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A STUDY ON THE IMPACT OF THE ELECTRICITY SECTOR ON THE INDUSTRIAL SECTOR

FINAL REPORT

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ABBREVIATIONS AND ACRONYMS

BFP	Budget Framework Paper
CDC	Commonwealth Development Co operation
ERA	Electricity Regulatory Authority
ESI	Electricity Supply Industry
ERT	Energy for Rural Transformation
GDI	Gross Domestic Investment
GDP	Gross Domestic Product
GNP	Growth National Product
GoU	Government of Uganda
GWH	Giga Watt Hour
FDI	Foreign Direct Investment
kWH	Kilo Watt Hour
kVA	Kilo Volt Ampere
LRMC	Long Run Marginal Cost
MEMD	Ministry of Energy and Mineral Development
MFPED	Ministry of Finance, Planning and Economic Development
MVA	Mega Volt Ampere
MW	Megawatts
MWLE	Ministry of Water, Lands and Environment
NEMA	National Environmental Management Authority
PEAP	Poverty Eradication Action Plan
PSRPS	Power Sector Restructuring and Privatisation Strategy
REA	Rural Electrification Agency
REB	Rural Electrification Board
REF	Rural Electrification Fund
SRMC	Short Run Marginal Cost
TOU	Time of Use Meters
UMA	Uganda Manufacturers Association
UIA	Uganda Investment Authority
UEB	Uganda Electricity Board
UEDCL	Uganda Electricity Distribution Company Ltd
UEGCL	Uganda Electricity Generation Company Ltd
UETCL	Uganda Electricity Transmission Company Ltd.
US Cents	United States Dollars (In cents)
VAT	Value Added Tax
WB	World Bank

Conversion

1000Watts	=	1 kW
1000kW	=	1 MW
1000kWH	=	1 MWH
1000MWH	=	1GWH
1000kVA	=	1MVA

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E1.0 EXECUTIVE SUMMARY

E1.1 Background

The power sector in Uganda has undergone various reforms in the recent past. These reforms were aimed at making the power sector financially viable and be able to perform without subsidies from the Government budget; increasing the sector's efficiency; improving the sector's commercial performance; meeting the growing demand for electricity and increasing coverage; improving the reliability and quality of electricity supply; attracting private capital and entrepreneurs; and taking advantage of export opportunities after satisfying local demand.

E1.2 Objectives of the study

The overall objective of this study was to analyse the impact of the electricity sector on the industrial sector by establishing the typical energy mix and costs imposed due to tariffs and quality of service on the manufacturing and other industries. The Electricity Regulatory Authority (ERA), Uganda Investment Authority (UIA) and Uganda Manufactures Association (UMA) commissioned this study of the medium[1] and large industries[2].

POWER NETWORKS (U) LIMITED, a local Engineering and Management Consultancy firm was commissioned to carry out the study on the effect of the electricity sector on the industrial sector. The findings from the study will inform the electricity demand planning and tariff setting processes.

[1] Refers to electricity supplies at low voltage (415 volts) with maximum demand above 50kVA but below 500kVA.

[2] Refers to electricity suplies at high voltage (11 & 33KV) with maximum demand above 500kVA.

E1.3 Approach and Methodology

In order to achieve the objective of the study the Consultant carried out the following tasks:

- A qualitative critique of the government's policy framework on electricity and the industrial sectors.
- Discussion with key stakeholders, ERA, UMA, UIA and Umeme staff to fully understand the terms of reference and get support from them.
- The consultants spent a total of 30 days in the field collecting data, which have been helpful in finalising this study.

E1.3.1 The sampling framework and design

A sampling frame of 840 medium and large-scale industries was constructed from records obtained from Umeme. From the sampling frame, a sample of 96 industries was selected using a multistage random sampling process. The country was divided into four regions and from these regions; firms were sampled using probability proportional to size.

E1.3.2 Survey instruments

After consultations with the stakeholders and reviewing literature on the energy sector in Uganda, a questionnaire was developed. The questionnaire had seven sections as follows:

(i) Industry bio-data
(ii) Capacity utilisation
(iii) Industrial production
(iv) Alternative sources of energy

(v) Tariff effect on the industry

(vi) Industrial cost structure

(vii) Energy efficiency and quality of service

(viii) Time of use metre

The questionnaire was pre-coded and used to collect information from the sampled industries.

E1.3.3 The Data collection Team

The team was composed of four people, comprising of a Senior Economist (Supervisor and Team Leader), an Engineer, a Statistician and a Social Scientist. The team leader trained the rest of the team before the data gathering exercise began. Each of the members of the team was assigned firms where a self-administered questionnaire was delivered. Where respondents were ready, the questionnaires were filled and collected. Otherwise, members re-visited the firms to pick the completed questionnaire.

E1.3.4 Responses from the Industries

The response of the industrialists was very encouraging and a total of 82 questionnaires were returned indicating 85% response rate. 31 out of the 82 questionnaires returned were from large industries while 51 were from medium industries. 14 industries either ignored or were not bothered with the whole exercises, which is about 14% non-response rate. (List of these industries is in appendix 7.5)

E1.3.5 Data coding, entry, and analysis

Before entering the data, the Consultant edited the questionnaires manually from the field to check for any possible errors. The supervisor further crosschecked the questionnaires before passing them over to the data entry personnel. The data entry personnel coded some of the questions that had not been coded, and prepared a code sheet. A data entry screen was designed in Access,[3] from where the data was captured.

Data was exported to SPSS,[4] the package used to analyse the data. Preliminary analyses included computation of descriptive statistics such as the mean, median, frequencies and percentages. Exploratory data analysis was also performed to check for outliers.

E1.4 Major Findings

The major key findings of the study are discussed under the following areas as presented in the terms of reference (TOR):

(a) **The load profiles of the industrial consumers.**

- The load analysis from the surveyed industries show that 53.8% of the energy is consumed during shoulder period while 20.7% is consumed in the peak period while 25.5% is consumed in the off peak periods respectively. This implies that 54% of the total energy is consumed during the day and 46% of the load is experienced during the night.

[3] A Statisical Software for Data Management.
[4] A Statisitical Package for Social Scientists for analysing data.

This has an implication on the capacity demand on the system, which cannot meet the current demand of around 370MW.

- The findings of the study also reveals that 53.1% of the industries surveyed have maximum demand of between 50 – 500 kVA, while 34% of the industries have maximum demand above 500 kVA. This maximum demand is registered during the shoulder period of the day, between 6.00 a.m – 6.00 p.m. at around 11.00 am in the morning.

(b) The production structures of the firms by industry category.

- It was found out that 30.8% of the firms operate one shift of eight hours a day. 14.8% of the firms operate two shifts of sixteen hours a day, and 54.4% work throughout 24 hours.

- It was found out that of the total energy consumed in Uganda, 60% is used by the medium and large industries. 54% of the total units consumed were used during the shoulder period while 20% were consumed in the peak period and 26% were used in the off peak.

- 94% of the firms that operate at shoulder and peak periods were not willing to shift their operations to off-peak periods. The reasons given by the industries include the following:
    - The production patterns of some industries dictate that they have to start heating the machines in shoulder and have final production in off - peak so it is very difficult for such industries to change their pattern of production and these include, Iron and Steel mills, Cement industries.

- That the efficiency of production is very low during the night, the safety of the operators and the machinery is compromised and it proves to be very expensive to supervise people at night.
- The nature of business the firm does, dictates that they have to produce in a certain period of time for example banks will have to operate during the day while Hotels, Floriculture firms, Hospitals and Educational institutions have to operate during peak hours of the day.

(c) The nature of the back-up sources of energy for the industrial Consumers.

- The study shows that almost all industries have standby generators. Only 36.6% use them at full capacity while 18.3% of the firms use below 30% and 45.1% use between 30 – 75% of the capacity of the installed generators. The explanation we got when we asked the industries why they don't use their generators at full capacity is that these generators are kept for priority loads to keep running some operations as they wait for power to come back. Another reason given was that running generators on full loads was very expensive and some firms would not afford.

