customers on the Distribution Network and Energy Consumption (December 2019)

Grid	**Domestic**	**Commercial**	**Medium Industrial**	**Large Industrial**	**Extra Large Industrial**	**Street Lighting**	**Total**
BECS	9,602	60	-	-	-	-	9,662
CNST	3,530	73	5	-	-	1	3,609
EST	6,106	119	-	-	-	-	6,225
KIL	14,569	161	50	-	-	-	14,780
KRECS	7,485	138	-	-	-	-	7,623
MWST	4,710	178	5	-	-	-	4,893
NEST	5,467	115	5	2	-	2	5,591
NNWST	8,872	165	11	-	-	5	9,053
NWST	18,856	531	47	5		3	19,442
PACMECS	3,893	73	-	-	-	-	3,966
SST	13,922	307	12	-	-	-	14,241
SWST	10,227	207	10	1	-	-	10,444
UMEME	1,347,914	118,340	2,714	551	37	237	1,469,793
Grid -	***1,455,153***	***120,467***	***2,859***	***559***	***37***	***248***	***1,579,322***
Off-Grid							
KIS	3,397	49					3,446
WENRECO	17,874	407	20	2	-	-	18,303
Off-Grid-	***21,271***	***456***	***20***	***2***	***-***	***-***	***21,749***
Energy sales (GWh)							
o/w Grid	698.44	385.29	507.65	894.44	759.32	1.29	**3,246.43**
o/w Off-	1.51	2.75	0.35	0.96	-	-	**5.56**
Total	**699.94**	**388.04**	**508.00**	**895.40**	**759.32**	**1.29**	**3,251.99**

Source: ERA

2.7.1 Energy Purchases and Sales of Distribution Utilities

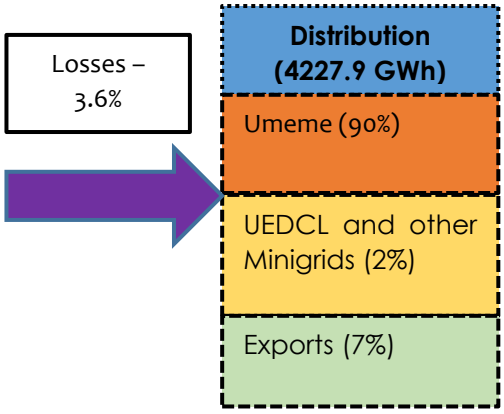
Figure 10 shows the Energy Purchases, Sales, and Losses of the Distribution Utilities operating on the National Grid. These Distribution Utilities combined, purchased 3,696 GWh in 2018, and sold 3,067 GWh to the End-Users with the difference attributed to Distribution Losses (17%).

The Energy Purchases and Losses increased by 9% in 2018 as compared to the Energy Purchases and Sales of 2017; with the overall Distribution Losses reducing by 0.3% (from 17.3% recorded in 2017 to 17.0% in 2018).

UETCL, the System Operator reported selling 3,925.7 GWh in 2019 to these Distribution Utilities[5] giving a Growth Rate of 6% as compared to the Energy Sales of UETCL in 2018.

Figure 10: Energy Purchases and Sales of Distribution Utilities operating on the National Grid

Source	No. Plants	Purchases (GWh)
Large Hydro	4	3,505.9
Small Hydro	18	479.9
Thermal (HFO)	2	102.8
Solar	4	78.1
Cogeneration/Bagasse	3	196.8
Imports	2	20.5
Total	33	4,383.9



Source: ERA Computation

2.7.2 Energy Purchases and Sales of Umeme Limited

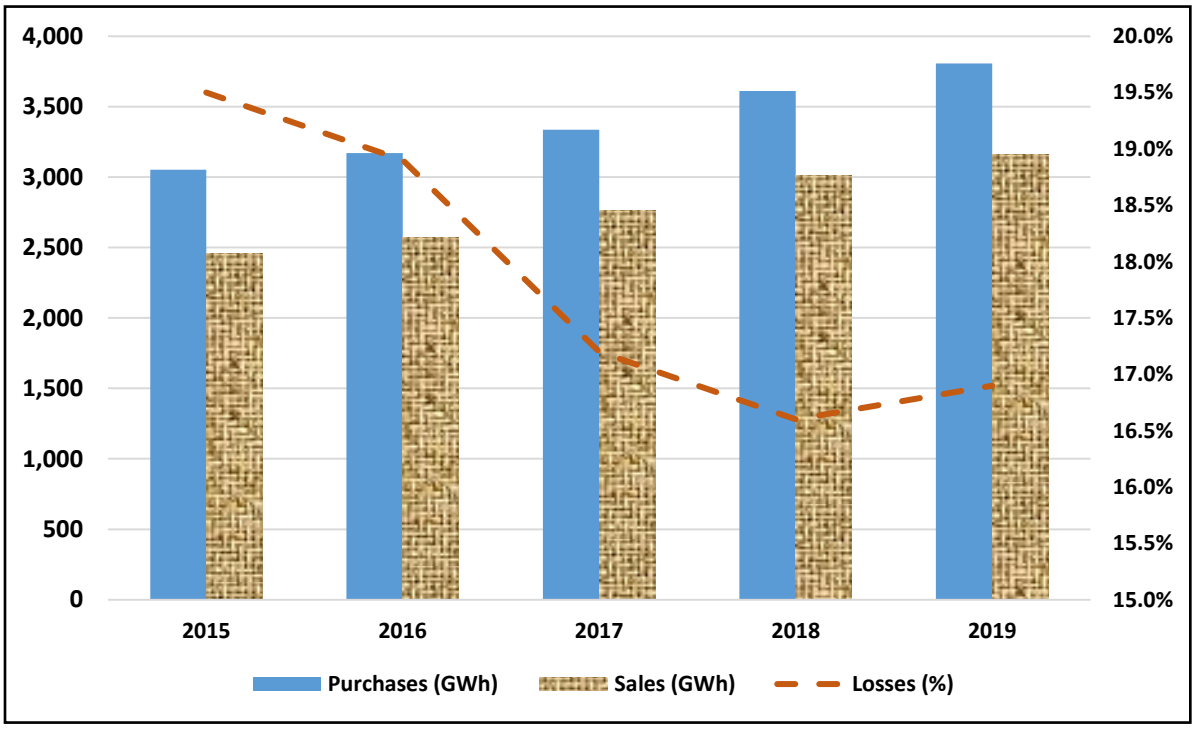
Umeme Limited is the leading and Major Electricity Distribution Utility in Uganda, purchasing about 92% and 90% of the Energy Sales of UETCL in

[5] With an addition of WENRECO

2018 and 2019 respectively. It serves 93% of the total number of customers on the National Grid.

Umeme Limited's Energy Purchases over the years 2013 to 2018 increased at an average Annual Compound Growth Rate (CAGR) of 5% with relatively higher growth in 2018 as compared to 2017 (8%). On the other hand, the Energy Sales increase at an Annual Compound Growth rate of 8%. Overall, the utility purchased and sold 3611.9GWh and 3011.0GWh respectively in 2018 with a Distribution Loss Factor of 16.6%.

Figure 11: Umeme Limited's Energy Sales and Purchases from 2015 to 2019



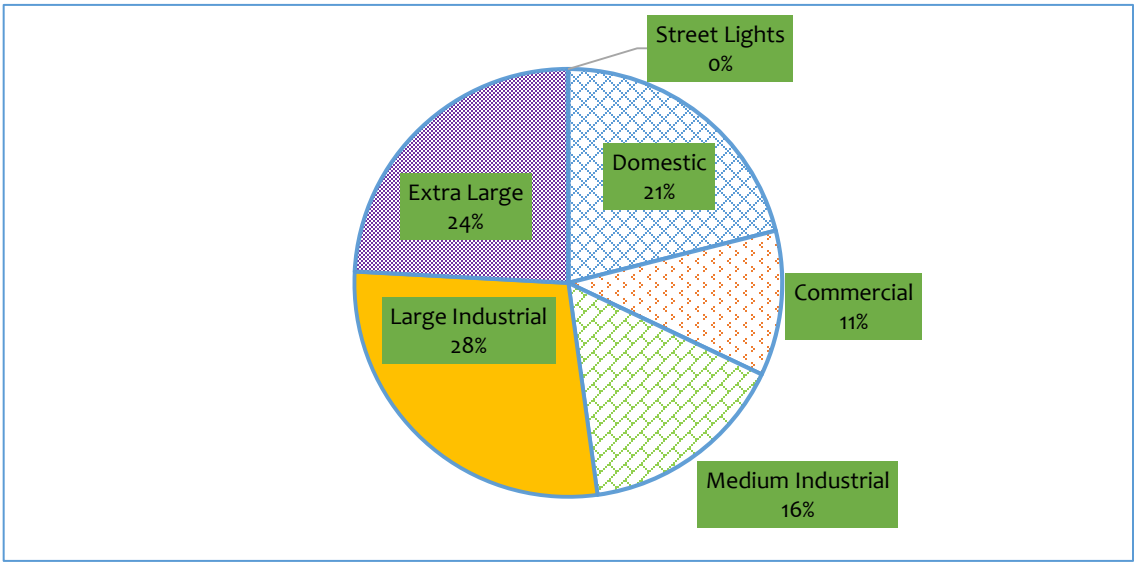
Source: ERA

2.7.3 Umeme Limited Energy Sales by Customer Categories

The distribution of the Energy Sales of Umeme Limited by Customer Category is presented in **Figure 122**. Of the Energy sold in 2019; 21% was

to Domestic Customers, 11% to Commercial Customers, and the remaining 68% to Industrial Customers. The distribution of Energy Sales by Customer Category remained relatively constant over the years.

Figure 12: Umeme Limited Energy Sales by Tariff Customer Category

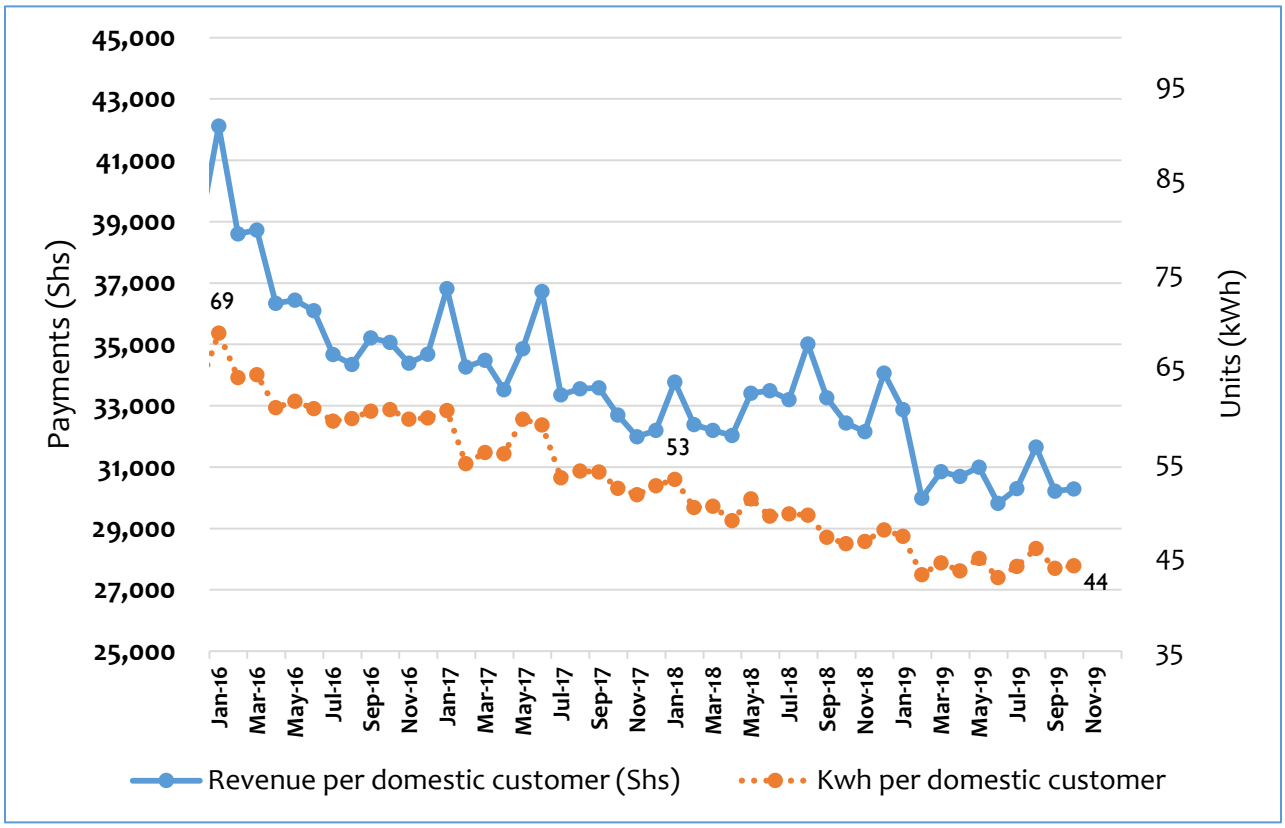


Source: ERA

2.7.4 Electricity Consumption behavior of Domestic Customers on the Umeme Limited Network

Domestic Customers constitute about 91% of the total Customers on the Umeme Limited Network with the proportion expected to grow higher with the Electricity Connection Policy. Whereas there is an increase in Domestic Customers, there is negative correlation growth in the average consumption per Domestic Customer. **Figure 13** shows that the average number of units per Domestic Customer dropped from 69kwh in January 2016 to 47Kwh per Customer in January 2019. This decline over the years is majorly attributable to the Rural Grid Extension where Customers have a relatively lower Electricity Demand and Purchasing Power.

