ELECTRICITY REGULATORY AUTHORITY

UGANDA ELECTRICITY SUPPLY INDUSTRY

An abstract of commercial performance

2010 - 2014

Table of Contents

List of Tables

List of figures

1. INTRODUCTION

This report is abstract of the commercial performance of Uganda's electricity supply industry for the period 2010 to 2014. The abstract is compiled from the statistical database of Electricity Regulatory Authority (ERA). The database is a compilation of statistics from quarterly technical, environmental, commercial, and financial reports that are submitted by all utilities or companies licensed by ERA to operate in the industry.

All data submitted by licensees is rigorously checked and validated for accuracy before adding to the database.

This abstract is structured under three major sections: electricity demand and supply, energy sales in bulk and electricity distribution and supply. Under the section on electricity demand and supply, we provide information on the 5-year trend (2010 – 2014) of country's licensed generation capacity, demand and supply situation, energy generated and imported.

Under the section on energy sales in bulk, we explain the 5-year trend of Uganda's energy sales in the domestic and export market including transmission losses, and bulk supply tariffs in the domestic and export market. The last section provides information on growth in customer numbers connected on the grid, energy sales and losses by distribution companies and end-user retail tariffs.

1. ELECTRICITY DEMAND AND SUPPLY

1.1 Generation capacity

Electricity generation plants in Uganda that sell power onto the national grid are composed of three (3) large hydro power plants, six (6) small hydro power plants, two (2) thermal (heavy fuel oil –HFO) power plants, and two (2) bagasse-based cogeneration power plants (Table 1). As at the end of 2014, thirteen (13) power plants were selling to the national grid with a total licensed generation capacity of 828.5MW.

Table 1: Electricity generation capacity in Uganda as at the end of 2014

	Generation Plant	Capacity (MW)	Percent of capacity
A	**Large Hydro Power Plants**	**630**	**78%**
1	Bujagali	250	31%
2	Kiira	200	25%
3	Nalubaale	180	22%
B	**Small Hydro Power Plants**	**61.5**	**8%**
1	Mpanga	18	2%
2	Mobuku 1	5.0	1%
3	Mobuku II	13.0	2%
4	Mobuku III	9.9	1%
5	Kabalega	9	1%
6	Ishasha	6.6	1%
C	**Thermal Power Plants**	**100**	**12%**
1	Namanve	50	6%
2	Tororo	50	6%
D	**Co-generation Power Plants**	**37**	**2%**
1	Kakira	32	1%
2	Kinyara	5	1%
	TOTAL	**828.5**	**100%**

All small hydro power plants (SHPPs), thermal power plants and cogeneration power plants in Uganda are operated by independent power producers (IPPs). It is only Kiira and Nalubaale HPPs that are owned by Government of Uganda but currently concessioned to and operated by Eskom Uganda Limited. The Bujagali HPP on the other hand was established by Government of Uganda and Bujagali Energy Limited (BEL) as a public private partnership (PPP). This plant is operated by BEL.

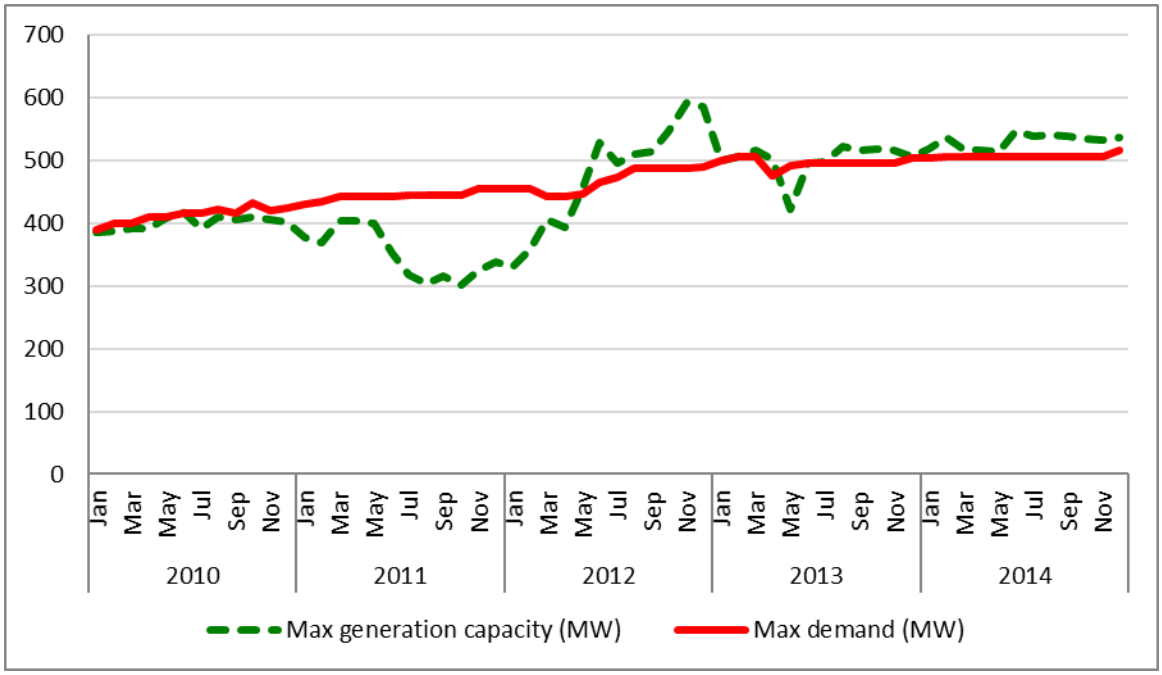
Uganda's Electricity Supply Industry (ESI) is highly dependent on hydro power plants (86%), where large hydro power plants contribute up to 78% of the generation capacity and the small hydro power plants contribute 8%. The generation from the other technologies including plant-by-plant contribution to total generation capacity is indicated in Table 1.

Besides the power plants that supply the national grid, there are a few power plants that generate and sell power within a specific locality and are not connected to the national transmission grid system, and these are categorized as off-grids. As at the end of 2014, there were three (3) off-grids namely; the 3.5 MW Nyagak 1 hydro power plant located in West Nile region and operated by West Nile Rural Electrification Company (WENRECo); 1.6MW solar-diesel hybrid power plant located on Bugala Island and operated by Kalangala Infrastructure Services; and the 0.3MW Kisiizi Hospital Power Plant located in Rukungiri District.