- The estimated total generation capacity of these standby generators for the surveyed industries was found out to be around 40MVA.

- It was also found out that the stand by generators couldn't singly run the operations in some industries when power from the network was off. Industries affected were Cement Industries, Cotton and Textile, Metal and Metal products, Iron and Steel, Building and Construction. Only a few of the industries like Bank of Uganda with 1500kVA generator, Britannia Industries with 2000kVA, Sheraton Kampala Hotel with 1200 kVA, and Mukwano Industries with 4000kVA could run all their operations on their Standby generators.

- The study revealed that the industries spend a total of almost 640 million shillings running the generators to supplement the power from the main grid system in a month, which is 30% of the total cost of the energy bill in the firms.

- 98% of the industries are not willing to sell part of the energy from their standby generators; reason being that:
    - There would be a lot of difficulties on how to meter the energy to be supplied to other customers.
    - The tariffs that the industry would charge other customers.
    - The firms that had generators would not be able to establish exactly the requirements of other customers in order to come up with the sufficiency of the generated energy.
    - That the industries were not in the business of selling power and that they had to concentrate on their core business.

The Consultants interpretation of the above findings is that these industries have backup generators for the purpose of having power to run their operations when power is off. Heavy consumers of power like Steel Rolling Mills, Nytil, and National Water and Sewerage Cooperation have no generators while UGMA engineering and Hima cement factories have generators of capacity of 130 kVA and 400kVA respectively to run priority operations. This implies that large industries cannot rely on generators for production in their industries.

(d) The effects of the electricity tariffs on overall industrial Competitiveness.

- The effect of the tariff on the industries was found in the contribution of different costs in the total cost of production and it was found out that electricity tariffs accounts for 15.3 % in the total cost of production in the surveyed industries.
- It has been established from the study that the most affected industries are pharmaceutical companies with electricity accounting for 22% in the total cost of the firms, followed by Packaging with 20% and by floriculture, dairy and dairy industries, iron and steel, and foods and beverages with 18%. Fish and fish farming with 16% and metal and metal product with 14 %. Other categories are in the range below 10%, which does not affect the costs of production greatly. The different percentages show how the industries are affected differently.

The Impact of the Electricity Sector on The Industrial Sector

- Majority of the industries use electricity as the major source of energy and hence it would be assumed that the tariffs has a big impact on their production process. However the study has revealed that the impact comes in when electricity accounts for a big percentage in the production process for example in industries where electricity accounts for more than 15% in the total cost, an increase of 10% on the tariff will affect the profit margin of the industries substantially. Such industries include Pharmaceuticals, Packaging, Floriculture, Dairy and Dairy products, Iron and Steel industries and Fish and Fish farming.

- It should be noted that any increase in the tariff affects industries differently because the effect of an increase in the tariff will be born by the consumer of the products.

- Our analysis show that the Iron and Steel industries and Cement industries will be affected because they use a lot of power and they compete with goods coming from Kenya and South Africa where the industries are subjected to lower tariffs comparatively and they don't face problems of unreliable power which increase the costs of production compared to their Ugandan counterparts.

(e) The level of price signals in time of use tariffs that can lead to Changes to off-peak hours consumption.

- The result reveals that 54% of the industries operate 24hours and 38% of the industries operate for 16 hours in a day. Only 8% of the industries work in shoulder time only. The amounts of energy consumed by these industries in the three periods of the day are 53.8% in shoulder, 20.7% in peak and 25.5% in off peak periods.

- At least 90% of the industries are taking advantage of the low off peak tariff. However the consultant found out that the current tariff level and price signals are not high enough or prohibitive enough to cause a change in production hours. For instance medium scale industry's retail price for off peak consumption is 55% lower than the normal consumption hours. For large industries the retail cost of off peak consumption is 59% more than the normal hours price.

- The above is attributed to the fact that production expenses are not dependant on electricity expenses and that any change in the production pattern of the industries is attributed to increase the production target to growing demand in the market rather than taking advantage of the low tariff in off peak.

- The price signal that would cause large and medium industries to reduce consumption during peak would be a tariff equivalent to the one charged on domestic consumers because they pose a great strain

on the network during peak hours. However, the price signal should be adjusted to take care of inflation.

(f) The industry cost structure and the percentage share of each cost category.

- The findings of the study shows that raw materials take the biggest percentage in the total cost of the firms with 39.8% followed by labour with 18.4 %; electricity and backup sources take 15.3% and 6.7% respectively. Transport and taxes each takes 5.4%, telephone and communications with 3.1%, while water takes 2.3%. Other overhead costs in the firm take 4.0%.

(g) The costs of centralised thermal visa-a vie the costs of the Identified alternative sources of energy for the firms.

- The findings show that firms are using back up generators as the only alternative sources of energy. The cost of one kWh was calculated from the costs of running the generator in terms of fuel, spare parts and other maintenance costs. It was found out that generators are run for 92 hours in a month. Fuel cost was taking 70% of the cost of a kWh while spare parts and maintenance took 30% of the cost of a kWh and the average cost of one kWH for these industries with back up sources was estimated at about 800/= per unit.

- The centralised thermal we took the costs at Aggreko (the company which is running a 50MW generator at Lugogo substation in

Kampala). The Consultant found out that Aggreko is selling an average of 22 million units per month. The total energy cost is estimated at US $0.295 per unit cost which translates to USHS 540/= per a kWh of which US $0.113 is given by Government as a subsidy which is equivalent to Ushs 205/=(at an exchange rate of 1835 per US dollars)

Company	Cost per kWh	Subsidy	Total cost per kWh
Surveyed Industries	800/=	-	800/=
Centralised Thermal/ Aggreko	540/=	205/=	335/=

- This implies that the firms' energy cost is very expensive at 800/= per kWh compared to the centralised thermal at 540/= per kWh. Centralised thermal is the best alternative because its unit price is considered cheaper, environmental issues can be mitigated, subsidies can be provided as Government can monitor fuel consumption easily.

(h) The measures that firms could employ to reduce the power bills.

- 75% of the firms surveyed are aware of the energy efficient mechanisms to save the electricity and about 70% of the industries had adopted energy saving initiatives, which include the following;

- Use of Capacitor banks (Power factor correction)
- Sensitive electric heaters
- Energy saving tubes/bulbs.
- Off peak power usage.
- Proper planning of operations.
- Switching off machines not in use.
- Using modern equipment with low power consumption.
- Regular maintenance of electric equipments.

(i) The impact of quality of service on the costs and patterns of Industrial production and the current level in the quality of Service.

- The survey revealed that almost 70% of the power interruptions are due to load shedding while 30% is due to outages due to technical faults.

- About 74% of the industries surveyed lose above three hours every week due to power failure and this has had an adverse effect on the production structures of these industries.

- 79% of the firms surveyed were not happy with the quality of service from UMEME because of poor customer service delivery. The main reasons advanced were:
  - Frequent power outages (up to three times a week).
  - Long duration of outages (up to eight hours a day).

- Delayed response time (up to about four hours).
- No prior information before outages.
- Voltage fluctuations.

(j) Availability of Time Of Use meters

- The study has revealed that the majority of the firms are conversant with time of use meters (over 80%). And their managers know the importance of time of use meters. All the large industries had time of use meters fixed on their premises and are billed on time of use meters.
- The study has revealed that 90% of the industries are billed on time of use meters. The 10% of the industries have had their meters fixed on their industries but not yet billed. And these were mainly educational institutions.
- The findings show that 92.8% of the firms consider time of use meters an advantage to their industries.