Figure 13: Monthly Average Energy Consumed per Domestic Customer



Source: ERA

Planning Process

The Planning Process for an Efficient Electricity Supply System includes a review of the current and expected projects to grow demand and generation/supply. This ultimately facilitates the alignment of expected generation to the projected demand for Electricity.

The Electricity Supply Industry has a System Planning and Coordination Committee (SPCC). The Committee is composed of Planners of various Professionals Representing key Electricity Industry Agencies and Utilities. The SPCC converges every Quarter to review the Operational and

Industry Plans including Generation, Transmission, and Distribution Infrastructure. The SPCC has representation from institutions including the Ministry of Energy and Mineral Development (MEMD), Uganda Electricity Transmission Company Limited (UETCL), Uganda Electricity Generation Company Limited (UEGCL), Umeme Limited, Uganda Electricity Distribution Company Limited (UEDCL), Rural Electrification Agency (REA) and other Operators.

In completing this Plan, input from the SPCC and key Stakeholders like Uganda Investment Authority (UIA) was sought on various subcomponents to reinforce the findings. The next sections of the Plan discuss Demand Forecasting as well as Generation Outlook.

2.8 Demand Analysis

Electricity Demand for Uganda can be derived from Customer Consumption among the various categories. This includes the Electricity Demand for Domestic, Commercial, and Industrial Customers on the National Grid and the Mini-Grids. This demand analysis started with the National Grid Utility (Umeme Limited) which represents more than 90% of the total demand and was then supplemented by small On and Off-Grid Utilities across the Country.

2.8.1 Demand Forecast

In the Least Cost Expansion Plan 2016-2025, the Plan adopted the Econometric Method of Demand Forecasting. A comparison was made between the forecast and the actual energy sales achieved by Umeme Limited from 2016 to 2019. Table 4 shows a 1% variation between the annual projection in comparison with the actual energy sales for the period 2016 and 2019.

Table 4: Comparison between Projection and Actual Energy Sales at Distribution Level.

	Projected Energy Sales By Umeme Limited (GWh)	Actual Sales by Umeme Limited (GWh)	Percentage Variation
2016	2,599	2,570	-1.1%
2017	2,789	2,761	-1.0%
2018	2,989	3,008	0.7%
2019	3,196	3,173	-0.7%

Source: ERA

Several studies were conducted in Uganda concerning Electricity demand forecasting. The major studies include; Power Sector Investment Plan (PSIP) 2011, the Performance of the Uganda Power Sector from 2011 to 2018 by Gulam Dhalla 2011; Master Plan Study for Hydro Plant Development by JICA (March 2011); The Energy Demand Outlook 2005-2020 by Mark Davis, Nuclear Power Investment Plan 2015 by MEMD, the Least Cost Generation Plan (2016-2025), The Grid Development Plan 2018 by UETCL, Updating the Power Sector Investment Plan: Q1-2019 PSIP by Energy and Security Group.

However, no other forecast method was found to have lesser variance compared to the one applied in the Least Cost Generation Plan 2016-2025. This Plan, therefore, maintained the same Econometric Demand Forecast Methodology for the period 2020 to 2040.

2.8.2 Description of the Forecasting Model

In this Methodology, Electricity Consumption is assumed to be a normal good that is affected by the income of the consumers. The functional form of the relationship is expressed as follows:

$$E = f(y, p)$$

Where:
E - Electricity Sales is proxy by total sales in Gigawatt-hours (GWh);
y – The proxy of income - the Gross Domestic Product (GDP); and
P – Price of Electricity.

This is transformed into the model specified as;

$$Log\ (Y) = log\ (A) + B\ log\ (GDP) + c(Log(p)$$

Where:
B = GDP Elasticity
C=Price Elasticity

To forecast the Energy Sales for the respective Customer Categories, the following equations were used as described in detail, the variables used in this study.

$$Domestic: \quad Log\ (ED\ ) = log\ (A) + B\ log\ (GDPc)$$
$$Commercial: \quad Log\ (EC\ ) = log\ (A) + B\ log\ (GDPs)$$
$$Medium\ Industrial: \ Log\ (EMI\ ) = log\ (A) + B\ log\ (GDPiI)$$
$$Large\ Industrial: \quad Log\ (ELI\ ) = log\ (A) + B\ log\ (GDPi)$$

Where

ED = Annual Domestic Energy Sales

EC = Annual Commercial Energy Sales and Street Lighting

EMI = Annual Medium Industrial Energy Sales

ELI = Annual Large and Extra-Large Industrial Energy Sales

$GDPs$ = Annual Commercial GDP (Which is represented by the GDP for services at a constant price.

$GDPI$ = Annual Industry GDP at constant price

Table 5: Definition of Variables

Definition of Variables for Energy Sales	
Domestic Sales	Electricity Sales to the Domestic Customer Category in Umeme Limited's Distribution Network.
Commercial Sales	Electricity Sales to the Commercial Customer Category in Umeme Limited's Distribution Network plus the Electricity Sales to the Street Lighting Customers.
Medium Industry Sales	Electricity Sales to the Medium Industrial Customer Category in Umeme Limited's Distribution Network.
Large Industry Sales	Electricity Sales to the Large Industrial and Extra-Large Industrial Customer Categories in Umeme Limited's Distribution Network.
Definition of Variables for GDP	
Industry GDP	Real Gross Domestic Product (GDP) to the Industrial Sector as defined by the Uganda Bureau of Statistics (BOS). This includes Mining and Quarrying, Manufacturing, Water, and Construction.
Commercial GDP	Real Gross Domestic (GDP) to the Services Sector as defined by UBOS. It includes Trade and Repairs, Transport and Storage, Information and Communication, Financial and Insurance, Public Administration, Education, Health and Social Services, and activities of Households

2.9 Demand Forecast Computations

2.9.1 Domestic Customers

An Econometric Model for the Domestic Customer Demand established that Domestic Consumption was neither influenced by the Tariff nor was it by Income. It was therefore forecasted using time which was found to be significantly independent of the domestic energy sales trend.

$Dom\ Sells\ (t)\ =\ 286.9\ +\ 12.88\ t$.....Eqn 1

Where,

$$\boldsymbol{Dom\ Sells\ (t)\ =\ Domestic\ Energy\ Sells\ in\ Year\ (t)}$$

$$\boldsymbol{T\ =\ Year}$$

2.9.2 Large Industrial Sector

The Industrial Sector differs from the Domestic Sector in terms of significant variables. The significant variable for Electricity Demand growth in this Sector was the Industrial Sector GDP. In the previous studies (Least Cost Expansion Plan 2016), Industrial GDP was used as an independent variable alongside Electricity tariffs for Industrial Consumers. It was however observed with the additional data points that Electricity tariffs had a minimal influence on the demand of the electricity by this category. This Plan, therefore, dropped the Electricity tariff in the forecast. Besides, the study considered logs of the variables to minimize stationarity in the variables. The resultant equation is as follows:

$\boldsymbol{Ln\_Large\_Ind\_Sells\ =-3.56\ +\ Ln\ 1.65\ Ind\_GDP}$**.....Eqn 2**

Where:

- $\boldsymbol{Ln\_Large\_Ind\_Sales\ =}$ $\boldsymbol{Natural\ Log\ Industry\ Energy\ Sales\ to\ Large\ Industry\ customers}$
- $\boldsymbol{Ind\_GDP\ =\ Gross\ Domestic\ Product\ of\ Industry\ Sector}$.

2.9.3 Medium Industrial Sector

The Least Cost Generation Plan 2016 considered Industrial GDP and Tariffs for Medium Industrial Customers as the determinants. This review maintained the observation that the log of both variables was still significant after regression.

$$\boldsymbol{Ln\_Med\ Ind\_Sells = 0.028 + 0.818 Ln\_Ind\_GDP - 0.319\ Ln\_Med\_Ind\_Tariff} \quad \textbf{.....Eqn 3}$$

Where:

- $\boldsymbol{Ln\_Med\_Ind\_Sales}$ **Natural Log Energy Sells to Medium Industry custo**
- $\boldsymbol{Ind\_GDP}$ **Natural Log Gross Domestic Product of Industry Sector**
- $\boldsymbol{Ln\_Med\_Ind\_Tariff}$ **Natural Log Natural Log Tariff Medium Industry**

2.9.4 Commercial Sector

The Least Cost Generation Plan 2016 considered Services Sector GDP and Commercial Electricity Tariffs. However, a review of the variable showed the minimal significance of the Electricity Tariff on Energy Sales by Commercial Category. To ensure stationarity of the regression equation, the log of the variable was used for both the energy sales and the GDP.

$$\boldsymbol{Ln\_Com\_Sells = -1.04 + 0.78\ Ln\_Serv\_GDP} \quad \textbf{.....Eqn 4}$$

Where:

- $\boldsymbol{Ln\_Com\_Sales}$ **Natural Log Energy Sales to Commercial customers**
- $\boldsymbol{Ind\_GDP}$ **Natural Log Gross Domestic Product of Services Sector**

2.9.5 Demand Forecast Scenarios

Two scenarios were developed to analyze the Demographic, Socio-Economic, and Technological Parameter development of Uganda as follows:

a. Base Case Demand Scenario

This is the baseline scenario that carries historic growth rates of all sectors to the future years. This is assuming a Business As Usual Case in the future years. In this case, the GDP growth rate is assumed to grow at 6.5% annually over the planning horizon. This is in line with the NDP III (2020-2025).

b. High Case Scenario

This scenario was developed with the assumption that demand for Electricity will increase considering accelerated Economic Growth, Access, and industrial activity and the Government Policies on increasing Access to Clean Energy. This assumption is based on the fact that the cost of Electricity Generation will decrease with the addition of low-cost Power Plants to the System. Electricity use in all the Sectors; Industry, Transport, Households, and Services will increase compared to the Base Scenario. It also assumed GDP growth of 10% over the planning horizon.

2.10 Demand at Distribution Level

To transform the Demand from Distribution to Generation level, the following inputs were considered:

a. Base Case Assumptions

- Assume an additional Energy Sale by other Domestic Small Grids as 4% of the energy sales by Umeme Limited.
- Assume Energy Exports to be maintained at a total of 7 MW in the first 3 years and then increase by 10% per year moving forward.
- Assume a GDP Growth Rate of 6.7% all through the planning period.

b. High Case Assumption

- Assuming the Industrial Parks will ramp-up with spikes in demand of at least 100 MW per year (for three years) in addition to the normal demand growth.
- Considering a GDP growth of 8% per year moving forward increasing to 10% after 4 years.
- Assume an additional Energy Sale by other Domestic Small Grids at 10% or above the Base Case Scenario.