1.2 Electricity maximum generation capacity and maximum demand

Figure 1 shows the 2010 to 2014 trend of the declared maximum generation vis-à-vis the registered maximum demand on the grid system in Uganda. The figure indicates that until May 2012, the registered maximum demand on Uganda's electricity grid outstripped the generation capacity of the country.

Figure 1: Maximum generation capacity vis-à-vis demand capacity (MW)



From 2012 onwards, the country's declared generation capacity is barely above the registered maximum demand. Important to note however is that the generation capacity depicted in Figure 1 does not include the full capacity of thermal power plants whose generation capacity is currently curtailed to a maximum of 7MW per plant.

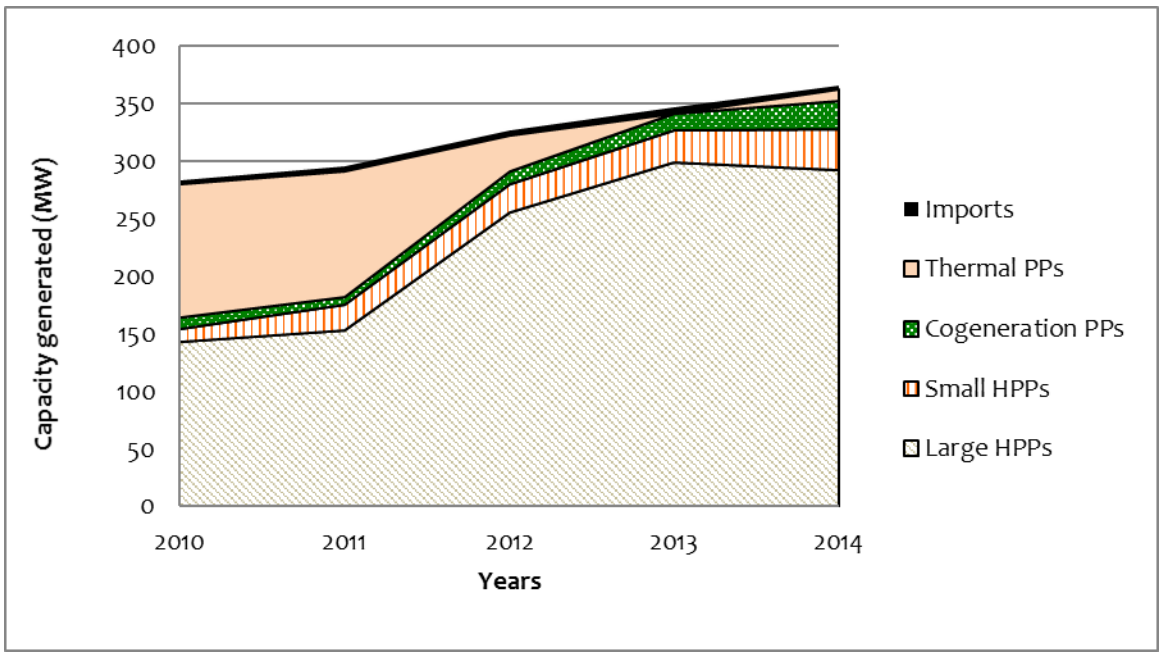
The nature of the electricity system dictates balancing demand with supply, otherwise the load (demand) is shed. As such, an electricity network of a country is usually interconnected with that of other countries to provide for any eventual shortage in domestic supply through imports. Uganda's national grid is interconnected with that of neighbouring states, namely Kenya, Tanzania, Rwanda and Democratic of Congo. Thus total electricity demand in Uganda is supplied by capacity generated within the country and where it is necessary, capacity is imported to meet the demand.

1.3 Electricity demand/supply

The nature of the electricity system dictates balancing demand with supply, otherwise the load (demand) is shed. As such an electricity network of a country is usually interconnected with that of other countries to provide for any eventual shortage in domestic supply through imports. Uganda's national grid is interconnected with that of neighbouring states, namely Kenya, Tanzania, Rwanda and Democratic of Congo. Thus total electricity demand in Uganda is supplied by capacity that is generated within the country and that which is imported.

Figure 2 shows the total electricity demand/supply by technology/source for the past five years. The graph indicates that between 2010 and 2014, there was a 29%, growth in total demand/supply of electricity in Uganda from an average of 284MW in 2010 to 366MW in 2014.

Figure 2: Electricity demand/supply (MW) by technology



The figure indicates that in 2012 and 2013, there was a notable increase in demand/supply from large hydro power plants on one hand and a significant reduction in demand/supply thermal HFO plants, which hitherto in 2010 contributed up to 40% of electricity generated in the country.

Besides large hydro power plants, and from 2012 onwards, electricity demand/supply from small hydro power plants and bagasse cogeneration power plants also increased to some extent. By 2013, electricity demand/supply from thermal HFO plants had plummeted to 1% and 3% in 2014.

Besides domestic supply, Uganda also imports a limited capacity (less than 1% of total demand) to balance system demand. Between 2010 and 2014, the country imported an average of 4.2MW mainly from Kenya (4MW) and to a limited extent from Rwanda (0.2MW).

1.4 Energy generated and imported

The bulk of electricity required in the country is locally generated. As at the end of 2014, Uganda's electricity demand/supply stood at 3,288GWh and only 1% (equivalent to 33GWh) was imported mainly from Kenya (Figure 3).