E1.5 Summary of Recommendations

The summary of recommendations are given below in five areas as presented below:

(A): Addressing supply deficit

- There is an urgent need to address the power supply deficit by increasing the generation capacity in the country through installing more thermal generators in the short run to address the current power crisis.
- There is need to start the development of Bujagali power station or development of other power stations in a phased manner.
- Government should encourage and assist the private developers in development of mini hydro power stations, which can be able to increase on the generation capacity.
- The Distribution Company should be given a target to reduce the technical and non-technical losses from the present 35% to levels below 25%. This will put almost 30MW into the system, which is claimed to be lost and it will be available to the authentic customers rather than being consumed by the illegal consumers.

(B): Quality of Customer service

- Load shedding is the major cause of low quality of service in the industries. We recommend that Consumers should be explained the

rationale for load shedding and that immediate action are being taken to address the problem.

- We recommend that there should be an amicable synchronised system among the players in the power sector. Noting that Generation, Transmission and Distribution systems all contribute to the satisfaction of the consumers and therefore all the companies responsible for these systems should be synchronised in their delivery of service. For example increased generated power may not be delivered efficiently if the transmission and distribution companies are weak.
- ERA can enforce the existing quality standards of electricity supply codes as measured by internationally recognized reliability indices. The utility companies should be measured against these international standards in order to keep track of their performance.

(C): Back up sources (Self-generation)

- The government should give concessions and subsidies on importing generators and tax waivers on fuel to those members of UMA who can afford to import generators for their own use since Umeme cannot meet the current demand of power in the country. If government has to give subsidies on fuel there should be a strong monitoring mechanism in those isolated industries such that the tax free fuel should not find its way back in the market.
- There is need to change the policy framework on self-generation such that those that have generators could supply other customers when there is a shut down. Presently the legislative framework allows only a

single buyer model where a Transmission company sell in bulk to the Distribution Company. The ability to change this framework lies entirely on government. Even if this legislation was in place there is need to develop the infrastructure to supply the power from private self-generators.

- In the medium term we recommend a centralised thermal generation because there is already a legal framework in place, it offers flexibility in its supply schedules, a lower tariff rate, a higher degree of safety, and a cleaner environment and its subsidy is very easy to implement and monitor due to one centralised control point.

(D): Industrial Tariffs

- It is our recommendation that tariffs should be raised for peak up to the level of forcing industrialists not to operate in that period because they cause a strain on the capacity of the systems. For example they can be increased to what domestic consumers pay.

- An increase of 10% in tariffs can also be effected on industries to cater for the capacity costs in generation.

- Tariff codes for industries may be changed to cater for big consumers of power such that there is a step in charges for instance all consumers who consume more than 40,000 units in the month can have a lower tariff above 40,000 units consumption.

- When reviewing tariffs ERA is advised to try and to use the long run marginal cost principle rather than the short run marginal cost principle because the former is more cost reflective.

(E): Other Recommendations

- The study also recommends that in order to improve the performance of the industries the following should be done;
  - The dialogue between UMA, ERA and Private sector should be strengthened to streamline the information flow on reviewing tariffs and energy demand management initiatives.
  - ERA and UMA should sensitise the industries about energy efficient mechanisms of saving electricity which include the following among others;
    - Use of Capacitor banks (Power factor correction)
    - Use of Sensitive electric heaters
    - Use of Energy saving tubes.
    - Moving production to off peak.
    - Proper planning of operations in the industries.
    - Switching off machines not in use.
    - Using modern equipment with low power consumption.
    - Regular maintenance of electric equipments.

E1.6 Study limitations and challenges

- One of the major challenges encountered in this study was collecting data from industries. Relevant officials in industries often declined to participate in the study unless permission was obtained from their superiors, some of who were not available during the entire period of the study. In some cases there was outright refusal even after locating responsible officers. The alleged heavy schedule on the part of some key informants made it difficult to make appointments within the allotted time for this study.
- Refusal to give data on costs of production by some industries because of fear that the information may be revealed to the tax authorities or to their competitors hampered the speed of data collection.
- In spite of all these challenges the consultants were able to get the data they needed for the study.

CHAPTER ONE

1.0 INTRODUCTION

1.1 The role of the manufacturing sector in Uganda's economy

Uganda's economic performance with high GDP growth during the last 15 years has been impressive. Over the past decade, the size of Uganda's economy has more than doubled, with an average growth rate of about 6.0 percent per annum. The power sector, however, still remains a constraint to increased and equitable growth. Surveys indicate that the quality and adequacy of power supply is perceived by the private sector as the most binding constraint to private investment. Expansion of generating capacity has not followed the rapid economic growth, which Uganda has experienced during the recent years. With continued strong economic growth and concurrent high electricity demand growth, projected at about 8 percent per year, Uganda needs to better utilize its domestic energy resources, mainly hydropower to, among others, support the manufacturing sector which has of recent experienced strong growth.

Albeit from a small base, the manufacturing sector has shown steady growth, increasing its share in total domestic output from 4.7% in 1986 to 14.2% in 2004. The Industrial Sector as measured by index on Industrial production has had an average annual growth of 14.3% per annum - more than twice the rate of growth of the whole economy.

Although the manufacturing base in Uganda is still very small and its contribution to GDP is about 13%, of recent this sector has attracted the largest share of investment in areas of beverages/soft drinks, textiles, cement, foot-ware packaging and food processing. As a result, the performance of the manufacturing sector as measured by the index of industrial production has generally improved during the last three years. The growth rate of the manufacturing sector during the year 2004 stood at 14.2% while in 2005, it was 13%. There was a slight decline in the growth rate in this sector from 14.2% to 13%, but the sector posted the third highest growth rate after Mining and quarrying, and Transport and communication showing growth rates of 15.6% and 15.4% respectively.

Table 1.1 Uganda's economic growth by sector (%)

Sector	**2002**	**2003**	**2004**	**2005**
Agriculture	7.0	8.4	5.6	4.4
Manufacturing	6.4	7.1	14.2	13.0
Mining & Quarrying	7.3	10.4	15.6	15.4
Electricity & Water	2.2	5.7	10.5	7.0
Construction	5.1	11.2	18.2	10.9
Wholesale & Retail Trade	6.2	5.9	10.9	5.4
Hotel & Restaurant	12.2	14.9	9.4	5.0
Community Services	7.3	7.9	5.9	5.8
Transport & Comm.	6.3	7.2	6.3	14.1
Total GDP	5.8	5.4	5.9	6.5

Source**:** Ministry of Finance, Planning and Economic Development**.**

1.2 The industrial sector in Uganda

The industrial sector was in a precarious state before 1988 but has now recovered since then, the index of industrial production increased at an average of annual rate of about 14% during the last four years. The manufacturing sector is basically largely on the processing of agricultural commodities such as cotton, coffee, sugarcane and food crops, there are a number of large scale industries producing tobacco, beverages, wood and paper products construction materials and chemicals. Small-scale industries are dominated by clothing industries but also include sugar, maize processing furniture making and general workshops.

In order to voice out their views to government and be able to manage effectively the Uganda manufacturers formed an umbrella association called The Uganda Manufacturers Association (UMA), which was established in the 1960s, at a time, when Uganda was having a young but robust industrial sector. However, the political social and economic turmoil of the 1970s interrupted the smooth growth of the Association. Therefore for the period that followed until April 1988, UMA was dormant. Today the Association is the largest Business Member Organisation representing the broad industrial and commercial sectors of Uganda's economy and an important forum for the private sector in the country. UMA has a membership comprising of close to 750 small, medium and large enterprises drawn from largely the private sector. The main objectives of UMA include; promoting, protecting and coordinating the interests of industrialists in Uganda; to act as a watchdog and an effective mouth piece for its members; to initiate

discussions and exchange of information amongst members on industrial issues; to advise Government on key policies affecting the industry.

1.3 Power Sector in Uganda

The provision of abundant electricity in Uganda after 1954 marked the beginning of manufacturing industries in Uganda. Firms involved in steel rolling, copper smelting, sugar and cable depended on electricity for their operation. This makes electricity a significant input for manufacturing industries in Uganda. Electricity as part of infrastructure, contributes to economic development through increasing productivity, providing amenities, which enhance the quality of life, and acting as an immediate input to production.