2.11 Demand at Generation

To derive the expected Electricity Generation that will be required to supply the National Grid, the demand at the Customer level was transformed into demand at Generation at the System Operator by considering the following:

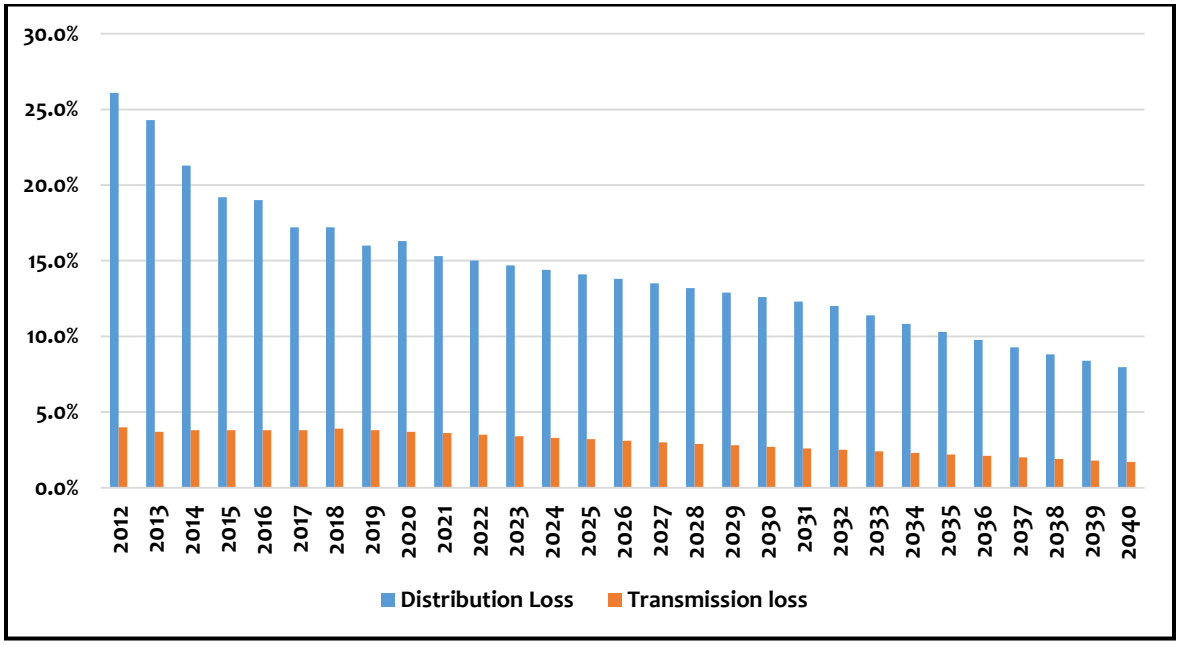
2.11.1 Energy Losses Recovery

The National Grid will experience an Energy Loss through both Technical and Commercial Losses. In the Uganda Power Supply System, the losses are subdivided into losses at the High Voltage Transmission System

(UETCL) and the Low Voltage Distribution System (Umeme Limited and Distribution Companies).

Following the recently completed performance review parameters for Umeme Limited, and the Multiyear Tariff Review Parameters for UETCL set by the Regulator, the projected Distribution and Transmission Energy Losses assumed are shown in Figure **14**. These projections include the Parameters set for 2023 and 2025 for Transmission and Distribution respectively as well as the assumption moving forward to 2040.

Figure 14: Distribution and Transmission Loss Trajectory



Source: ERA

2.11.2 Energy Sales by Other Utilities apart from Umeme Limited

A review of the Energy Sales by the Small Distribution Utilities was undertaken as shown in ***Table 6***. It can be observed that growth in energy sales grew on average by 22% from 2014 to 2019. Since the implementation of the Electricity Connections Policy, it is projected that

the increase in sales will grow by 25% per year. This is because much as more customers will be connected, the consumption per customer per year is expected to be relatively lower as more and more rural low-income customers are connected. This Plan, therefore, assumed 25% annual growth in Energy Sales to the other Distribution Utilities apart from Umeme Limited.

Table 6: Trend of Energy Sales by Other Utilities

YEAR	FERDSULT	BECS	PACMECS	KIL	KRECS	UEDCL	Total	Annual Growth
2019		4,272	2,393	6,607	4,375	79,084	96,731	15%
2018		3,088	2,347	6,410	4,153	68,135	84,132	40%
2017		2,928	2,151	5,459	3,482	46,160	60,179	11%
2016	30,427	2,906	2,263	4,856	2,642	11,217	54,312	17%
2015	26,815	2,221	2,186	4,590	2,093	8,476	46,382	26%
2014	22,380	1,883	1,760	3,715	1,374	5,566	36,679	
Average Growth								**22%**

2.11.3 Energy Exports to Neighboring Countries

The Government of Uganda through UETCL made efforts to increase Energy Exports to the neighboring countries. These include; Kenya, Tanzania, Rwanda, and DR Congo. ***Table 7*** shows the trend of Energy Exports from 2014 to 2019. Negative growth in exports is noted in 2015 and 2018. This is due to times when Kenya utilized her internally generated power while the network was not constrained which often happened in the time of spike in exports. The energy exports were noted to be growing on average 20% over the same period.

Table 7: Trend of Energy Exports by UETCL in MWh.

(MWh)						
Year	**KENYA**	**TANESCO**	**RWANDA**	**DR CONGO**	**Total**	**Growth Rate**
2019	212,865	81,562	7,789	2,443	304,659	31%
2018	129,167	93,374	8,335	2,244	233,120	-26%
2017	225,876	79,171	9,279	2,478	316,804	92%
2016	83,214	77,181	2,409	2,185	164,989	35%
2015	55,720	61,402	2,693	2,266	122,080	-27%
2014	107,057	55,647	2,586	2,438	167,728	
Average						**21%**

2.11.4 Load Factor Analysis

Much as it is ideal to establish the Load Factor of the System for the respective Customer Categories in the Energy System; the Electricity System in Uganda is quite meshed that Maximum Demand for the respective Customer Categories cannot be independently established.

Table 8 shows the movement in the Transmission Energy Purchases and Sales in comparison with the Peak Demand over the review period. The Load Factor generally varied from 68% to 72%. The Load Factor improved in 2017 and 2018, followed by a drop in 2019.

This was partly as a result of the growth in Rural Electrification with increased Domestic Customer Numbers but with lower Electricity Consumption. The Domestic Customers tend to consume significantly at the peak since they mainly use the energy for lighting.

Besides, the exports to Kenya were more significant during the Peak Period which pushed the Peak Demand beyond the Average Demand. There was also a decline in Electricity Sales to Tanzania and Rwanda in 2019 as compared to 2018 (see Table **9**). In this 10-Year Plan, we assumed that the average Load Factor would be 68% for the first 10 years since the country is still expanding Rural Electrification.

Table 8: System Load Factor Computation for the Period 2015 to 2019

Year	Peak Demand (MW)	Annual Energy Purchases at UETCL	Computed Average Demand (MW)	Annual Load Factor [6]
2015	560.1	3,348,112	382.20	68%
2016	579.3	3,549,040	405.14	70%
2017	625.3	3,867,092	441.45	71%
2018	644.8	4,078,517	465.58	72%
2019	723.0	4,383,918	499.10	69%
Average				**70.0%**

Table 9: UETCL Sales by Point of Sale (GWh)

	2015	2016	2017	2018	2019
UMEME	3,053.2	3,180.8	3,333.9	3,608.1	3,821.4
UEDCL	8.5	11.2	46.0	68.1	81.7
KIL	4.6	4.9	5.5	6.4	6.8
BECSL	2.2	2.9	2.9	3.1	5.1
PACMECS	2.2	2.3	2.2	2.3	2.4
KRECS	2.1	2.6	3.8	4.2	4.4
KENYA	55.7	83.2	225.9	129.2	208.1
TANESCO	61.4	77.2	79.2	93.4	81.1
Rwanda	2.7	2.4	9.3	8.3	7.5
DRC	2.3	2.2	2.5	2.2	2.5
Ferdsult	26.8	30.4	4.9	0.0	0.0
WENRECO	0.0	0.0	0.0	0.0	3.8
Total	**3,221.7**	**3,400.1**	**3,715.9**	**3,925.4**	**4,224.9**

[6] $Load\ Factor = \frac{Actual\ Energy\ Purchased}{Installed\ Capacity \times Hours\ in\ a\ year}$

3 ELECTRICITY SUPPLY/GENERATION

3.1 Generation Capacity in Operation

Figure 5 presented the growth in Generation Capacity over the years, reaching 1,252.4 MW by the end of December 2019. This Generation Capacity includes approximately 5.9 MW of Off-Grid while the rest is connected to the National Grid.

The decline in the Off-Grid Installed Capacity in 2019 as compared to 2018 was due to the confirmed decommissioning of the 1.6 MW Thermal units previously operated by the WENRECO in West Nile. In 2019 alone, a total of 269 MW were commissioned while an additional 700 MW was expected in 2020 alone as shown in ***Table 10***.

Table 10: Generation Capacity Commissioned in 2019 Alone

Plant	Technology	Capacity (MW)
Isimba HPP	Large Hydro	183
Emerging Power U Ltd (Mayuge/Bufulubi)	Solar PV	10
Sindila (Butama)	Small Hydro	5.3
Siti II Small Hydropower Plant	Small Hydro	16.5
Ziba Limited (Kyambura) Hydropower Plant	Small Hydro	7.6
Ndugutu Hydropower Plant	small Hydro	4.8
Achwa I Hydropower Plant	Large Hydro	42
Total		**269.2**

Source: ERA

Uganda enjoyed a Mix of Energy sources including Hydro, Cogeneration/Bagasse, Solar, and Heavy Fuel Oil (HFO). Despite its

environmental and cost implications, the existing HFO Plants were installed to provide standby generation in case of shortage of supply from other technologies due to key factors such as drought. **Table 11** shows the trend of Generation Capacity for the last 8 years.

Table 11: Generation Capacity by technology over the years 2012 to 2019 (in MW)

	2012	2013	2014	2015	2016	2017	2018	2019
Large Hydro	630.0	630.0	630.0	630.0	630.0	630.0	630.0	855.0
Small Hydro	65.2	65.2	65.3	65.3	65.3	82.3	114.0	149.3
Thermal (HFO)	101.6	101.6	101.6	101.6	101.6	101.6	101.6	100.0
Cogeneration	75.1	75.1	75.1	96.2	96.2	96.2	96.2	96.2
Solar	0.0	0.0	0.0	0.6	10.8	20.8	40.8	50.8
Others	0.1	0.1	0.1	1.1	1.1	1.1	1.1	1.1
Total	**872**	**872**	**872**	**895**	**905**	**932**	**983.8**	**1252.4**

Source: ERA

3.2 Installed Capacity and Projections in Growth

The projects in the Pipeline at various stages of development and their likely commissioning date are presented in Appendix 2.

3.2.1 Hydro Generation

Hydropower is the major source of Electricity Generation in Uganda. According to the Ministry of Energy and Mineral Development, Uganda has a potential Hydropower Capacity of over 2,500 MW. The completion and commissioning of the three Large Hydropower Plants (Karuma 600 MW, Isimba 183 MW, and Bujagali 250 MW) will significantly increase the Installed Capacity comparative to the projected demand.

In addition to the Large Hydropower Plants, more than 15 Small Hydropower Plants are in the pipeline (either licensed or undertaking

feasibility studies for development) and expected to be in operation in a period not exceeding 5 years from 2020. The above notwithstanding, there is a potential for more than 1,000 MW of additional Hydropower Generation Capacity that can be exploited soon.