Figure 3: Energy generated and imported

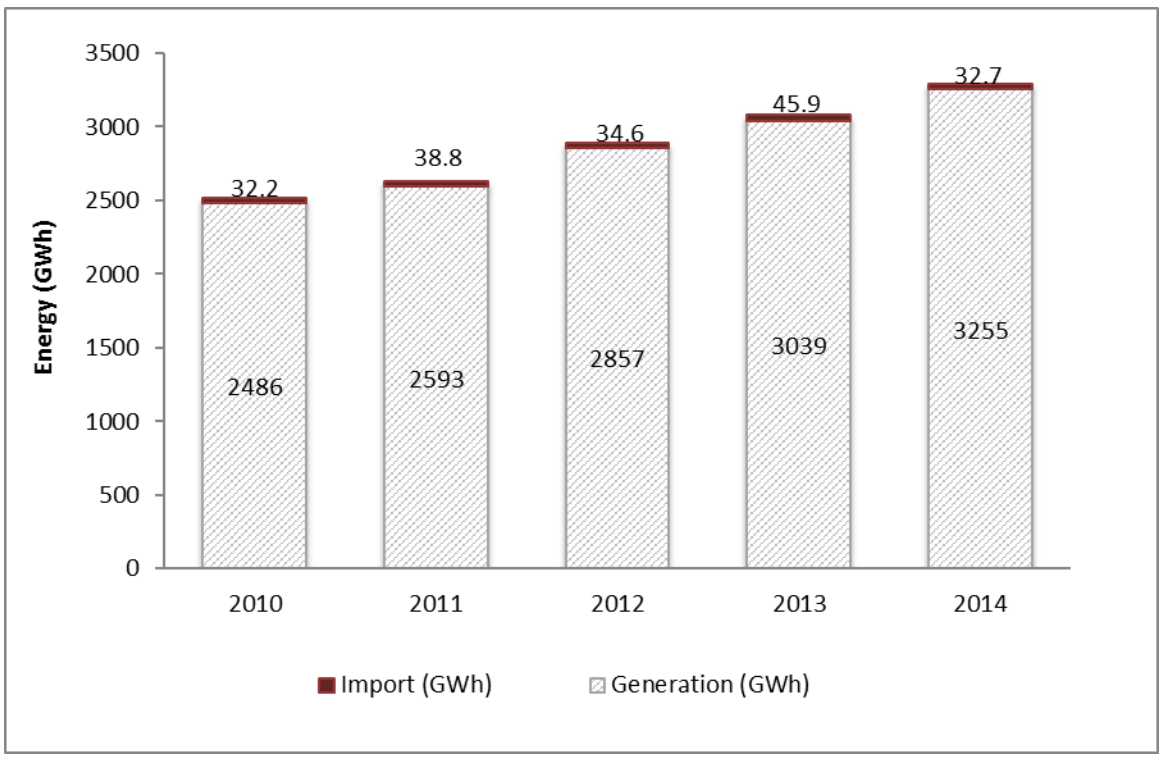
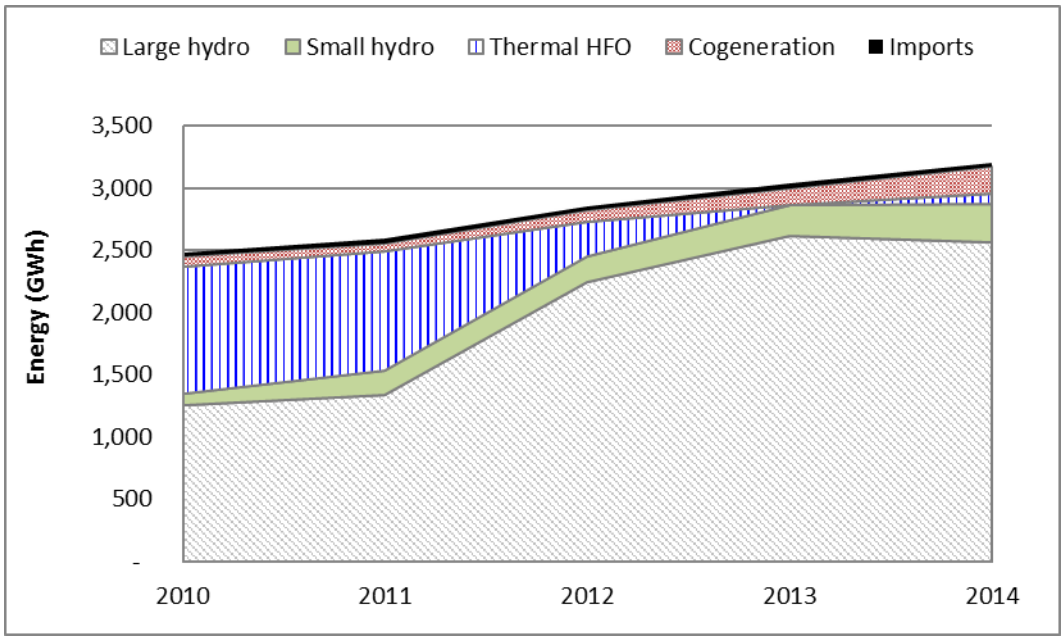


Figure 4 shows that trend of energy generated by technology over the past five years. The trend indicates that from 2012 onwards, energy generated from large hydro power plants increased dramatically and energy generated from thermal power plants declined significantly. This situation was as a result of the commissioning of the 250MW Bujagali HPP in 2012 and the subsequent reduction of the volume of energy generated by two thermal power plants. At present, each of the two thermal power plants generates a maximum of 7MW only.

Figure 4: Energy generated by technology and imported, GWh



Following the commissioning of Bujagali HPP, few small HPPs were also commissioned. These include Kabalega HPP commissioned in 2013, Ishasha HPP commissioned in 2012, Mobuku III (Bugoye) also commissioned in 2012. In 2014, Kakira Sugar Limited, a cogeneration power plant increased its generation capacity to the grid from 12MW to 32MW.

All the initiatives above have led to the increase in electricity energy generation in Uganda by 68%; from about 2,000GWh in 2010 to 3,300Gwh in 2014. Details on generation statistics are available on our website at http://www.era.or.ug/index.php/statistics-tariffs/2013-11-27-16-54-30

2. ENERGY SALES IN BULK

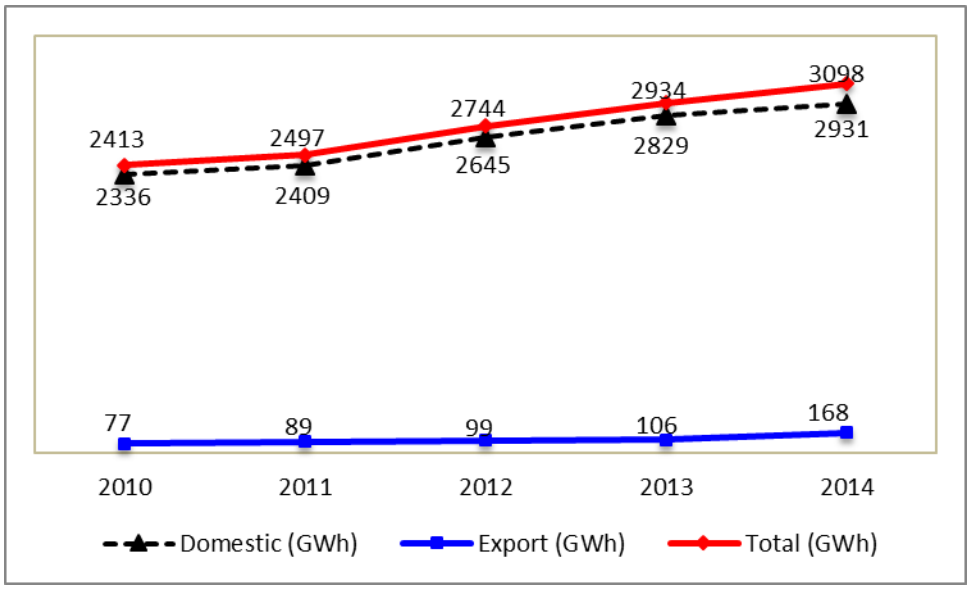
Uganda's current electricity supply industry structure requires that all energy generated for the national grid is sold to the System Operator -a government company that is a single buyer. This company, -called Uganda Electricity Transmission Company Limited (UETCL), is also the only company licensed to sell electricity in bulk to grid-connected distribution companies within the country. Besides, UETCL is the only company involved in transportation of electricity at high voltage (66kV and above –currently up to 220kV) and export and import of power outside of and into the country.