The power sector in Uganda has undergone various reforms in the recent past. These reforms were aimed at making the power sector financially viable and able to perform without subsidies from the Government budget; increasing the sector's efficiency; improving the sector's commercial performance; meeting the growing demand for electricity and increasing coverage; improving the reliability and quality of electricity supply; attracting private capital and entrepreneurs; and taking advantage of export opportunities after satisfying local demand. The power sector is currently experiencing a power deficit of almost 158 MW, which has forced the distribution company to ration power, and load shed an equivalent of 90 MW during the day for 12hours and 90MW for 12 hours during the night. This is a big challenge to the industrial sector since power is the main source of energy to drive their machines.

1.4 Specific Objectives of the Study

Realizing the importance of the manufacturing sector in Uganda's economy, the Electricity Regulatory Authority (ERA), Uganda Manufacturers Association (UMA) and Uganda Investment Authority (UIA) has taken an initiative to commission a study on the effect of the electricity sector, specifically the power sector, on the manufacturing sector for the purpose of establishing the typical energy mix and costs imposed by tariffs and quality of service on manufacturing and other industries.

This study will be an important input to electricity demand planning and tariff setting processes. The study of the impact of the electricity on the industrial sector was to assess the impact of electricity and in particular the electricity quality and tariffs on the industrial sector by establishing the typical energy mix, and costs imposed due to tariffs and quality of service on manufacturing and other industries.

This study is aimed at providing an input to electricity demand planning and tariff setting processes. The study assesses the impact of electricity and in particular the electricity quality and tariffs on the industrial sector by establishing the typical energy mix, and costs imposed due to tariffs and quality of service on manufacturing and other industries. The study will provide the concrete recommendation to tariff setting, customer service management and improving the electricity sector in general.

Specifically the objectives of the study were to:

- Determine the load profiles of the industrial consumers.

- Analyse the production structures of the firms by industry category. In particular, examine the possibility of the industry categories to shift their load profiles off the peak period.

- Identify the nature of the back-up sources of energy for the industrial consumers; determine the generation capacity of these standby sources of energy and assess the total energy needs of each firm. Assess the feasibility of self-generation and selling to the grid.

- Assess the effects of the electricity tariffs on overall industrial competitiveness and by industry category.

- Investigate the level of price signals in time of use tariffs that can lead to changes to off-peak hours consumption and/ or alternatively sources of consumption, and whether the current price signals in the electricity tariff structure, as a tool for demand side management is effective.

- Identify the industry cost structure and the percentage share of each cost category. In particular, determine the monthly expenditure on the alternative sources of energy relating to total expenses of the firm.

- Work out and compare the costs of centralised thermal visa-a vie the costs of the identified alternative sources of energy for the firms.

- Assess the measures that firms can employ to reduce the power bills.

- Assess the impact of quality of service on the costs and patterns of industrial production.

- Analyse the current level in the quality of service and identify the areas of weakness

- Determine how many of the firms have time of use (TOU) metres and how many of these are billed based on TOU.

1.5 Literature Review

In most developing countries most especially Uganda, electricity for long was treated as a public good and the tariffs set by the state, did not cover costs and were much higher for industrial consumers than for households and other final consumers.

The most recent studies done on the electricity sector in Uganda reveals that electricity tariffs have less impact on the manufacturing industries as they do to domestic and commercial consumers, (ERA, 2004). The annual consumer satisfaction study done by the Ministry of Energy and Mineral Development (2003) revealed that 80% of the customers were not happy with the quality

of service from the distributor. Other studies done like the East African Power Master Plan (2004) are geared in making an interconnection among the East African countries to ensure that there is enough power in the region.

Reineikka and Svensson (1999), carried out a study on Uganda Industry initiated by World Bank, primarily to collect Data on the constraints facing private enterprises in Uganda covering a total of 243 firms. Their study revealed that unreliable power and lack of power in Uganda reduces investment considerably. They found out that manufacturers lose a total of 156 days in a year because of load shedding. They established how the role of poor infrastructure and deficient public services determine the level of private capital inflow. Their results have a clear policy implication if a substantial share of firms cost items is attributed to the poorly financing public sector, which is beyond firms' control.

The Government of Uganda's strategy for fighting poverty is expressed in the PEAP (2004) (Poverty Eradication Action Plan) through its five pillars, which are:

1. Economic management;
2. Production, competitiveness and incomes;
3. Security, conflict-resolution and disaster-management;
4. Good governance; and
5. Human development.

Energy is under pillar 2 of the Production, Competitiveness and incomes; but energy activities are also supported in Pillars 1, 4 and 5. "Within the economic services sector, Government is aiming at providing better infrastructure for industrial parks and improving access to power for rural

area from 2% to 10% in 2010 thereby strengthening business development services in the country. So development of the electricity sector is government's top priority.

In Uganda, a Social Impact Assessment Report (2001) prepared for the Utility Reform Unit shows that it is justified to increase tariffs on electricity. This study showed that the majority of the consumers would be able to absorb the envisaged tariff increases and that tariff increases will not be high enough to create sustained resistance. The study also showed that the immediate imperative of achieving higher growth as a co-producer of long-term human and socio economic development mandates higher electricity prices and concluded that "higher tariffs are the 'investment' required to ensure more equitable and fair access to electricity. However, some methodological issues emerge from their analysis.

Although tariffs have been increasing in Uganda since 2001, there is still no clear empirical indication of the effects and their impact on industries. It is expected that tariff increases may have significant negative economic effects on the manufacturing industries.

This study will therefore analyse the effects of the electricity sector, specifically the power sector, on the industrial sector for the purpose of establishing the typical energy mix and costs imposed by tariffs and quality of service on manufacturing and other industries.

1.6 Organisation of the report

This report is divided into six chapters; The Executive summary, Chapter one which handles the introduction to the study; Chapter two discusses the background of the electricity sector; Chapter three discusses the regulatory framework and tariff setting in Uganda; Chapter four describes the methodology used in the study while Chapter five discusses the results of the study and Chapter six discuses the conclusions and recommendations.

CHAPTER TWO

2.0 BACKGROUND INFORMATION

2.1 The Power Sector in Uganda

Hydropower provides about 98% of the country's utility power supply. The resource however currently contributes to less than 2% of Uganda's total energy consumption. Uganda's hydrological resources are estimated to have a potential power production of over 2500MW. The large hydropower sites (over 2000MW) are mainly concentrated along the River Nile while sites for small hydro (0.5 – 5.0MW) are scattered in many parts of the country. Due to low head and large discharge of water, development cost is generally on the high side. Total generation in 2005 was about to 148.4 GWH with a peak demand of 209 MW and with a load factor of 75 percent. Several major hydropower projects are in the planning stage.

The two main hydroelectric plants are Nalubaale generating station (Owen Falls power station) and the Kiira power station (Owen Falls Extension). There are other small hydro generating plants; Maziba and Kikagati (both of which are not in operation), located in the Southwest with a 1 MW and 1.25 MW capability respectively, Kilembe Mines and Kasese Cobalt plants, privately owned, located in the west with a capability of generating 5 and 10 MW respectively.

Diesel units are in the Northern part of the country and supply areas that are not connected to the main grid. These generators range in size from 100

kVA to 350 kVA and the total of the principal generators amounts to 2,400 kVA.

The Aggreko company in 2005 won the tender to install, operate and sell energy from a new 50 MW diesel power plant, that was urgently needed to meet peak power demand.

WENRECO was also given a concession to supply power to West Nile region and they have installed a 1.5MW diesel generator and are supplying for 18 hours in a day.

Co-generation. One sugar factory presently generates electricity from cogeneration plants using biogas as the principal fuel. The total installed capacity of these this plants is 7.2 MW. The Kakira Sugar Works Company may increase the installed capacity of its plant to between 12 and 20 MW by the year 2007, compared to its current capacity of 5 MW. Kakira expects to sell its "excess" generation to the grid.