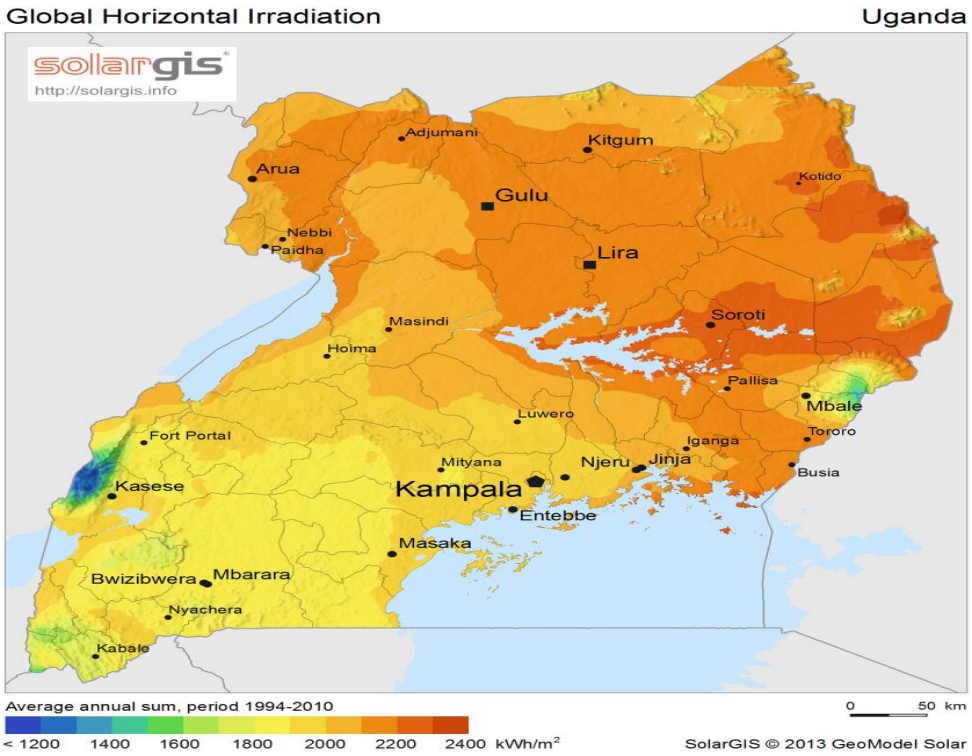
3.2.2 Bagasse-Cogeneration

There are currently 3 (Three) Bagasse Cogeneration Plants supplying Electricity to the National Grid, with the number expected to increase to at least five in the next 5 years, supplying at least 100 MW. The level of Generation of the respective Plants is affected by the availability of cane and general weather conditions to grow cane in the country. It is expected that Plants in operation now will have the capacity to supply adequate generation over the planning horizon.

3.2.3 Solar PV

The potential of Solar Energy in Uganda is incredible with the possibility of harvesting it in almost any part of the country as shown in **Figure 15.** By the end of 2019, the country had 50MWp of Solar Capacity Generation connected to the National Grid and 0.8 MW Off-grid. One of the main limitations of Solar PV on the National Grid is its intermittent nature. This necessitates an alternative capacity to smoothen the fluctuation for Solar. Nonetheless, this is expected to improve significantly as the battery technology matures and becomes price competitive in the medium term.

Figure 15: Uganda's Solar Potential



3.2.4 Geothermal

In 2012, the Ministry of Energy estimated that the country had a potential of about 450 MW of Geothermal Capacity. By the end of December 2019, feasibility studies were still underway with surface Geothermal investigation surveys completed at Kibiro and Panyimur areas. Drilling works are expected in the Geothermal reservoirs at Kibiro and Panyimur. This Technology is expected to provide Generation Capacity to the National Grid by end of 2027.

3.2.5 Wind

A total of 6 (Six) Wind Measuring Masts are expected to be installed in Northern/North Eastern Uganda by the end of 2020. By the end of 2019, one developer was in advanced stages in the feasibility study with the

possibility of developing a 50 MW Wind Power Plant. Additional generation of 150 MW with the current technology is expected by 2027 on a need arises basis.

3.2.6 Nuclear

Nuclear Energy is considered a critical source of energy that will satisfy Uganda's Energy Demand for the future. According to the Nuclear Unit in the Ministry of Energy, Government continues to promote and develop Nuclear Energy for peaceful applications in Electricity Generation, Cancer Management, and Food Safety Assessment, Tsetse Control, Improving Agricultural Productivity, Water Resources Management, and Industries.

Pre-feasibility studies for launching the first Nuclear Power Plant in Uganda were completed. The studies confirmed that the generation potential from hydro, if fully developed, and cannot meet the Country's future energy needs. Therefore, to meet the future development targets, Nuclear Energy among other sources needs to be integrated into the future Electricity Generation Mix.

To create a conducive environment for the introduction of Nuclear Power into the future Generation Mix and development of Nuclear Energy for other peaceful applications, the Ministry continues to strengthen the Policy and Regulatory Framework, Establish Supporting Infrastructure, Build Capacity for managing Nuclear Energy Projects and establish cooperation with Development Partners. The outlook for the development of Nuclear Energy is estimated to be 2032 to 2035.

3.2.7 Heavy Fuel Oil (HFO) Thermal

As of December 2019, the National Grid had two 50 MW Power Plants using imported heavy Fuel Oil that is; Electro-Max Tororo and Jacobsen Namanve which operate under a merit order dispatch regime to

provide Emergence Supply. The Government of Uganda took commitment to partly utilize fuel expected from oil explorations from the Albertine Region to Generate Electricity. The amount of fuel to be provided and the time frame within which this shall be realized however remains subject to when the operation of the refinery shall begin. The indicative capacity, to begin with, is around 50 MW which can, later on, be expanded accordingly in line with the needs of the country.

3.3 Strategic Intervention in Uganda's Electricity Generation

3.3.1 Contribution of the GETFiT Program

GETFiT Uganda is a Public-Private Partnership (PPP) Program that leverages Commercial Investment in Renewable Energy Projects in Uganda. The Programme is widely viewed as a PPP success story with Uganda now among the top destinations for Renewable Independent Power Producers (IPP) on the continent.

A total of 17 Renewable Energy Projects were fast-tracked under the Global Energy Transfer Feed-in Tariff (GETFiT Program) – see Table 12. Whereas this Program was closed, it significantly enhanced the number of Private Investors willing to undertake investment in Uganda even at less attractive terms than those that were given in the earlier years.

Table 12: Projects Supported by GETFiT Program

No	Name	Licensed Capacity (MW)	Technology	Year Commissioned	Tariff
	Commissioned Plants				
1	Access Uganda Solar Limited	10.0	Solar	2016	11.11
2	Siti I Small HPP	5.0	Small Hydro	2017	10.04
3	Muvumbe HPP	6.5	Small Hydro	2017	9.44
4	Tororo Solar North	10.0	Solar	2017	11.19
5	Rwimi HPP	5.5	Small Hydro	2017	9.83
6	Nyamwamba HPP	9.2	Small Hydro	2018	8.52
7	Kakira Sugar Limited	51.1*	Cogeneration	2009	9.55
8	Lubilia HPP	5.4	Small Hydro	2018	9.92
9	Nkusi HPP	9.6	Small Hydro	2018	8.52
10	Waki HPP	4.8	Small Hydro	2018	10.11
11	Sindila (Butama) HPP	5.3	Small Hydro	2019	9.9
12	Siti II Small HPP	16.5	Small Hydro	2019	8.5
13	Ziba Limited (Kyambura) HPP	7.6	Small Hydro	2019	9.9
14	Ndugutu HPP	5.9	Small Hydro	2019	10.1
	Under construction				
15	Nyamaghasani 1 Hydropower Project	15.0	Small Hydro	2020	

16	Nyamaghasani 2 Hydropower Project	6.0	Small Hydro	2020	
17	Kikagati Hydropower Project	14.0	Small Hydro	2020	

*20 MW of the Capacity is under the GETFiT Program

3.3.2 Renewable Energy Feed-in Tariffs

The REFiT Guidelines provide clarity and guidance to Project Developers, Investors, and key Institutional Stakeholders, on the key components and operational structure of the Renewable Energy Feed-in Tariff (REFIT).

A REFIT was initially established in Uganda which ran from 2007 to 2009 (Phase 1), revised in 2010 (REFIT Phase 2), 2016 (REFIT Phase 3), and 2019 (REFIT Phase 4). ***Table 13*** shows the current REFiT Tariffs. This is expected to support the development of Small Renewables Technologies.

Table 13: REFIT Phase 4 Tariffs, O&M %age, Capacity Limits

Technology	Tariff US$/kWh	O&M %age	Cumulative Capacity Limits (MW)			Payment Period (Years)
			2019	2020	2021	
Hydro (10 ><= 20 MW)	0.0751	12.9%	30	60	80	**20**
Hydro (5 ><= 10 MW)	Linear tariff[1]	13.4%	20	40	50	**20**
Hydro (500kW ><= 5 MW)	0.0792	13.8%	10	20	30	**20**
Bagasse	**0.0793**	**45.8%**	**30**	**50**	**60**	**20**

1. Computed as a regressive allocation of costs with an increase in Plant Size.

4 DEMAND SUPPLY BALANCE

4.1 Projected End-User Demand and Generation Demand Needs

As a result of the consideration of the Distribution Forecast and Demand Assumptions; the resultant overall projected Demand both at Generation and Distribution (the End-User level) is shown in **Table 14**.

Table 14 shows the projected End-User and Generated Power Demand under the Base Case and High Case Assumptions. The average Demand Growth under the Base Case Scenario is 7.8% per year while the High Case Demand is 11.8% per year. On the other hand, considering the High Case Scenarios, the total Demand will grow from 807 MW in 2020 to 2,319 MW in 2030.

The total Power Demand Requirement is expected to increase from 767 MW in 2020 to 1,644 MW for the Base Case and 2,319 MW for the High Case in 2030 with an Annual Average Growth Rate of 7.8% and 11.8 % for the Base Case, and High Case respectively.

Table 14: Base Case Demand Forecast 2020-2030

Year		Base Case Demand			High Case Demand		
	End-User Demand (GWh)	Generation Demand (GWh)	Peak Demand (MW)	Peak Growth	Generation Demand (GWh)	Peak Demand (MW)	Peak Growth (%)
	A	**B**	**C**	**D**	**F**	**G**	**H**
2020	3,655	4,569	767	6.10%	4,804	807	10%
2021	3,936	4,855	827	7.90%	5,217	889	10%
2022	4,246	5,213	888	7.40%	5,732	977	10%
2023	4,587	5,594	953	7.30%	6,317	1,076	10%
2024	4,964	6,013	1,025	7.50%	6,983	1,190	11%
2025	5,405	6,505	1,108	8.20%	7,771	1,324	11%
2026	5,918	7,076	1,206	8.80%	8,697	1,482	12%
2027	6,461	7,678	1,308	8.50%	9,723	1,657	12%
2028	7,031	8,303	1,415	8.10%	10,855	1,849	12%
2029	7,628	8,947	1,524	7.80%	12,143	2,069	12%
2030	8,282	9,650	1,644	7.90%	13,610	2,319	12%
Average				**7.70%**			**11%**

Source: ERA

4.2 Projected Actual Installed Generation Capacity Vs Projected End-User Demand

This section provides a comparison of the expected Demand to the Total Installed Generation Capacity currently under operation in addition to those expected to be commissioned over the planning horizon. A