As a bulk buyer, UETCL has a metering interface with electricity generators installed next to the generation plant, and buys all the energy generated as indicated in Figure 4. This energy is immediately sold to distribution companies and/or transported and exported as the case may require.

2.1 Domestic sales and export

Figure 5 shows the trend of electrical energy sales by UETCL in the domestic and export market. The figure generally indicates that for all the years under review, UETCL sold the bulk of energy in the domestic market and very little was exported.

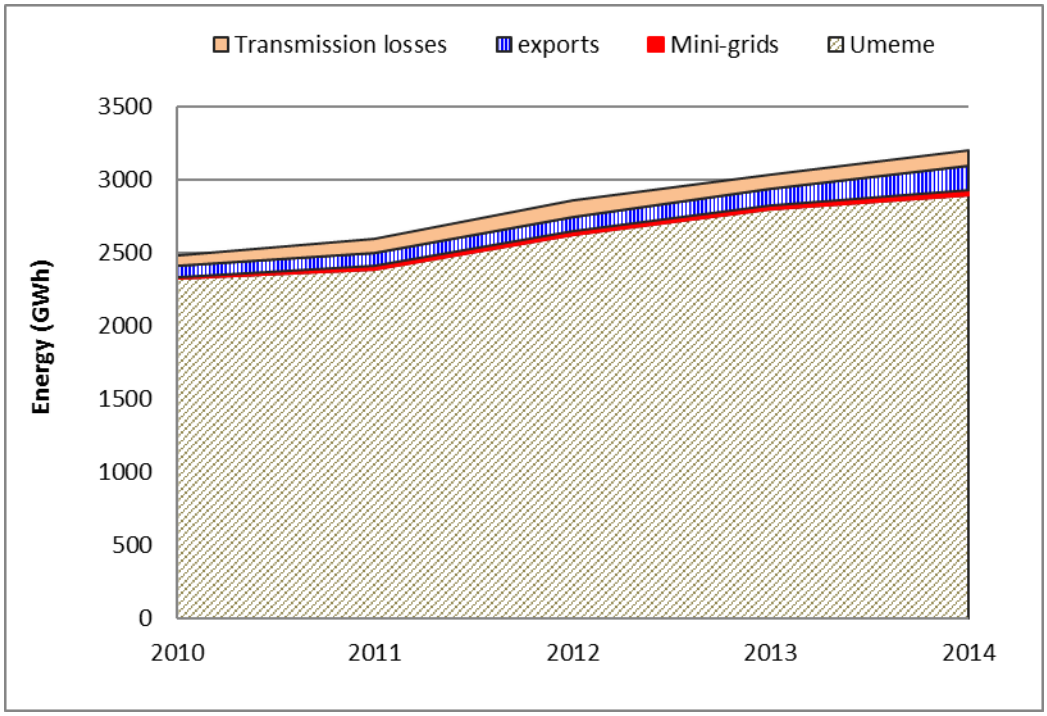
Figure 5: Energy sales, domestic and export (GWh)



2.3 Energy sales to distribution companies, exports and losses

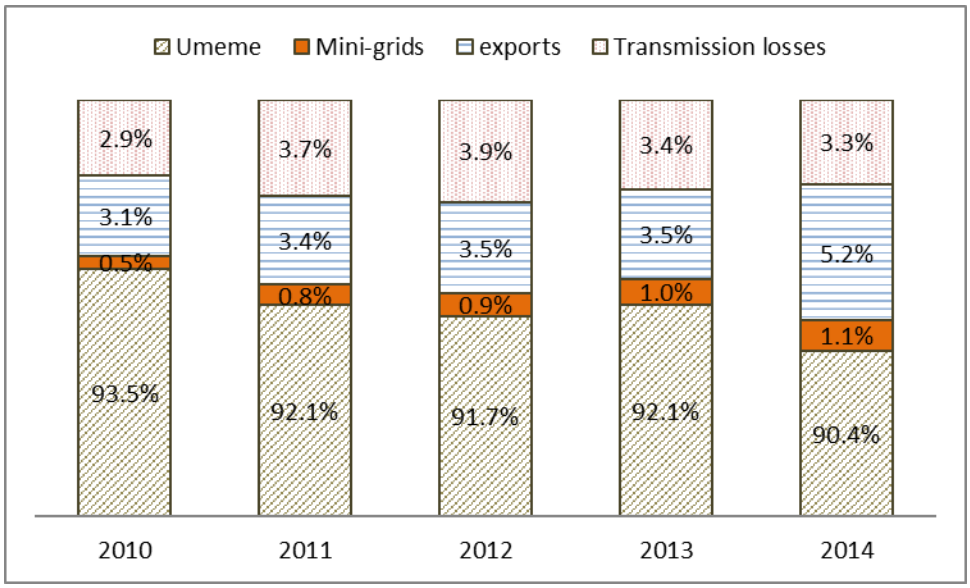
In terms of detail with respect to the companies to which UETCL sold energy, Figure 6 indicates that UETCL sold the bulk of energy to Umeme Limited followed by exports.