Planned additions

Kiira: Two new units (14 and 15) at Kiira are under construction and are in the testing stage.

Other projects under planning are:

***Bujagali*:** This project will have a total installed capacity of 200 MW, with provision to include a fifth 50 MW unit. The option for a fifth unit requires further clarification from the project's sponsor and verification of hydrology and economics. The firm energy generated by Bujagali is expected to be 1600 GWh (with 4 units). If financed in 2006 it is expected to come in service in 2010/2011.

Small Hydro: The following mini hydroelectric plants are also committed: (according to the MEMD)

- Ishasha hydro – 3 MW, to be commissioned in 2007
- Nyagak hydro – 3 MW, to be commissioned in 2007
- Muzizi hydro – 10 MW, to be commissioned in 2008
- Buseruka hydro – 10 MW, to be commissioned in 2008

2.2 Electricity consumption in Uganda

The importance of power as an engine of growth cannot be overstated. It is part of manufacturing that starts production and therefore crucial for the growth and development of the country. Only about 6% of the population in Uganda has access to electricity of which 70% is in the three major urban cities of Kampala, Jinja and Entebbe, (according to Umeme records).

The major source of electricity in Uganda has been the Nalubaale (Owen Falls Hydro-Power Station), which was commissioned in 1954 and completed in 1968 with the installed capacity of 150MW. In 1989, a project to refurbish and upgrade the existing generation capacity to 180MW was initiated and the project was completed by 1996. Another power station adjacent to Nalubaale power station, Kiira power station (Owen Falls extension) was commissioned in 2001 with the planned installed capacity of generating 200 MW.

There has been a strong relationship between the electricity consumption and the level of economic activity as measured by indicators such as Gross

National product (GNP), Electricity is necessary for the rapid development of industry and it helps in raising the standard of living.

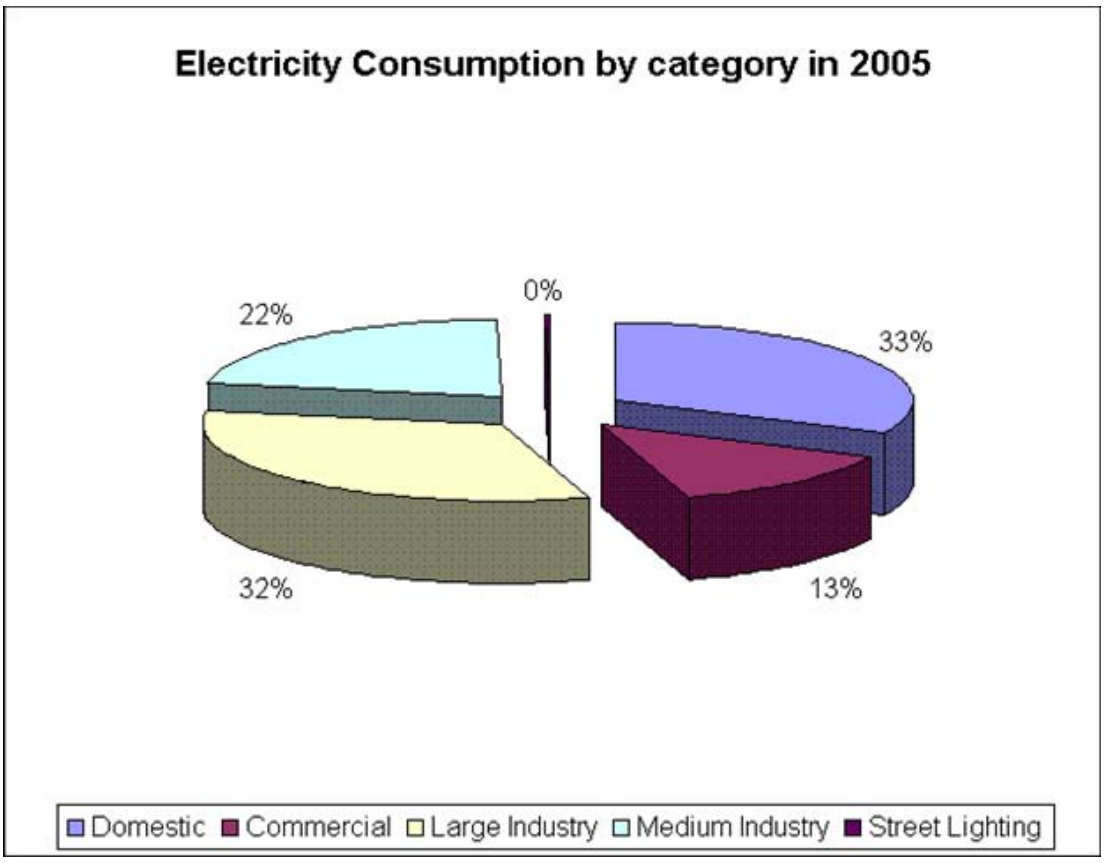
Table 1.2, Consumers and Electricity consumption by category 2002-2005

Consumers/Year	2002	2003	2004	2005
Domestic	203,086	221,110	240,736	256,033
Commercial	21,368	22,383	23,941	24,608
Large Scale Industry	81	94	103	108
Medium Scale Industry	667	697	666	740
Street Lighting	331	335	328	325
Total	255,513	244,619	265,774	281,814
%age of medium & large industry to total consumers	**0.29%**	**0.32%**	**0.29%**	**0.31%**
Consumption in GWh	2002	2003	2004	2005
Domestic	382.80	439.97	340.13	339.75
Commercial	148.32	147.78	142.82	142.44
Large Scale Industry	255.64	290.69	344.51	343.99
Medium Scale Industry	199.47	262.51	231.76	230.95
Street Lighting	3.20	2.36	1.04	1.05
Total	989.43	1,143.32	1,060.26	1,060.26
%age of medium &large industry to total consumption	**46.0%**	**48.4%**	**54.4%**	**54.3%**

Source: UEDCL, Umeme Ltd and consultants computation

It is evident from Table 1.2 above that there is increasing consumption in industrial group category which pattern is explained by the growth of the manufacturing sector in Uganda. The two categories of the medium and large industries contribute about 0.3 % of the total consumers but consume 54.3 % of the energy consumed in Uganda.

Figure 1.1 Electricity Consumption by Category



2.3 Demand forecast for the industries

The most recent demand forecast for the electricity consumption in Uganda was done by SWECO in 2003 as part of UETCL's - Transmission and Sub Transmission study. The Demand growth in the electricity sector is correlated with the growth in the manufacturing sector and total GDP growth of the economy, which is now at 6% per annum. The demand forecast for the electricity sector is put at 8% per annum (according to UETCL). The demand forecast for the industrial sector is contained in the number of units consumed by the industrial consumers and the industrialists contribute almost 80% of the load during the day. Peak demand for the industries occurs between 6a.m. – 6.00p.m (shoulder time), The peak demand in the evening is mostly domestic, with few industries running more than one shift, although clearly some commercial enterprises like hotels have a similar load profile to domestic customers. Logically, then, the energy cost of unconstrained electricity is zero, with the capacity charges being loaded onto the peak, i.e. onto those least able to afford it. The next and major problem for pricing and planning is that increments of capacity are mainly large, costly and rather slow to deliver. Bujagali is on the least-cost Ugandan expansion plan, and is located 8km downstream of the two existing dams at Jinja. It has a maximum capacity potential of 250 MW, but the plans at least since 1999 have been for an initial installed capacity of 200 MW.