Demand-Supply balance was developed as shown in **Table 15** and Figure **16.**

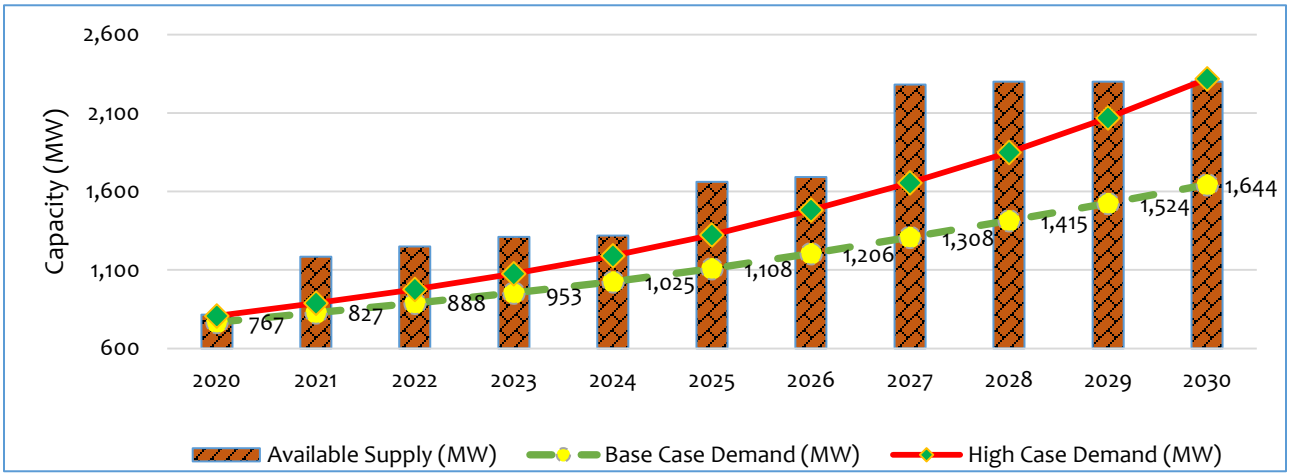
Considering both the Base Case Forecast of Demand and the High Case Forecast of Demand, it is observed that if all planned Generation Projects are commissioned as assumed in the study, then Uganda will face a challenge of Excess Generation Capacity if no additional mitigation measures are undertaken in the next 10 years (2020 to 2030). Uganda, therefore, needs to undertake interventions to grow demand in the short term to medium.

Table 15: Demand-Supply Balance

Year	Available Supply (MW)	Projected demand		Balance (Surplus)	
		Base Case Demand (MW)	High Case Demand (MW)	Base Case (MW)	High Case (MW)
A	**B**	**C**	**D**	**B-C**	**B-D**
2020	816	767	807	49	10
2021	1,185	827	889	358	296
2022	1,250	888	977	362	274
2023	1,310	953	1,076	357	234
2024	1,319	1,025	1,190	294	129
2025	1,662	1,108	1,324	554	338
2026	1,693	1,206	1,482	488	211
2027	2,281	1,308	1,657	973	625
2028	2,300	1,415	1,849	886	451
2029	2,300	1,524	2,069	776	232
2030	2,300	1,644	2,319	658	807

Source: ERA Computation

Figure 16: Illustration of Uganda's Demand-Supply Balance



Source: ERA

4.3 Deemed Energy Implication

Considering the Plants that already have Licenses with Take-Or-Pay Clauses in their Licenses, and assuming that no additional Plants are Licensed with a deemed energy obligation commissioned in the next five years, the deemed energy obligation for capacity not consumed in the next five years is shown in

Table ***16***. This cost may be as high as USD 92Million in 2021 increasing to USD`137Million in 2025. It is noted that the growth in deemed energy while demand is growing is due to the second loan obligation for Karuma in 2023 as well as the Large hydro planned for 2025 by Kiba HPP.

Table 16: Estimated Deemed Energy

Year	Deemed Energy (GWh)	Deemed Energy Costs (USD)
2021	1,907	92,485,992
2022	1,970	95,531,285
2023	2,310	112,022,223
2024	2,203	106,859,936
2025	2,830	137,255,626

Source: ERA Estimate

4.4 Demand Growth and Electricity Access Initiatives

Since 2016, several interventions have been proposed by the Government and agencies to fast-track growth in Demand and Electricity Access in the ESI in the short to medium term. These interventions include the following:

4.4.1 Uganda Distribution Sector Diagnostic Review

In 2019, the World Bank contracted a consultant, Ms. Ricardo Energy and Environment to conduct a Distribution Sector Diagnostic Review and the Future Reforms for the Development and increased Electricity Access.

The report of the consultant observed that access to electricity supply was constrained by prohibitive household wiring, connection costs, suboptimal technical, operational, and financial capacity of the small distribution Utilities as well as noncomprehensive Regulatory and Administrative Policies for the ESI. The report, therefore, recommended that the Distribution Sub-Sector is restructured so that there are not more than three Service Providers covering the whole country. This is expected to achieve efficiency in Electricity Access, Operation, and Governance.

It also recommended the conversion of the Rural Electrification Agency (REA) into a Registered Legal Entity that can be Regulated by the ERA.

4.4.2 Electricity Connection Policy (ECP)

The ECP covers a period of 10 (Ten0 years (2018 – 2027). The primary objective of the Policy is to increase Electricity Access and provide Cleaner Energy for Ugandans. The Policy aims to increase the number of connections made annually from an average of 150,000 to 300,000 connections and Increase Electricity Demand on the Main Grid by 500 MW by 2027 on account of only Domestic Demand.

By December 2019, about 223,974 Customer Connections had been made under the Policy. In 2019, the implementation of the Policy faced some logistical challenges which affected the rate of connections.

To maintain the pace of connections, a new approach where Customers that could afford to fully pay for the connection cost were allowed to connect while the other customers who could not afford to pay were to wait to be connected as and when resources were acquired by the Government. In the same vein, a credit connection scheme was to also be considered where some customers could be connected and pay the connection costs over time through the units of energy consumed.

4.4.3 Technology Advancement

There has been unprecedented technology transformation in the Electricity System and more is expected to come at an increasing rate. As technology and innovation are noted to disrupt traditional models from Electricity Generation to the final user, three trends in Uganda's

Power System pause a challenge and can be considered as game-changers or disruptions. These are:

a) Increased connection to standalone Solar Home Systems which have enhanced Electricity Access at a faster rate than anticipated. Despite its benefits, this may limit the cash flow projection in the medium term for some grid utilities.
b) There is a growing number of Captive Power Producers on the System which may affect the projected Demand, Sales, and infrastructure requirements in the medium term.
c) Energy efficiency in End-User equipment may reduce the energy demand in the medium term reasonably.

4.4.4 PAWAKAPO

In November 2019, the Electricity Regulatory Authority launched the " **PAWAKAPO"** campaign aimed at growing the number of Certified Wire Persons and promoting the use of Certified Wire Persons for Electrical Installation Works by consumers. It targeted to increase the number of Certified Wire Persons from 2,700 to 4,000 by 2022 and to encourage Electricity Consumers to utilize services of Certified Wire Persons to ensure the safety of life and property. This would consequently facilitate Electricity Access and empower the public to have access to Qualified Personnel for Electrical Installations.

4.4.5 Charcoal to Power Initiative

The Electricity Regulatory Authority initiated a Program to implement a campaign to avert usage of Biomass to Electricity called ***"Charcoal to Power for cooking".*** This was intended to Promote Electricity Demand by increasing the use of Electricity for cooking in households and institutions.

This initiative is in line with Uganda's National Development Plan and Uganda's Vision 2040 ultimate goal "to meet the Energy Needs of the Ugandan population for social and economic development in an environmentally sustainable manner".

4.5 Re-Categorization of Customers

In 2017, the Authority approved a set of Consumers to constitute a new Customer Category out of Umeme Limited's Large Industrial Category called the Extra-Large Customer Category. This grouping was based on consumption levels above 1500 KVA. It was also a prerequisite that qualifying customer accounts are those relating to manufacturing activity.

This was intended to incentivize a critical section of manufacturers to increase the consumption of energy as the prices for the Extra-Large Category were set to be the lowest and not to exceed US cent 5/kWh at the Off-Peak time. This category since 2017 has been between 37 and 42 customers reviewed per year that are consuming approximately 25% of the overall Energy Sales by Umeme Limited. Whereas limited impact on demand has been observed in the past 2 years, it is expected that demand will grow gradually in response to the incentive given that it is capital intensive.

5 TRANSMISSION AND DISTRIBUTION INVESTMENT REQUIREMENT

For the Grid to Transmit and Distribute all the Additional Generation Capacity, there is a need to reinforce and expand the Transmission and Distribution Network Infrastructure. This investment includes the construction of Grid Evacuation Lines, Network Reinvestment, Support of the Network to cope without load completion of growth as well as Regional Interconnection to Promote Regional Power Trade.

Table 17 shows that USD 6.03 billion is required to support the infrastructure required to evacuate the Power that will be evacuated over from the Generation Facilities to the Load Centers over the planning horizon. Out of the total investment, USD 1.6Billion is required for power evacuation, while USD 2.9Bn is required for Network Expansion over the planning horizon. Regional interconnection required USD 704Mn.

It is noted that overall, out of the USD 6.03 Billion required, only USD 3.0 Billion is committed to financing these needs over the planned period while approximately USD 3.0 Billion remains unfunded.

Besides, a report by UETCL indicates that Shs 490,739 million is required to acquire way leaves corridor for Transmission Infrastructure Development. However, less than 40% of the required financing has been to date committed by the Government of Uganda. The delay in the financing of the way leaves can translate into delayed project implementation/ completion, leading to stranded assets and Deemed Energy Costs.

Table 17: Investment Requirement for the Absorption of the Planed Generation 2020-2030

Sub Category	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total Cost (Shs '000)	Commited Funding (Shs '000)	Funding Gap (Shs '000)
UETCL	**490,739,401**											**490,739,401**	**212,228,300**	**278,511,101**
Evacuation														
Sub Category	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**Total Cost USD (X1000)**	**Commited Funding USD (X1000)**	**Funding Gap USD (X1000)**
UETCL	831,298	58,635	34,111	46,208	23,685	9,391	0	3,265	11,194	104,114	51,301	1,173,203	1,191,115	-17,912
Distribution	74,700	74,600	73,400	69,700	69,900	53,400	0	0	0	0	0	415,700	0	415,700
REA	2,796	0	0	0	0	0	0	0	0	0	0	13,980	13,980	0
Sub-Total	**908,794**	**133,235**	**107,511**	**115,908**	**93,585**	**62,791**	**0**	**3,265**	**11,194**	**104,114**	**51,301**	**1,602,883**	**1,205,095**	**397,788**
	Expansion													
UETCL	423,990	137,664	31,988	31,364	21,726	47,482	77,225	50,592	60,699	66,239	58,404	1,007,374	704,091	303,283
Distribution	146,010	136,250	131,700	118,000	92,400	69,200	115,593	115,593	115,593	115,593	115,593	1,271,527	-	1,271,527
REA	101,386	101,386	67,591	67,591	67,591	67,591	78,856	78,856	78,856	78,856	78,856	675,909	484,309	191,600
Sub-Total	**671,386**	**375,300**	**231,279**	**216,955**	**181,717**	**184,273**	**271,675**	**245,042**	**255,149**	**260,688**	**252,854**	**2,954,809**	**1,188,400**	**1,766,409**
	Re-investment													
UETCL	106,652	178,126	68,384	0	0	0	0	0	0	0	0	353,163	163946.5836	189,216
Distribution	47,200	26,500	23,800	30,800	44,100	54,900	37,883	37,883	37,883	37,883	37,883	416,717	-	416,716.67
Sub-Total	**153,852**	**204,626**	**92,184**	**30,800**	**44,100**	**54,900**	**37,883**	**37,883**	**37,883**	**37,883**	**37,883**	**769,879**	**163,947**	**605,933**
	Regional Interconnection													
UETCL	43,840	22,618	20,298	480	48,855	37,096	56,940	148,397	138,345	94,777	93,034	704,681	520839.765	**183,842**
Subtotal	43,840	22,618	20,298	480	48,855	37,096	56,940	148,397	138,345	94,777	93,034	**704,681**	**520,840**	**183,842**
Grand Total	**1,777,873**	**735,780**	**451,272**	**364,143**	**368,257**	**339,060**	**366,498**	**434,587**	**442,571**	**497,462**	**435,072**	**6,032,252**	**3,078,281**	**2,953,972**