Figure 6: Energy sales to distribution companies, exports and losses



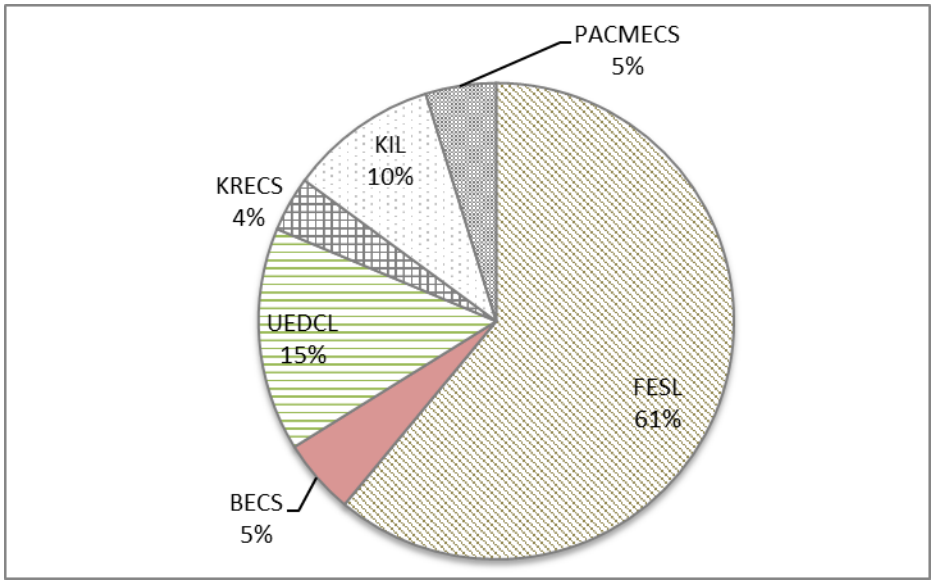
Umeme Limited is the national distribution grid operator with over 90% of Uganda's electricity and distribution and supply business (Figure 7). The company took over the operation and maintenance of the distribution grid from a government entity - Uganda Electricity Distribution Company Limited in 2005 for a 20-year concession.

Figure 7: distribution companies, exports and losses



In late 2000, government of Uganda established cooperatives and other small distribution firms to take on the activity of distribution and supply of power in areas where Umeme Limited distribution grid had not reached. These new distributors were leased the mini-grids established by a government Rural Electrification Agency. As of end of 2014, there were six small companies (mini-grids) that were distributing just 1.1% of all energy purchases by UETCL (Figure 8).

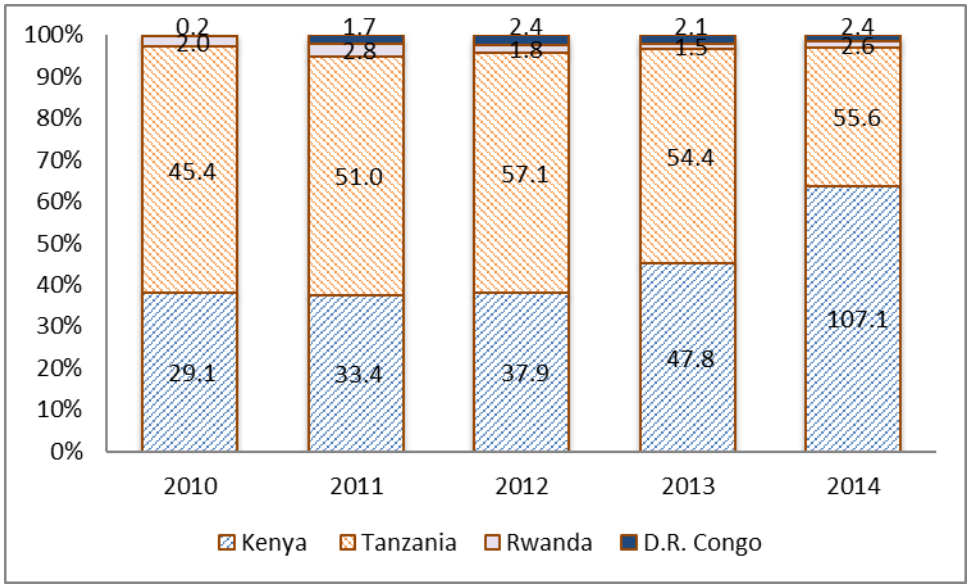
Figure 8: Share of energy sales among Mini-grids in 2014



Traditionally since 1964, Uganda has exported to and imported from Kenya. Energy exchange between Kenya and Uganda has been used mainly for ancillary services – that is for grid stabilization. It is only of recent that Uganda started exporting power to Kenya over and above the requirement for grid stabilization. To the other countries in the region, Uganda has mainly exported power to these countries for onward distribution to end-use consumers.

Figure 7 shows that until 2014 when Uganda energy exports reached 5.2% of total energy sales by UETCL, they hovered in the range of 3.1% to 3.5%. Figure 9 shows the quantum (GWh) and share (%) of UETCL energy exports to neighbouring countries. The figure indicates that until 2014 when energy exports to Kenya surged, Tanzania was the major destination. UETCL energy exports to Rwanda and Democratic Republic of Congo (DRC) remained low and stable.

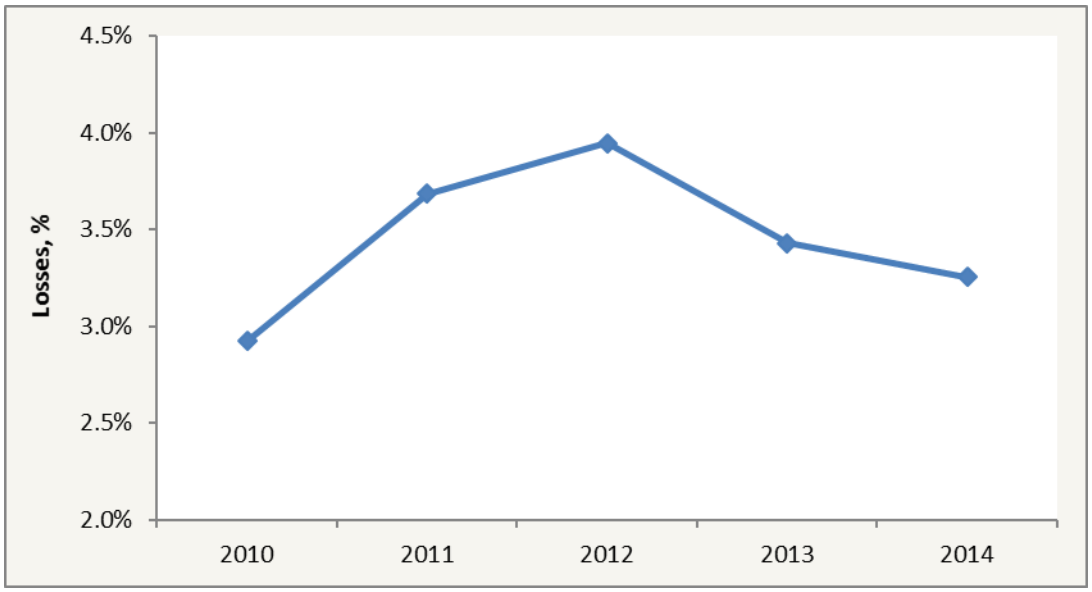
Figure 9: Share of UETCL energy sales to export destinations



In the process of transporting electrical energy from generation plants to the point of sale (to distribution companies or for export), some of the energy is lost as heat and in the conductors and/or noise in transformers so long as they are energized.