2.4 Status of Electricity Sector Reform

In 1997 the Government of Uganda formulated a comprehensive and detailed Strategic Plan for transforming the Uganda power sector into a financially viable electricity industry, in order to enable the sector to supply reasonably priced and reliable power, and to make its full contribution to the further economic and social development of Uganda. This New Strategic Plan 2000 placed particular emphasis on the role of competition in promoting efficiency within the power sector and on private sector participation as being a key driver to enhance the power sector's performance. The reform efforts were also designed to address the need to finance large investment projects in the sector (Uganda Power Sector Restructuring and Privatisation Strategy (PSRPS), 1998). The objectives of PSRPS were to:

- To make the power sector financially viable and able to perform without subsidies from the government budget.
- To increase the sector's efficiency.
- To improve the sectors commercial performance.
- To meet the growing demand for electricity and increasing area coverage.
- To improve the reliability and quality of electricity supply.
- To attract private capital and entrepreneurs.
- To take advantage of export opportunities.

In 1999, the new electricity legislation was enacted, providing for the liberalisation of the power sector, the introduction of new private sector electricity infrastructure providers and the privatisation of the existing

assets. The Electricity Act of 1999 set the legal basis for the industry's restructuring. In 2001, the Government functionally unbundled Uganda Electricity Board (UEB) into separate generation, transmission and distribution companies. The assets, liabilities and operations of UEB were transferred to the:

- Uganda Electricity Transmission Company Ltd (UETCL), which has a key role, (i) as owner, investor and operator of transmission power lines (66 kV lines and above) in the country; (ii) as single buyer for grid connected generation, which is sold on to the distributors; (iii) as power expansion planner, and (iv) responsible for imports and export of power.
- Uganda Electricity Distribution Company Ltd (UEDCL), which is owner of the interconnected distribution assets owned by the state, and monitors the concession (asset maintenance) of Umeme.
- Uganda Electricity Generation Company Ltd (UECGL), which owns the power stations of Nalubaale and Kiira. The main task of UEGCL is to monitor the maintenance of state-owned generation assets that have been leased to Eskom, as well as the completion of Kiira power station. But the business plans of UEGCL, proposes to rehabilitate small hydropower plants and to construct new small hydropower plants.

The Government opted for long-term concessions for the generation and distribution businesses and decided that, in the interim, responsibility for transmission would remain with UETCL, which would operate as an independent and profit making business unit.

Generation and distribution are in the hands of the private sector on 20-year concessions, with cost-of-service regulation. The costs are based on written-down asset value increased by additional investment.

The distribution concession was transferred to Umeme in March 2005. The new company, Umeme, is 56% owned by Globaleq, an emerging markets power company a subsidiary of CDC, and 44% by Eskom.

Eskom Uganda (a subsidiary of Eskom Enterprises, the holding company for Eskom's non-South African business interests) won the electricity generation concession in late 2002. Under the 20-year concession, Eskom is responsible for all the power generated at the two dams in Jinja.

Ownership, operation and maintenance of the national transmission network will for the foreseeable future continue to be a government responsibility. For this purpose UETCL was established in 2000, as an independent company fully owned by the government. UETCL is the single buyer of bulk purchases in the Ugandan power market, and responsible for export sales and for power planning in close co-operation with MEMD.

In line with the unbundling of UEB, two new government institutions have been established in the electricity sector:

- The *Electricity Regulatory Authority (ERA***)** was established in 2000 as an independent regulator with the task to licence, approve tariffs and monitor generation, transmission, distribution of electrical energy

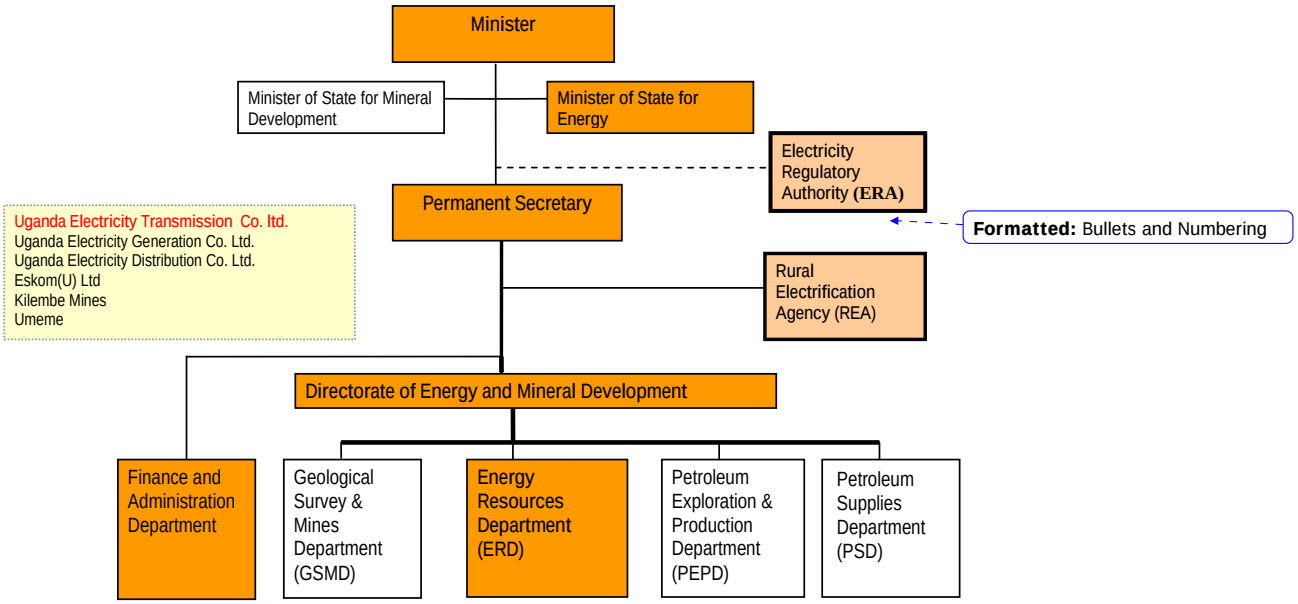
in Uganda. With financial support from Norway ERA has grown to be a capable organisation able to fill its mandate quite well.

- The *Rural Electrification Agency (REA)* was established in 2003 to promote social and economic development in the rural areas through planning and provision of subsidies to commercial/private sector based investments in rural electrification schemes. REA is currently receiving support from Sida for institutional capacity building.

MEMD/Energy Resources Department (ERD) has the overall responsibility for policy formulation and monitoring of policy implementation and sector performance. The Department is also responsible for mobilisation of domestic resources for policy implementation and international private capital for the larger infrastructure investment needed.

The restructuring of the power sector is complete in principle. Uganda Electricity Board (UEB) functions have been successfully unbundled. The Ministry and the unbundled new institutions have fully adjusted to the new situation but however, involving private sector requires a lot of commitment from the government, particularly in generation and rural electrification, since the private sector does not have the required competence and capacity ready available. Power supply has thus been moved from a monolithic, and widely considered inefficient, state owned industry, to a privatised and commercialised mode of service delivery within a fairly short period of time. The new structure of the restructured sector is shown in the figure below.

Figure 1.2 The organisation structure of the Ministry after the sector reforms



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Source: Ministry of Energy and Mineral Development.

CHAPTER THREE

3.0 THE REGULATORY AND POLICY FRAMEWORK

3.1 Electricity Sector Planning

The energy policy objectives of the power sector is laid out in Energy Policy for Uganda (September 2002) and the "Strategic plan and Implementation Plan" of June 1999. It is aimed at ensuring that the power sector is financially able to perform without subsidies from the government budget

- Increasing the sector's efficiency
- Improving the sectors commercial performance
- Meeting the growing demand for electricity and increasing area coverage
- Attracting private capital and entrepreneurs and
- Taking advantage of export opportunities

The Strategy Plan places particular emphasis on the role of competition in promoting efficiency within the power sector and on private sector participation as key drivers to enhance the power sector's performance. Extensive Power Sector Reforms have now been made and the electricity sector is successfully reorganised in order to better be able to achieve the Government's goals.

However, the reforms have not been enough to achieve the intended results such as

(i) Access to electricity for the poor and for the industry and

(ii) Quality of supply (e.g. outages, low voltage).