Table 18: ESI Risk Matrix

		IMPACT		
		ACCEPTABLE	**TOLERABLE**	**UNACCEPTABLE**
		Little or No Effect	***Effects are Felt but Not Critical***	***Serious Impact on Outcome***
VERY UNLIKELY	***Risk Unlikely to Occur***	• Transfer to Off-Grids Use. • Corporate Governance Failure.	• Fuel Price Volatility. • A slump in Energy Consumption. • Generation Supply Shortfall.	• Grid Failure. • Low Electricity Access. • Political Instability. • Catastrophic Events. • Economic Meltdown. • *Regulatory Capture.*
POSSIBLE	***The risk will likely Occur***	• Winding up of Licensee Disco. • The continuous change of Operators. • Environmental Effects.	• Low Investment in Distribution. • Low Investment in Transmission. • Deemed Energy due to inadequate evacuation. • None compliance with the Law. • Tariffs and Trade Tension. • Change in market structure.	• *Deemed Energy due to demand.* • *Unsustainable Tariffs.* • *Scarcity of Talent.* • *Failure to Maintain or Rehabilitate Power Generation Assets.* • *ICT System Insecurity.* • *Total System Failure.*
LIKELY	***Risk will Occur***	• A high Volume of Complaints	• *Various financial risks.* • *Network Constraints.*	

Appendix 1: List of Generation Plants in Operation by December 2019

No.	Name	District Located	Category	COD	Licensed (MW)	Tariff (US cents/kWh)	PPA Term (Take or Pay, Capacity Deal, Energy Deal)
1	Kilembe Mines Limited-Mubuku I	Kasese	Small Hydro	1956	5	102.7*	Take or Pay
2	Eskom	Buikwe	Large Hydro	1954	380	54,010.3**	Capacity Deal
3	Kasese Cobalt Company Limited- Mubuku III	Kasese	Small Hydro	2008	9.9	5.4	Take or Pay
4	Jacobsen Thermal Plant	Mukono	Thermal	2008	50	17.9	Energy Deal
5	Bugoye Hydro Limited-Mubuku II	Kasese	Small Hydro	2009	13	8.7	Take or Pay
6	Electro-Maxx Uganda Limited	Tororo	Thermal	2010	50	8.0	Energy Deal
7	Eco Power Uganda Limited- Ishasha	Kanungu	Small Hydro	2011	6.4	7.5	Take or Pay
8	Africa EMS Mpanga	Kamwenge	Small Hydro	2011	18	6.7	Take or Pay
9	Bujagali Energy Limited	Buikwe	Large Hydro	2012	250	9.8	Capacity Deal
10	Hydromax Limited – Buseruka	Hoima	Small Hydro	2012	9	10.0	Take or Pay
11	Access Uganda Solar Limited	Soroti	Solar PV	2016	10	11.0	Take or Pay
12	Siti I Hydropower Plant	Bukwo	Small Hydro	2017	5	10.0	Take or Pay

13	Muvumbe Hydropower Plant	Kabale	Small Hydro	2017	6.5	9.4	Take or Pay
14	Tororo Solar North	Tororo	Solar PV	2017	10	11.0	Take or Pay
15	Rwimi Hydropower Plant	Kasese	Small Hydro	2017	5.5	9.8	Take or Pay
16	Nyamwamba Hydropower Plant	Kasese	Small Hydro	2018	9.2	8.5	Take or Pay
17	Kakira Sugar Limited	Jinja	Bagasse	2009	51.1	9.8	Take or Pay
18	Kinyara Sugar Limited	Masindi	Bagasse	2010	14.5	8.1	Take or Pay
19	Sugar and Allied Industries Limited	Kaliro	Bagasse	2015	11.9	9.6	Take or Pay
20	Sugar Corporation of Uganda Limited	Buikwe	Bagasse	1998	9.5	9.8	Energy Deal
21	Lubilia Hydropower Plant	Kasese	Small Hydro	2018	5.4	9.9	Take or Pay
22	Nkusi Hydropower Plant	Hoima	Small Hydro	2018	9.6	8.5	Take or Pay
23	Mahoma Hydropower Plant	Kabarole	Small Hydro	2018	2.7	10.9	Take or Pay
24	Waki Hydropower Plant	Hoima	Small Hydro	2018	4.8	8.5	Take or Pay
25	MSS Xsabo Power Limited	Kabulasoke	Solar PV	2018	20	11.0	Take or Pay

26	Isimba Hydropower Plant	Mukono	Large Hydro	2019	183	4.2	Energy Deal
27	Emerging Power	Mayuge	Solar PV	2019	10	11.0	Take or Pay
28	Sindila (Butama) Hydropower Plant	Bundibugyo	Small Hydro	2019	5.3	9.9	Take or Pay
29	Siti II Hydropower Plant	Bukwo	Small Hydro	2019	16.5	8.5	Take or Pay
30	Ziba Limited (Kyambura) Hydropower Plant	Rubirizi	Small Hydro	2019	7.6	9.9	Take or Pay
31	Ndugutu Hydropower Plant	Bundibugyo	small Hydro	2019	5.9	10.1	Take or Pay
32	Achwa II Hydropower Plant	Gulu	Large Hydro	2019	42	10.0	Take or Pay

*** UShs/kWh** **** Ushs/MW**

Appendix 2: Licensed Generation Projects in the Pipeline

No.	Power Plant	Technology	Capacity (MW)	COD	Tariff (US $)	PPA Term (Take or Pay, Capacity Deal, Energy Deal)
1	Nyamagasani 1 HPP	Hydro	15.0	2021	0.085	Take or Pay
2	Nyamagasani 2 HPP	Hydro	6.1	2021	0.096	Take or Pay
3	Muyembe HPP	Hydro	6.9	2021	0.092	Take or Pay
4	Kabeywa 1 HPP	Hydro	6.5	2022	0.094	Take or Pay
5	Kabeywa 2 HPP	Hydro	2.0	2023	0.107	Take or Pay
6	Achwa 2 HPP	Hydro	41.0	2021	0.1	Take or Pay
7	Karuma HPP	Hydro	600.0	2021	0.048	Energy Deal
8	Kikagati HPP	Hydro	14.0	2021	0.085	Take or Pay
9	Nyabuhuka HPP	Hydro	3.2	2023	0.107	Take or Pay
10	Kakaka HPP	Hydro	5.0	2021	0.100	Take or Pay
11	Nyagak III HPP	Hydro	5.5	2025	0.0574	Take or Pay
12	Nyamwamba II HPP	Hydro	7.3	2025	0.1	Energy Deal
13	Nyamabuye HPP	Hydro	7.0	2025	0.102	Take or Pay
14	SCOUL Bagasse Plant	Bagasse	25.0	2021	0.098	Energy Deal
15	Rupa Wind Power Project	wind	20.0	2023	0.101	Energy Deal
16	Atari HPP	Hydro	3.3	2022	0.107	Take or Pay
17	Sironko HPP	Hydro	7.0	2025	0.102	Take or Pay

No.	**Power Plant**	**Technology**	**Capacity (MW)**	**COD**	**Tariff (US $)**	**PPA Term (Take or Pay, Capacity Deal, Energy Deal)**
18	Simu HPP	Hydro	9.5	2024	0.095	Energy Deal
19	Sisi HPP	Hydro	7.0	2024	0.102	Energy Deal
20	Kigwabya HPP	Hydro	4.2	2025	0.0792	Energy Deal
21	Hoimo HPP	Hydro	3.3	2024	0.0535	Take or Pay
22	Igassa HPP	Hydro	0.3	2024	0.0535	Energy Deal
23	Kabasanja HPP	Hydro	0.4	2024	0.0535	Energy Deal
24	Tokwe HPP	Hydro	0.3	2024	0.0535	Energy Deal
25	Nsongya HPP	Hydro	0.7	2024	0.0535	Energy Deal
26	Katooke HPP	Hydro	0.3	2024	0.0535	Energy Deal
27	Nchwera HPP	Hydro	0.5	2024	0.0535	Energy Deal
28	Warugo HPP	hydro	0.5	2024	0.0535	Energy Deal
29	Xsabo Nkoge Solar	Solar	20.0	2023	0.071	Energy Deal

Appendix 3: Project under Feasibility Study

No.	Project Name	Technology	Capacity (MW)	District
1	Mukoki HPP	Hydro	3.4	Kabale
2	Ulepi Solar	Solar	10.0	Madi-Okollo
3	Kamuli Sugar Bagasse Power Plant	Cogeneration	3.0	Kamuli
4	Pramukh Steel Bagasse Power Plant	Cogeneration	8.0	Buikwe
5	Mitano HPP	Hydro	13.6	Rukungiri
6	Kisinga HPP	Hydro	2.5	Kasese
7	Ayago HPP	Hydro	840.0	Kiryandongo & Nwoya
8	Kiiba HPP	Hydro	400.0	Kiryandongo & Nwoya
9	Oriang HPP	Hydro	392.0	Kiryandongo & Nwoya
10	Muzizi HPP	Hydro	48.0	Kibaale
11	Unergy Biomass Power Project	Biomass	20.0	Masindi
12	Pece Biomass Power Project	Biomass	20.0	Gulu
13	Panyimur Geothermal Power Project	Geothermal	10.0	Packwach
14	Nsongi HPP	Hydro	7.0	Bunyangabu
15	Achwa-Aber Multipurpose HPP	Hydro	135.0	Pader
16	Kiraboha HPP	Hydro	5.0	Kasese
17	Latoro HPP on R Aswa	Hydro	4.2	Nwoya
18	Buwangani HPP	Hydro	7.0	Manafwa
19	Nyakinengo SHP	Hydro	5.2	Kanungu
20	Lower Achwa HPP	Hydro	17.4	Lamwo & Amuru
21	Awere HPP	Hydro	18.0	Pader
22	Okollo SHPP	Hydro	5.0	Arua
23	Rwembya SHPP	Hydro	0.4	Kasese
24	Lwakhakha HPP	Hydro	6.7	Namisindwa
25	Jinja Waste to Energy Power Project	Biomass	2.5	Jinja
26	Maziba HPP	Hydro	1.2	Kabale

27	Excess Associated Gas Thermal Power Project	Thermal	146.0	Albertine Region
28	Ngenge HPP	Hydro	13.8	Kween
29	Nengo Bridge HPP	Hydro	7.5	Kanungu
30	Atari 2 HPP	Hydro	2.0	Kapchorwa & Kween
31	Kingfisher Gas to Power Project	Thermal	39.1	Albertine Region

Appendix 4: Umeme Limited Distribution Infrastructure Costs (USD. Million)

	YEAR	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**Totals (USD. Million)**
Growth & Access	LV Voltage Compliance	6.00	6.00	6.00	6.00	6.00	6.00	36.00
	MV Lines/Cables	17.70	10.80	17.80	8.20	17.90	9.90	82.30
	LV Lines	2.00	2.00	1.90	1.90	1.70	1.70	11.20
	Power Transformers	5.20	4.80	2.40	4.50	4.00	1.80	22.70
	Substation Works	15.80	23.00	17.20	21.00	12.00	5.70	94.70
	Last Mile (New Connections)	28.00	28.00	28.10	28.10	28.30	28.30	168.80
	Sub - Total: Growth & Access	**74.70**	**74.60**	**73.40**	**69.70**	**69.90**	**53.40**	**415.70**
Asset replacement	Secondary Plant (Batter Banks, Relays, RTUS)	0.10	1.70	2.00	3.80	0.20	0.10	7.90

	YEAR	2020	2021	2022	2023	2024	2025	Totals (USD. Million)
	Primary Plant (Power Transformers and Switchgear, Plant House/Repairs)	6.60	5.60	3.10	4.90	3.10	2.10	25.40
	MV Line Restoration	4.90	4.30	3.20	2.20	1.60	1.10	17.30
	LV Reliability Improvement (Restoration)	9.10	7.60	7.30	7.70	11.20	8.00	50.90
	Metering and Metering Units, Connection Accessories, Retrofits and AMR	26.50	7.30	8.20	12.20	28.00	43.60	125.80
	Sub - Total: Asset Replacement	**47.20**	**26.50**	**23.80**	**30.80**	**44.10**	**54.90**	**227.30**
Technical Loss Reduction	New Substation and Splitting Feeders	6.60	7.20	3.50				17.30
	LV-ABC Conversion	11.56						11.56
	MV Conductor Upgrade	4.20						4.20