Figure 10 shows the proportion of energy lost during the transportation of electricity by UETCL. The figure indicates that in 2014, up to 3.3% of energy generated – equivalent to 108.7GWh was lost during transmission to distribution companies.

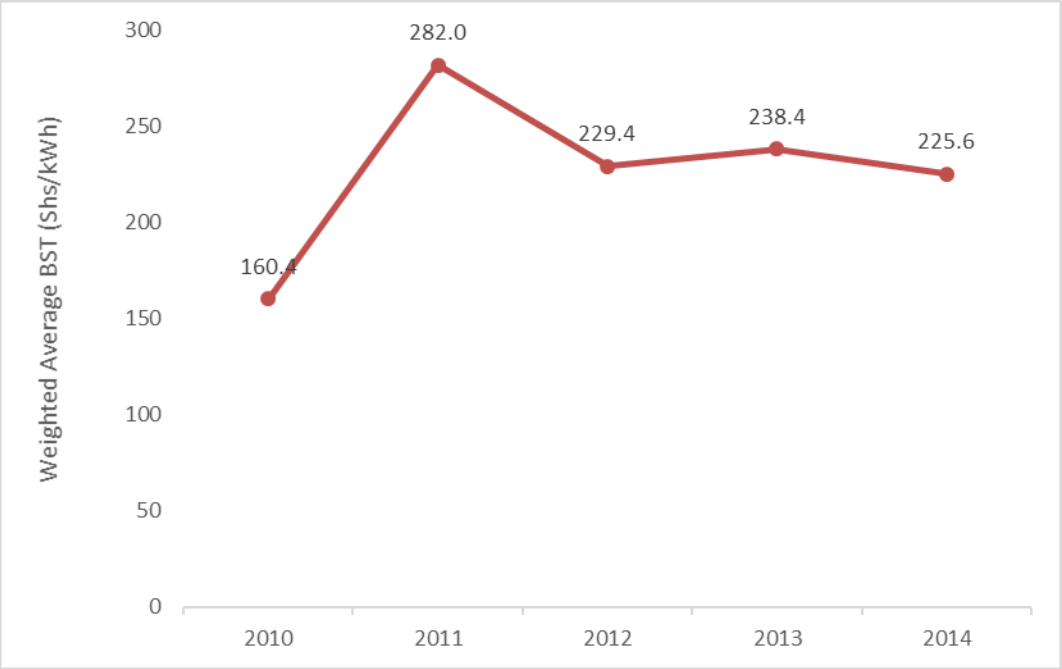
Figure 10: Electrical energy transmission losses (%), 2010 to 2014



2.4 Bulk supply tariffs

The trend of the average tariff (bulk supply tariff –BST) at which UETCL sold power to distribution companies is shown in Figure 11. The trend indicates that in 2011 there was sharp rise in the BST and a subsequent drop in 2012 and stable trend thereafter. For further information on the BST, please follow the link to the ERA website; http://www.era.or.ug/index.php/statistics-tariffs/tariffs/bulk-supply-tariffs

Figure 11: Weighted average bulk supply tariff

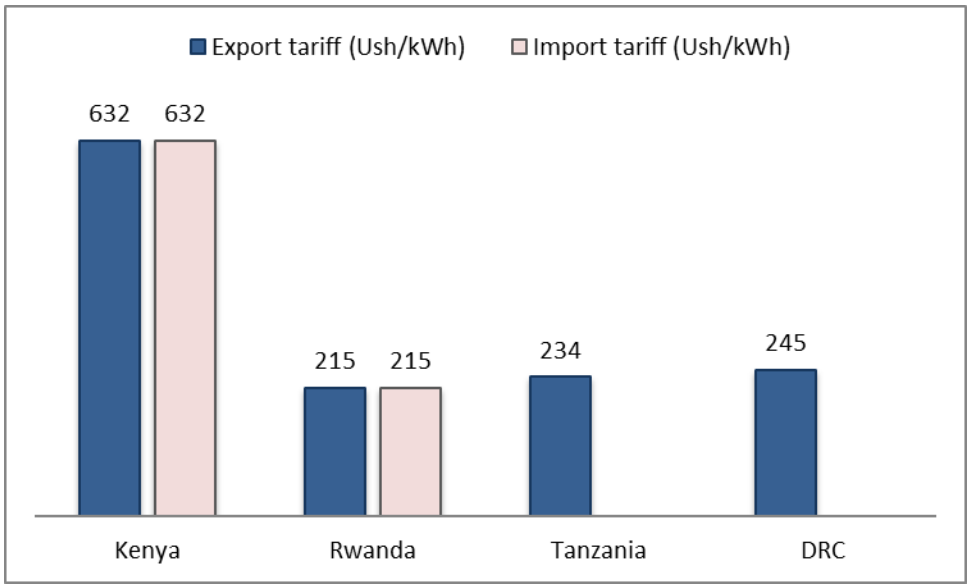


2.5 Electricity export and import tariffs

The local currency equivalent tariffs that UETCL charges export to and pays for import of energy to and from neighbouring countries is shown in Figure 12.

The tariff for energy export and import to and from Kenya and Rwanda is similar because this is considered as a bilateral exchange of energy for which no country is expected to profit from another. The energy exchange tariff between Uganda and Kenya is two and half times higher than that with Rwanda.