For rural electrification, the new framework is composed of the Rural Electrification Agency (REA), the Rural Electrification Board (REB), and the Rural Electrification Master Plan (RE Master Plan). In accordance with the Act, the moneys of the fund shall consist of:

- Appropriations by the Parliament;
- Any surplus made from the operations of the ERA;
- A 5% levy on bulk purchases of electricity; and
- Donations, grants, and loans acceptable to MEMD and MFPED.

The impressive scope of Ministry of Energy and Mineral Development (MEMD)'s work is illustrated by the following list of key energy policy documents: Power Sector Reform Strategic Plan (1999), Rural Electrification Strategy and Plan 2001 – 2010 (from 2001), Biomass Energy Strategy and Plan 2002 – 2010 (from 2001), Energy Efficiency Strategy and Plan (2002 – 2010), Energy Policy (2002).

In the medium term (2005/06 – 2007/08), the main policy priorities stated in the Budget Framework paper (BFP) input are to:

- Put in place policies and laws, which will enable private investment and capital inflow into the energy and mineral sectors
- Increase electricity generation and rural electrification
- Stabilise the prices of petroleum products and achieve security of supply
- Conduct petroleum exploration and development in order to achieve local production.

3.2 The Energy Policy for Uganda (2002)

The Energy Policy for Uganda (2002), guides plans of the energy sub-sector. Its main policy goal is "to meet the energy needs of the Ugandan population for social and economic development in an environmentally sustainable manner". The broad policy objectives are: -

(i)To establish the availability, potential and demand of the various Energy resources in the country.

(ii) To increase access to modern affordable and reliable energy Services as a contribution to poverty eradication.

(iii) To improve energy governance and administration.

(iv) To stimulate economic development.

(v) To manage energy-related environmental impacts.

Plans that are used to implement this policy are; Power Sector Reform Strategic Plan (1999), Rural Electrification Strategy and Plan (2001 – 2010), Biomass Energy Strategy and Plan (2002 – 2010), and Energy Efficiency Strategy and Plan (2002 – 2010).

3.3 The Electricity Regulatory Authority

The Electricity Regulatory Authority (ERA) was established by the Electricity Act 1999 as an independent statutory body responsible for regulating the electricity industry in Uganda. The functions of the Electricity Regulatory Authority as stated in section 76 of the Electricity Act (1999) include among others;

- To issue licenses for –

- The generation, transmission, distribution or sales of electricity; and
- The ownership or operation of transmission systems; generation plants and distribution networks.

- To receive and process applications for licenses;
- To prescribe conditions and terms of licenses issued under this Act;
- To modify licenses issued under this Act;
- To make and enforce directions to ensure compliance with licenses issued under this Act;
- To establish a tariff structure and to investigate tariff charges, whether or not a specific compliant has been make for a tariff adjustment;
- To approve rates of charges and terms and conditions of electricity services provided by transmission and distribution companies;
- To review the organization of generation, transmission and distribution companies or other legal entities engaged in the generation, transmission and distribution of electricity to the extent that organization affects or is likely to affect the operation of the electricity sector and the efficient supply of electricity;
- To develop and enforce performance standards for the generation, transmission and distribution of electricity;
- To encourage the development of uniform electricity industry standards and codes of conduct;
- To establish a uniform system of accounts for licensees.

The Authority first approved an increase in end –user electricity tariffs in 2001 after the unbundling of the vertically integrated Uganda Electricity Board (UEB) into three independent companies. This was the first tariff

adjustment in eight years the last having been carried out by UEB in 1993. Since then, the Authority has been approving tariff adjustments annually.

3.4 The Electricity Act

The Electricity Act 1999 is "an Act to provide for the establishment of the Electricity Regulatory Authority; to provide for its functions, powers and administration; to provide for the generation, transmission, distribution, sale and use of electricity; to provide for the licensing and control of activities in the electricity sector; to provide for plant and equipment and for matters relating to safety; to liberalise and introduce competition in the electricity sector, to repeal the Electricity Act, Cap 135 and the Uganda Electricity Board (Special Provisions) Act, Cap. 136; to provide for a successor Company to the Uganda Electricity Board, and for connected purposes." It received assent on 31 October 1999.

The object of the Act is "to regulate the generation, transmission, distribution, sale, export, import and distribution of electrical energy in Uganda." Part V deals with licensing, and Part VII sets out the details of the licenses required for generation, transmission, distribution and export. Generation licenses are required for all plants of more than 0.5 MW, and the license for a hydropower plant with a generation capacity exceeding 10 MW is time limited. "Upon expiry the plant, including all existing installations, property and rights needed for power generation, shall be transferred to the Government without any compensation being paid to the licensee."

Part VII of the Act deals with Rural Electrification and states that "The Government shall undertake to promote, support and provide rural electrification programmes through public and private sector participation. The Minister shall prepare a sustainable and co-coordinated Rural Electrification Strategy and Plan for Uganda for the approval of Cabinet." Part XIII establishes the Electricity Disputes Tribunal. "The Minister, in consultation with the Judicial Service Commission shall appoint the Chairperson and Vice-Chairperson of the Tribunal."

The Act puts in place the necessary legislative framework for a regulated Single Buyer Model electricity system which allows private ownership, although the method that seems to be preferred is the concession model (and that is obligatory for any large hydro project).

3.5 Electricity Tariff Setting in Uganda

Electricity tariff is incremental charge on electricity due to power consumption for both domestic and industrial customers. Current tariff Rates for supplies of electricity in Uganda are made up of five categories namely: Domestic, Commercial, Medium Industry Large Industry and Street lighting. The present tariffs are shown in Appendix 7.3 the structure indicates the unit charges for the energy consumed, the maximum demand charges reflecting the capacity cost imposed on the system, and a monthly standing service fee.

The Authority first approved an end-user electricity tariff in 2001 after the unbundling of the vertically integrated Uganda Electricity Board (UEB) into three independent companies. This was the first tariff adjustment in eight

years, the last having been carried out by UEB in 1993. Since then, the Authority has been approving tariffs adjustments annually. Sometimes these tariffs have actually dropped and at other times, they have gone up depending on the revenue requirements approved for the utility companies in a particular year. Tariff increases were effected in June 2001, September 2002, June 2003, January 2004 and April 2005.

Section 76 of "The Electricity Act, 1999" stipulates that the tariff structure shall take into account licensee's total revenue covering all reasonable costs and offering a reasonable rate of return. Tariff structure should be in accordance with the principles of tariff calculations, and methodology and procedures of tariff calculation should be approved by ERA. "The Electricity (Tariff Code) Regulation, 2003" (Statutory Instrument 2003; No. 23) stipulates that tariffs shall be based on accurate cost information, reflecting short term variation in costs imposed on the system by the time of use, seasonal factors, consumer load profile, voltage levels and other similar factors. The regulation also stipulates that the tariff shall reflect true cost of the service provided and set clear price signals to the consumers.

Prior to 1st June 2001, the Long-Run Marginal Costing (LRMC) system was used to calculate the tariff structure. LRMC took into account changes in costs resulting from additions to capacity to serve incremental load increases i.e. capital expenditure. In accordance with Section 76 of "The Electricity Act, 1999" and Regulation "The Electricity (Tariff Code) Regulation, 2003", as cited above, the tariff structure was changed in June 2001 so that customers were charged for costs imposed on the system and for operational

costs incurred in delivering the service. This tariff structure is based on the Short-Run Marginal Costing system (SRMC).

The key features of the tariff reform were to remove cross subsidies between customer classes, partial removal of the lifeline subsidy for the first 30kWH of consumption, and the introduction of foreign exchange and inflation indexing in the tariff.