	YEAR	2020	2021	2022	2023	2024	2025	Totals (USD. Million)
	Sub - Total: Technical Loss Reduction	**22.36**	**7.20**	**3.50**	**-**	**-**	**-**	**33.06**
Reliability, Security of Supply & Asset Mgt Systems	New Substations and Integration Lines	3.00	4.50	11.70	24.00	3.80	-	47.00
	Meshing and Feeder Reconfiguration for N-1 Redundancy	6.80	2.70	1.80	1.30	0.90	0.80	14.30
	Distribution Automation for Worst Performing Feeders	3.10	2.70	4.80	3.60	0.30	0.30	14.80
	New Switching Stations Addressing Legacy Networks	-	18.10	12.80	0.70	1.50	-	33.10
	Security of Supply (Substations)	4.30	1.50	1.20	1.00	2.40	2.00	12.40
	Security of Supply (LPUs)	2.80	0.10	-	-	-	-	2.90
	Urban OH to UG Conversion	3.80	3.80	2.50	2.50	3.80	3.80	20.20
	MV Line Restoration	5.80	4.90	4.30	3.20	2.20	1.60	22.00

	YEAR	2020	2021	2022	2023	2024	2025	Totals (USD. Million)
	LV Network Restoration	15.80	13.40	13.50	10.50	7.60	7.30	68.10
	Asset Management Systems	3.55	2.75	2.20	1.50	-		10.00
	Sub - Total: Reliability Improvement	**48.95**	**54.45**	**54.80**	**48.30**	**22.50**	**15.80**	**244.80**
	GRAND TOTAL	**193.21**	**162.75**	**155.50**	**148.80**	**136.50**	**124.10**	**920.86**

Appendix 5: UETCL PROJECTS

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
A	**POWER EVACUATION PROJECTS**				
1	Bujagali 220kV Switchyard Project (2X250MVA 220/132/33kV Power Transformers).	Evacuation of Power from Bujagali HPP.	9,001.80	AfDB at EPC.	9,001,795.017
2	Karuma Hydro Power & Interconnection Project (2X650MVA 400/132kV Karuma SS, 2X20MVA 132/33kV Karuma SS 2X650MVA 400/132kV Kawanda SS, 2X20MVA 132/33kV Olwiyo SS; 248km 400kV Karuma - Kawanda Transmission Line, 54.2km 400kV Karuma - Olwiyo Transmission Line, 75.5km 132kV Karuma - Lira Transmission Line).	Evacuation of Power from Karuma HPP and Supporting Rural Electrification Program.	320,432.78	China EXIM Bank at EPC.	320,432,782.2
3	220kV Nkenda - FortPortal - Hoima (2X40MVA 132/33kV Hoima SS; 54km 220kV Nkenda - FortPortal Transmission Line, 172km 220kV FortPortal - Hoima SS).	Improvement of Reliability and Quality of Supply in the Western Region of Uganda. Provision of Transmission Capacity to Evacuate Power from Kabaale 53 MW Testcrude.	81,807.85	Government of the Royal Kingdom of Norway and French Development Agency (AFD) at EPC.	81,807,847.34
4	132kV 42km Isimba Interconnection Project.	Provision of Transmission Capacity to Evacuate Power from Isimba HPP.	578,414.20	China EXIM Bank at EPC.	l578,414,196.1

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
5	220kV Bujagali - Kawanda Line Bays.	Provision of Transmission Capacity to Evacuate Power from Bujagali Substation.	3,182.81	World Bank at EPC.	3,182,813.14
6	Muzizi Interconnection: (2x90 MVA 220/132/33 kV Muzizi Substation).	Provision of Transmission Capacity to Evacuate Power from Muzizi SHPP.	Under Consideration for Funding Using EPC+F	Under Consideration for Funding Using EPC+F	0
7	Ayago Interconnection Project (2km 400kV Ayago - Nile HPPs Switching Station Underground Cable; 10km 400kV Nile HPPs Switching Station - T-Ayago Underground Cable).	Provision of transmission capacity to evacuate power from Ayago HPP.	33,789.20	Under Consideration using EPC + F (China Gezhouba Bank).	33,789,203.99
8	37.3km 132kV Mirama-Kikagati-Nsongezi (2X32/40MVA 132/33kV Nsongezi SS).	Provision of Transmission Capacity to Evacuate Power.	Under Consideration using EPC + F	Under Consideration using EPC + F	0

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
9	183km, 132kV Single Circuit Agago - Lira Transmission Line on Wooden Structures and Related Substations.	Provision of Transmission Capacity to Evacuate Power from Agago 42 MW HPP.	21,728.42	GOU	21,728,423.89
10	83km 132kV Gulu-Agago TL Project (2X32/40MVA 132/33kV Agago SS).	Provision of Transmission Capacity to Evacuate Power from Agago 83MW HPP.	39,432.65	GOU at FS and kfW at EPC.	39,432,649.9
11	45km 220kV Hoima-Kinyara (2X90/40MVA 220/132/33kV Kinyara Substation).	Provision of Transmission Capacity to Evacuate Power.	46,261.08	Government of the Royal Kingdom of Norway at FS. EPC Funding to be determined	46,261,079.67
12	74km 132kV Mbale - Bulambuli - Kapterol Transmission Line; 2X 60/80MVA 132/33kV Mbale SS, 2X45/60MVA 132/33kV Kapterol SS.	Provision of Transmission Capacity to Evacuate Power from IPPs in Bulambuli area.	57,063.71	KFW at FS	57,063,711.64

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
13	Extension of Transmission Grid to Evacuate Excess Electricity Generated from Tilenga and Kingfisher Oil Fields (Substations: 2x32/40MVA 132/33KV King Fisher SS, 3x32/40MVA 132/33KV Tilenga SS & 2x250/250/50MVA 220/132/33 kV Kabaale SS; Transmission Lines: 135km, 132kV Transmission Line from Tilenga SS to Kabaale SS & 50km, 132kV Transmission Line from Kingfisher SS to Kabaale SS).	Provision of Transmission Capacity to Evacuate Power from Tilenga and King Fisher Oil Fields.	Under Consideration using EPC + F	Under Consideration using EPC + F	0
14	400kV Oriang Interconnection Project (10km 400kV Oriang - Nile HPPs Switching Station Underground Cable).	Provision of Transmission Capacity to Evacuate Power from Oriang HPP.	To be determined.	To be determined.	0
15	400kV Kiba Interconnection Project (10km 400kV Kiba - Nile HPPs Switching Station Underground Cable).	Provision of Transmission Capacity to Evacuate Power from Kiba HPP.	To be determined.	To be determined.	0
16	400kV Uhuru Falls Interconnection Project (145km 400kV Uhuru - Tilenga - Kabaale Transmission Line).	Provision of Transmission Capacity to Evacuate Power from Uhuru Falls.	To be determined.	To be determined.	0

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
			1,191,115		
B	**GRID RE-INVESTMENT PROJECTS**				
	High Voltage Transmission Line Works				
1	Kabulasoke-Nkonge-Nkenda 132kV 216.5 km (Re-stringing)	Improvement of Reliability and Power Supply Quality.	To be determined.	To be determined.	0
2	Kabulasoke-Masaka West 132kV 60km (Re-stringing)	Improvement of Reliability and Power Supply Quality	To be determined	To be determined	0
3	Reconductoring 3km of Bujagali - Nalubale line with HTLS Conductor	Improvement of Reliability and Power Supply Quality.	To be determined.	To be determined.	0
4	Reconductoring 113km of Bujagali - Tororo line with HTLS Conductor.	Improvement of Reliability and Power Supply Quality.	To be determined.	To be determined.	0
	Substation Works				

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
1	50MVA 33/33kV Bujagali Phase Shifting Transformers.	Enable Power Supply to the Distribution Network.	To be determined.	To be determined.	0
2	Mirama Substation Upgrade (2X50/63MVA, 132/33kV Transformers).	Enable Power Supply to the Distribution Network.	To be determined.	Under Consideration using EPC + F	0
3	2X250MVA 220/132kV Tororo Interbus Transformers.	Connection of 132kV Grid to the 220kV Grid at the Substation.	To be determined.	Under Consideration using EPC + F	0
4	2X250MVA 220/132kV Mbarara South Interbus Transformers.	Connection of 132kV Grid to the 220kV Grid at the Substation.	To be determined.	Under Consideration using EPC + F	0
5	Reallocation of 1X60MVA 220/132/33kv Transformer From Mbarara to Mirama Substation.	Provision Of Additional Transformation Capacity.	To be determined.	Under Consideration Using EPC + F	0
6	Refurbishment of Transformer bay and shift of 20MVA Transformer to Lira Substation from Tororo.	Improvement of Reliability and Power Supply Quality.	80.00	GOU	80,000

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
7	10MVAr 11kV Capacitor Banks at Lugazi.	Improvement of Reliability and Power Supply Quality.	510.00	GOU	510,000
8	20mvar Capacitor Banks At Sukulu 10.5kv Bus.	Improvement Of Reliability And Power Supply Quality.	700.00	Developer of Sukulu Phosphate Factory.	700,000
9	Tororo 80MVA, 132/33kV.	Improvement of Reliability and Power Supply Quality	2,219.18	GOU	2,219,178.082
10	Mbarara North Substation Upgrade (2x50/63MVA, 132/33kV Power Transformers)	Improvement of Reliability and Power Supply Quality	To be determined.	Under Consideration for Funding Using EPC+F	0
11	Kampala North substation upgrade (1X32/40MVA 132/33kV Transformer).	Provision of Adequate Capacity.	1,972.60	GOU	1,972,602.74
12	Kawanda Substation upgrade (1X32/40MVA 132/33kV Transformer).	Provision of Adequate Capacity.	1,972.60	GOU	1,972,602.74
13	Opuyo Substation 132/33kV Upgrade (2X32/40MVA 132/33kV Transformers).	Provision of Adequate Capacity.	5,800.00	KFW	5,800,000

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
14	Nkenda Substation 132/33kV Upgrade (2X60MVA 132/33kV Transformers).	Increase Substation Capacity.	11,992.20	World Bank for Tender Document Preparation. EPC - To Be Determined.	11,992,200
15	2km 132kV Mukono - Nalubaale Toff - Lugazi SS (2X32/40MVA 132/33kV Lugazi SS).	Provision of Adequate Capacity, Improvement of Reliability	To be determined.	To be determined.	0
16	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	Provision of Adequate Capacity, Improvement of Reliability.	138,700.00	JICA at EPC	138,700,000

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
	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, 3X125MVA 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).				