Figure 12: Electricity export and import tariffs in 2014



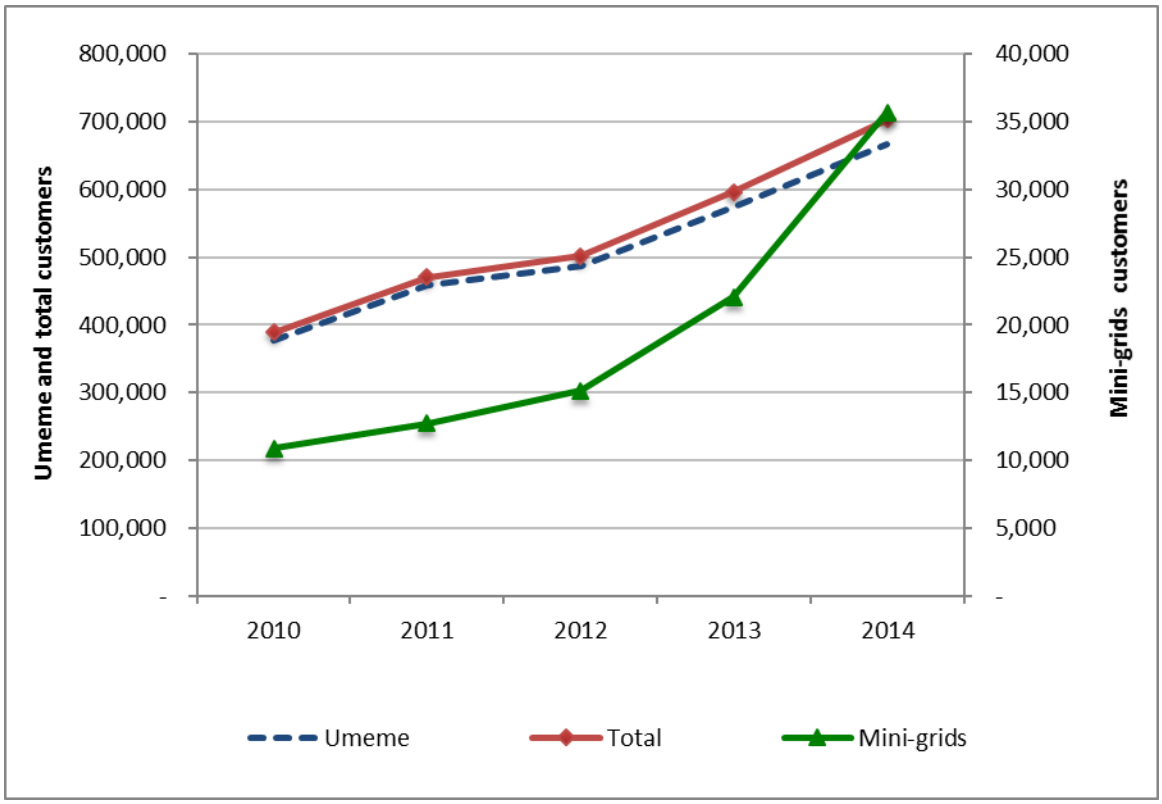
To note in Figures 11 and 12 is that UETCL exports power to Rwanda, Tanzania and DRC at the tariff that is equivalent to bulk supply tariffs for the local distribution companies.

3 ELECTRICITY DISTRIBUTION AND SUPPLY

3.5 Customer Numbers

As at the end of 2014, there were 700,000 customers connected to the national grid (Figure 13). The bulk of the customers (95%) were on Umeme Limited distribution network and the rest on mini-grids operated by five small distribution companies, namely: Ferdsult Engineering Services Limited (FESL), Bundibugyo Electricity Cooperative Society (BECS), Kilembe Investments Limited (KIL), Pader Abim Community Multipurpose Electricity Cooperative Society (PACMECS) Uganda Electricity Distribution Company Limited (UEDCL) and Kyegegwa Rural Electricity Cooperative Society (KRECS).

Figure 13: Customer connections on national grid



Besides grid-connected electricity consumers, the three off-grid generation, distribution and supply companies (WENRECO, KIS, and Kisiizi Hospital power limited) altogether have about 8,000 electricity consumers they serve.

3.2 Energy sales and losses by distribution companies

Table 6 shows the quantum of energy sales as well as losses of Umeme Limited and the other six small distributors combined. Given Umeme Limited's nationwide footprint, in 2014, Umeme lost an amount of energy through the distribution, which was almost 25 times the total energy distributed by the six mini-grid companies combined.

Table 2: Energy sales and losses by distribution companies

	Umeme		Mini-grids	
Year	Energy Sales (GWh)	Energy losses (GWh)	Energy Sales (GWh)	Energy losses (GWh)
2010	1,627.5	696.3	0.8	0.3
2011	1,732.0	655.4	9.4	4.2
2012	1,937.3	687.5	16.3	8.8
2013	2,091.8	704.6	19.4	9.8
2014	2,276.5	622.3	25.1	11.7

Umeme limited sold most of the energy to industrial consumers, followed by domestic consumers (Figure 14). Commercial consumers including street lighting took up only 12% of total energy sales of Umeme. For small distribution companies, energy sold was in equal proportion between domestic and commercial consumers. There are hardly any industrialists in rural locations where the mini-grids are located. That is the major reason the total demand (sales) for mini-grids is low.