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
17	Power Transformers Project 1 (Reinforced Substations: 2X32/40MVA 132/33kV Nkonge SS, 2X50/60MVA 132/33kV Mutundwe SS, 2X50/60MVA 132/11kV Mutundwe SS, 2X50/60MVA 132/33kV Lugogo SS, 2X50/60MVA 132/11kV Lugogo SS, 2X50/60MVA 132/33kV Masaka West SS; New Substations: 3X50/60MVA 132/33kV Jinja SS, 2X40MVA 132/33kV Mubende SS, 2X40MVA 132/33kV Ishaka SS & 2X40MVA 132/33kV Rakai SS; Transmission Lines: 5km 132kV Bujagali Tororo T-Off to Jinja SS, 30km 132kV Nkonge - Mubende, 10km 132kV Mbarara South - Nkenda to Ishaka & 10km 132kV Masaka - Kyaka T-Off to Rakai).	Provision of Adequate Capacity, Improvement of Reliability.	To be determined.	Under Consideration using EPC + F	0
18	Substation Reinforcement Project (Upgrade of Tororo Substation (3x50/63MVA, 132/33kV Power Transformers) & Upgrade of Kole Substation (2x32/40MVA, 132/33kV Power Transformers).	Provision of Adequate Capacity, Improvement of Reliability.	To be determined.	Under Consideration using EPC + F	0

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
19	Upgrade of Nkenda - Hoima to 220kV (Nkenda 2X250MVA 220/132/33kV Substation, 2X90MVA Fort Portal 220/132/33kV Substation, 2X250MVA Hoima 220/132/33kV Substation).	Provision of Adequate Capacity, Improvement of Reliability.	To be determined.	Under Consideration using EPC + F	0
			163,946.58		
C	**System Expansion Projects**				
1	160km 132kV Mbarara-Nkenda & 260km 132kV Tororo - Opuyo - Lira TL Project & 2X32/40MVA 132/33kV Fortportal SS.	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.	31,442.21	AfDB at EPC	31,442,214.49

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
2	137km 220kV Kawanda-Masaka Project: Substations; 2X125MVA 220/132kV Masaka SS; 2X250MVA 220/132kV Kawanda SS; 15MVAr 220kV Shunt Reactor at Masaka SS; 2X15MVAr 220kV Shunt Reactor at Mbarara SS.	Improvement of Reliability, Availability, and Quality of Power Supply.	66,921.53	WB at EPC	66,921,533.63
3	23.5km 132kV Mutundwe-Entebbe Transmission Line Project: Substation; 2X60/80MVA 132/33kV Entebbe SS.	Improvement of Reliability and Quality of Power Supply.	57,291.03	KFW at FS and EPC	57,291,028.48
4	Queensway SS Project (2X32/40MVA 132/33kV SS).	Improvement of Reliability, Availability, and Quality of Power Supply.	6,330.26	JICA at EPC	6,330,259.849

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
5	Industrial Parks SS Project: Substations; 3X32/40MVA 132/33kV Luzira SS, 3X40/63 MVA 132/33kV Mukono SS, 2X32/40MVA 132/33kV Iganga SS, 3X40/63MVA 132/33kV; Transmission Lines; 15km 132kV 2cct Namanve South SS - Luzira SS, 8km 132kV 2cct 132kV Nalubaale-Namanve Transmission Line to Mukono SS, 15km 132kV 2cct from the Existing 132kV Bujagali-Tororo Transmission Line to Iganga SS & 6km 132kV 2cct from the Existing 132/33kV Namanve Substation and 132kV Nalubaale-Namanve Transmission Line to the proposed Namanve South SS.	Improvement of Availability, Reliability, and Quality of Power Supply.	127,895.12	China EXIM Bank at EPC	127,895,117.5
6	160km 132kV Opuyo-Moroto Transmission Line Project (2X32/40MVA 132/33kV Moroto SS).	Grid Expansion to serve new load centers and Supporting Rural Electrification Programme.	64,147.60	ISDB at EPC	64,147,601.24

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
7	130km 132kV Bulambuli - Moroto Transmission Line (2X60/80MVA 132/33kV Bulambuli SS).	Improvement in the Availability of Power Supply.	To be determined.	To be determined.	0
8	90km 132kV Kabale – Ishaka Transmission Line Project.	Improvement in the Availability of Power Supply.	To be determined.	To be determined.	0
9	65km 132kV Kitgum - Agago Transmission Line (2X15/20MVA 132/33kV Kitgum SS).	Improvement in the Availability of Power Supply.	To be determined.	To be determined.	0
10	220km 132kV Kitgum - Moroto Transmission Line.	Improvement in the Availability of Power Supply.	To be determined.	To be determined.	0
11	110km 132kV Agago - Adjumani Transmission Line Project (2X15/20MVA 132/33kV Adjumani SS).	Improvement in the Availability of Power Supply.	To be determined.	To be determined.	0
12	105km 132kV Adjumani - Arua Transmission Line.	Improvement in the Availability of Power Supply.	To be determined.	To be determined.	0

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
13	85km 132kV Mirama - Kabale Transmission Line (2X32/40MVA 132/33kV Kabale SS).	Improvement of the Availability, Reliability, and Quality of Power Supply.	49,067.07	ISDB at EPC	49,067,071.71
14	130.5km 400kV Masaka - Mbarara Transmission Line	Improvement of the Availability, Reliability, and Quality of Power Supply.	106,829.86	AFD at FS and EPC	106,829,858.2
15	132kV Mutundwe-Gaba-Luzira (32/40MVA 132/33kV Gaba SS; 25km 132kV Mutundwe - Gaba Transmission Line, 25km 132kV Gaba - Luzira Transmission Line).	Improvement of the Availability, Reliability, and Quality of Power Supply.	To be determined.	To be determined	0
16	132kV Lira-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: 90km 132kV Lira SS - Gulu SS, 160km 132kV Gulu SS - Nebbi SS & 63km 132kV Nebbi SS - Arua SS).	Improvement of the availability, Reliability, and Quality of Power Supply.	96,941.73	World Bank at FS & EPC	96,941,729.03

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
17	65 km 132kV Mubende - Kiboga Transmission Line (2X15/20MVA 132/33kV Kiboga SS).	Improvement of the Availability, Reliability, and Quality of Power Supply.	82,681.52	GOU	82,681,520.07
18	47km 220kV Kinyara-Kafu Transmission Line (2x250/250MVA, 400/220/33kV Kafu SS).	Improvement of the Availability, Reliability, and Quality of Power Supply	To be determined.	To be determined.	0
19	54km 132kV Kawanda - Kasana (1X20MVA 132/33kV Kawanda SS, 1X20MVA 132/33kV Kasana SS & 132kV Matugga Switching Station).	Improvement of the Availability, Reliability, and Quality of Power Supply	To be determined.	To be determined.	0
20	50km 220kV Buloba - Gaba Transmission Line (2X60MVA 220/132/33kV Gaba SS).	Improvement of the Availability, Reliability, and Quality of Power Supply.	To be determined.	To be determined.	0
21	303km 220kV Nkenda - Buloba Transmission Line (Consideration to be made for 400kV; initially operated at 220kV).	Improvement of the Availability, Reliability, and Quality of Power Supply.	To be determined.	To be determined.	0

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
22	345km 400kV Karuma - Tororo Transmisson Line (2X650MVA 400/220kV Tororo SS).	Improvement of the Availability, Reliability, and Quality of Power Supply.	To be determined.	To be determined.	0
23	Sukulu Phosphate Transmission Line Project (2X50/63MVA 132/10.5kV Power Transformers - Phase 1; 2x125MVA, 220/10.5kV Power Transformers - Phase 2).	Improvement of the Availability, Reliability, and Quality of Power Supply.	To be determined.	To be determined.	0
24	T-Matugga - Kapeeka (Substations: 1X20MVA 132/33kV Kapeeka, 132kV Matugga Switching Station; Transmission Lines: 45km 132kV T-Matugga - Kasana).	Improvement of the Availability, Reliability, and Quality of Power Supply.	6,953.11	GOU	6,953,108
25	Nakasongola - Kaweweeta - Kapeeka (2X32/40MVA 132/33kV Nakasongola SS, 2X32/40MVA 132/33kV Kaweweeta SS; 160km, 132kV double circuit Nakasongola, Kaweweta Kapeka Transmission Line).	Improvement of the Availability, Reliability, and Quality of Power Supply.	To be determined.	To be determined.	0

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
26	37km 220kV Wobulenzi - Kapeeka Transmission Line (2x250/250/50MVA 400/220/33kV Wobulenzi Substation, 2x125MVA 220/132/33kV Kapeeka Substation, 3X50/63MVA 132/33kV Kapeeka SS).	Improvement of the Availability, Reliability, and Quality of Power Supply.	To be determined.	Under Consideration using EPC + F	0
27	142.9km220kV Kapeeka - Kiboga - Hoima Transmission Line.	Improvement of the Availability, Reliability, and Quality of Power Supply.	To be determined.	Under Consideration using EPC + F	0
28	Mbale Industrial and Business Park Substation (3X60/80MVA 132/33kV Transformers).	Improvement of the Availability, Reliability, and Quality of Power Supply to several Industrial Parks in Mbale.	To be determined.	To be determined.	0

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
29	Standard Gauge Railway Transmission Line Project (Substations: 2X10MVA 132/27.5kV Tororo, Buwoola, Iganga, Nyenga, and Kampala East Traction Stations; Transmission Lines: 11km 132kV 2cct from UETCL Tororo to the SGR Tororo SS, 64km 132kV 2cct double pi-branch off from Bujagali – Tororo 132kV to the SGR Buwoola SS, 3.5km 132kV 2cct from UETCL Iganga Industrial Park SS to SGR Iganga SS, 5km 132kV cct double pi-branch off from Nalubaale – Lugogo 132kV to the SGR Nyenga Traction SS & 3.7km 132kV 2cct from UETCL Namanve South Industrial Park SS to SGR Kampala East Traction SS).	Improvement of Availability, Reliability, and Quality of Power Supply.	To be determined.	To be determined.	0
30	Olwiyo 400kV Line Bays.	Improvement of the Availability, Reliability, and Quality of Power Supply.	To be determined.	To be determined.	0
D	**Other System Expansion Projects**				

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
1	SCADA and Communication upgrade and Emergency Control Centre.	Improvement of the Availability, Reliability, and Quality of Power Supply.	7,590.00	World Bank.	7,590,000
			704091.04		
E	**Regional Interconnection Projects**				
1	220kV NELSAP (Bujagali - Tororo & Mbarara - Mirama): Substations: 1X60MVA 220/132 Mirama SS, 1X60MVA 220/132kV Mbarara SS, 20MVAr 220kV Shunt Reactors at Mbarara, Mirama and Tororo SSs; Transmission Lines: 127km 220kV Bujagali – Tororo- UG/KY Border & 66km 220kV Mbarara – Mirama-UG/RW Border).	Regional Power Trade.	26,182.20	AfDB and JICA at EPC	26,182,201.11
2	Nkenda-Mpondwe (D.R.Congo) 220kV, 72.5km Uganda's side (Consideration to be made for 400kV; initially operated at 220kV).	Regional Power Trade.	To be determined.	Under Consideration Using EPC + F	0
3	400kV Northern Corridor (Substations:2X200MVA, 400/220kV transformers at, New Masaka, New	Improvement of the Availability, Reliability,	494,657.56	Government of Uganda Government	494,657,563.9

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
	Mbarara, and Shango SSs; Transmission Lines: 5.76km 220kV Double Circuit Transmission Line from 220/132kV Tororo SS to 400/220kV Tororo SS, 41.4km 220kV Double Circuit Transmission Line from 220/132kV Kawanda SS to 400/220kV Wobulenzi SS, 2.16km 220kV Double Circuit Transmission Line from 220/132kV Mbarara SS to 400/220kV Mbarara SS, 198km 400kV Double Circuit Transmission Line from 400/220kV Tororo SS - 400/220kV Wobulenzi SS, 152km 400kV Double Circuit Transmission Line from 400/220kV Wobulenzi SS - 400/220kV New Masaka SS, 130km 400kV Double Circuit Transmission Line from 400/220kV New Masaka - 400/220kV New Mbarara SS & 160km 400kV Double Circuit Transmission Line from 400/220kV New Mbarara - 400/220kV Shango SS).	and Quality of Power Supply.		of Rwanda/Government of Kenya at FS.	

No.	PROJECT	OBJECTIVE	COST(X1000 USD)	FINANCIER	USD
4	82km 220kV Masaka - Mutukula - Mwanza Transmission Line (Consideration to be made for 400kV; initially operated at 220kV).	Regional Power Trade.	To be determined.	To be determined.	0
5	400kV Olwiyo-Nimule-Juba (Sudan) 400kV Line (Substation: 2X150MVA 400/220kV Olwiyo SS; 190km Olwiyo - Nimule - Juba Transmisison Line- Uganda's part).	Regional Power Trade.	To be determined.	To be determined.	0
6	15km 132kV Arua - Arua TL Project (2X15/20MVA 132/33kV Arua SS).	Regional Power Trade.	To be determined.	To be determined.	0
			520,840		**2579991894**