Figure 14: Umeme limited energy sales by customer category in 2014

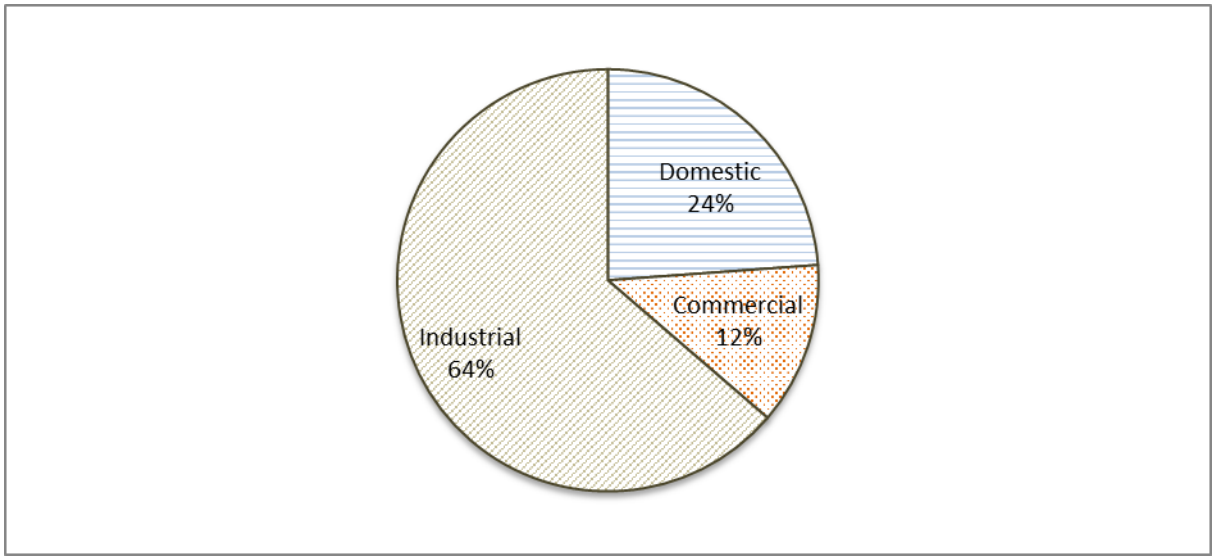
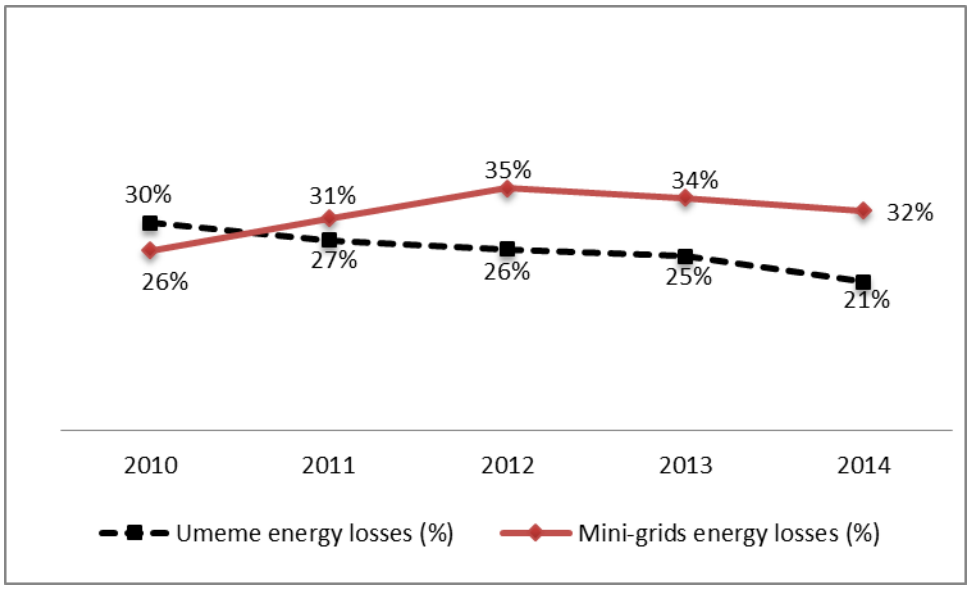


Figure 15, shows the trend of energy losses as a percentage of energy purchases by distribution companies. The figure indicates that much as Umeme Limited had higher levels of energy losses in 2010, the figure drastically reduced within 5 years, from 30% in 2010 to 21% in 2014. The significant reduction in loses registered by Umeme Limited is due to the incentive embedded in the Umeme Limited license that allows the company to recover invested capital in addition to a 20% return on investment net of taxes

Figure 15: Share of energy losses by distribution companies



The share of energy losses for mini-grids instead of reducing has increased from 26% in 2010 to 32% in 2014. The increase in losses registered by mini-grids is due to the fact the operation and maintenance agreement that mini-grid operators have signed with REA (the owner of the network) does not allow them to prudently invest in the network.

3.3 Electricity retail tariffs

Figure 16 shows the nominal weighted average tariff (WAT) for electricity end-user consumers. The WAT is an average tariff of all consumer categories weighted by their respective volume of consumption. For example, Umeme Limited has five customer categories with varied consumption weights, namely Domestic consumers at 24%; Commercial consumers at 12%; Medium industries at 16%; Large industries at 48%, and street lights at 0.1%. Small distributors (Mini-grids) have mainly two customer categories (Domestic consumers and Commercial consumers).

Figure 16: Weighted average retail tariffs

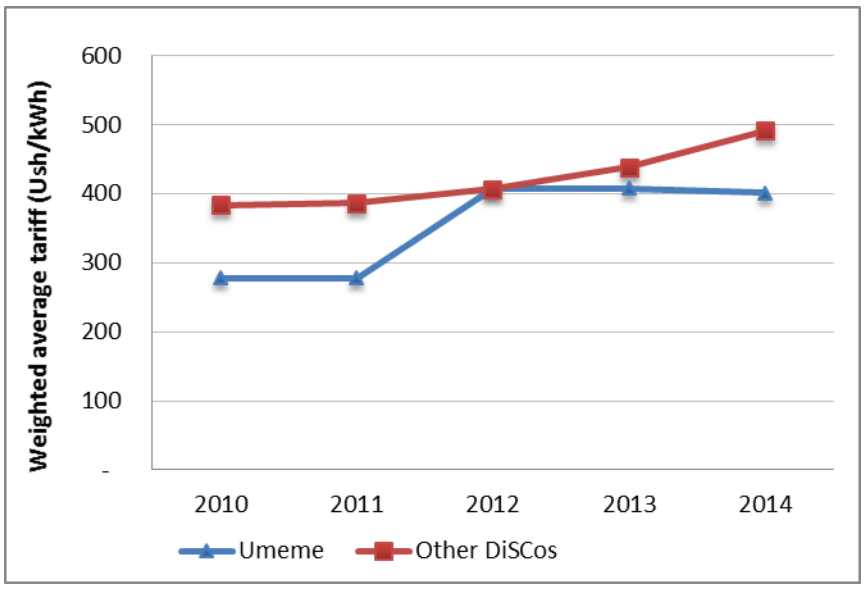


Figure 16 indicates that the WAT for consumers connected by small distributors (Mini-grids) is consistently higher than that of Umeme customers. The reason for this phenomenon is that much as small distributors have mainly Domestic consumers and Commercial consumers who tariffs are similar or even lower than Umeme customers, Umeme on the other hand has the Industrial customers whose tariffs are lower and contribute to 60% of energy consumption. Detailed information on tariffs per Distribution Company are available on our (ERA) website through the link http://www.era.or.ug/index.php/statistics-tariffs/tariffs/distribution-tariffs .