The rationale for the tariff reforms were given by ERA as follows:

- That retail tariffs had not been adjusted since 1993 and inflation and exchange rate fluctuations had not been taken into account.
- Tariff adjustment was required to finance the investment in improved quality of service and new connections and grid extensions.
- Removal of cross – subsidies between industrial and domestic consumers to reflect the true cost of supplying different customer classes
- To enable the sector to cover its costs without government subsidies

CHAPTER FOUR

4.0 METHODOLOGY

4.1 Sampling Frame and the sample selection procedure

The survey was conducted from 96 industries. These industries were randomly selected from a sampling frame of 840 industries constructed from the records of Umeme. These are large and medium industries that are operating in Uganda. Using a multi-stage, random sampling process, 96 firms were selected, and out of these, 31 large industries and 51 medium industries responded totaling to 82 industries. This random sample was arrived at taking into consideration of the distribution of these industries in the different regions of the country. Over 60% of the industries in the sampling frame were situated in Kampala. With most of the firms concentrated in Kampala, the majority of the firms sampled are from the Kampala District. Thus, the consultant sampled 47 industries from Kampala, 20 from the central region, 21 from eastern and 8 from western region. No industry was sampled from the Northern region because the consultant found that there were less than 4 industries in the northern region some of which are not in production. UIA provided the classification of these industries depending on what the industry is engaged in and it was found out that there are 24 categories of these industries. The Consultant sampled only five industries from each category. Out of the 24 categories from which the sample was drawn, responses were received from 18 categories as shown in table 1.3 below.

Table 1.3 Sampled industries by region

Region	Estimated number of Industries	Number of industries Sampled	Percentage Sampled from the region	Number of responses from the region	Percentage Of responses from the region
Kampala	500	47	48%	43	91%
Central Region	140	20	21%	19	95%
Western	70	8	9%	8	100%
Eastern	140	21	22%	13	62%
Northern	10	0	0%	0	0%
Total	840	96	100%	82	86%

Source Umeme records and consultants own computations

From table 1.3 above it should be noted that the Consultant sampled 11% of the industries in the medium and big industrial category, 48% of the Industries sampled were drawn from Kampala, 21% were drawn from central Region 9% from the western region and 22% from eastern region. This distribution of the sample covers almost the whole country save for the northern region where industries are non operational[5]. The Table also gives the estimated number of industries by region, the number of industries sampled from each of the four regions and the associated responses. 95% of the sampled industries from the Central responded while 100% of the industries from Western regions responded, while 91 % and 62% of the sampled industries responded from Kampala and Eastern regions respectively.

[5] No industry was samlped from the north becuse it was established that none of the industries is currently operating due to insecurity.

Table1.4 Responses from 24 industry categories

Index	Industry category	Number of responses
1	Floriculture	4
2	Forestry	0
3	Fruits and Vegetables	0
4	Fish and Fish Farming	5
5	Livestock	0
6	Mining	3
7	Cotton and Textiles	4
8	Edible oil	4
9	Foods and Beverages	10
10	Leather	3
11	Dairy and Dairy products	5
12	Electronics	0
13	Packaging	6
14	Pharmaceuticals	2
15	Metal and metal products	5
16	Iron and steel	4
17	Building and construction	5
18	Energy	0
19	Storage	0
20	Transport and Communication	5
21	Financial services	5
22	Health care	5
23	Tourism	4
24	Education services	3
Total		82

Source: UIA and consultant's own computations.

Table 1.4 above gives the number of industries sampled from each industrial category. The Consultant was not able to select a sample from forestry, fruits and vegetables, livestock, electronics, energy and storage categories because they didn't have industries in the large and medium categories but the consultants results will not be substantially affected by these categories of industries.

4.2 Survey Instruments

After consultations with the stakeholders and review of the literature on the energy sector in Uganda, a questionnaire was developed. The questionnaire had seven sections as follows:

(i) Industry bio-data
(ii) Capacity utilisation
(iii) Industrial production
(iv) Alternative sources of energy
(v) Tariff effect on the industry
(vi) Industrial cost structure
(vii) Energy efficiency and quality of service
(viii) Time of use metre

The questionnaire was pre-coded and used to collect information from the sampled industries.

4.3 The Data collection team

The data collection team composed of four people; a senior economist (supervisor and team leader), an engineer, a statistician and a social scientist. The team leader trained the rest of the team before the data gathering exercise began. Each of the members of the team was assigned firms where a self-administered questionnaire was delivered. Where respondents were ready, the questionnaires were filled and collected. Otherwise, members revisited the firms to pick the filled questionnaire.

4.4 Responses From the Industries

A total of 96 questionnaires were delivered to the sampled industries but only 82 questionnaires were returned. Of these 31 were from large scale industries while 51 were from medium scale industries

4.5 Data Coding, Entry, and Analysis

Before entering the data, researchers edited the questionnaires manually from the field to check for any possible errors. The supervisor further crosschecked the questionnaires before passing them over for data entry.

The data entry personnel coded some of the questions that had not been coded, and prepared a code sheet. A data entry screen was designed in Access, from where the data was captured.

Data was exported to SPSS, the package that was used to analyse the data. Preliminary analyses included computation of descriptive statistics such as the mean, median, and frequencies. Exploratory data analysis was also performed to check for outliers.

CHAPTER FIVE

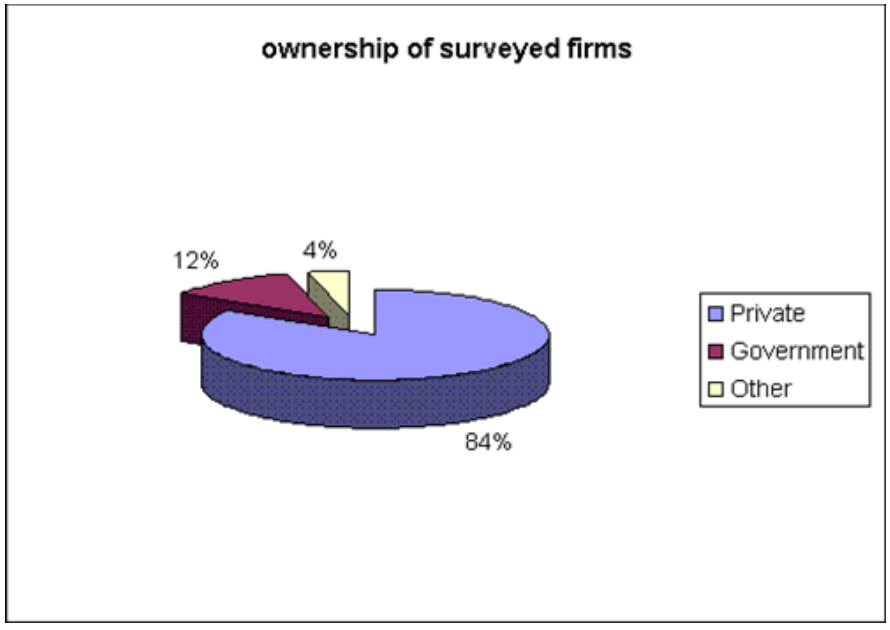
5.0 RESULTS FROM THE STUDY

5.1 Background Characteristics of the Surveyed Firms

5.1.1 Ownership

The survey has revealed that the majority of firms are privately owned. Out of the 82 firms that responded, 84% of them are privately owned, and 12% are Government owned while 4% are jointly owned.

Figure 1.3 Ownership of the surveyed firms



5.1.2 Dates of firms' establishment

Date/Period	Number of firms
Before 1950	10
Between 1950 – 1960	2
Between 1960 – 1970	11
Between 1970 – 1980	4
Between 1980 – 1990	6
Between 1990 – 2000	21
After 2000	19
Non response	9
Total	82

5.2 Load profiles of the industrial consumers.

- The study has revealed that these industries have installed capacity of almost 120MVA although they use only 80MVA, which is 67% of the installed capacity.
- The load analysis from the energy consumption according to Umeme records is shown in the table below.

Table 1.5 Load profile analysis for Medium and Large industries (Sept -Dec 2005)

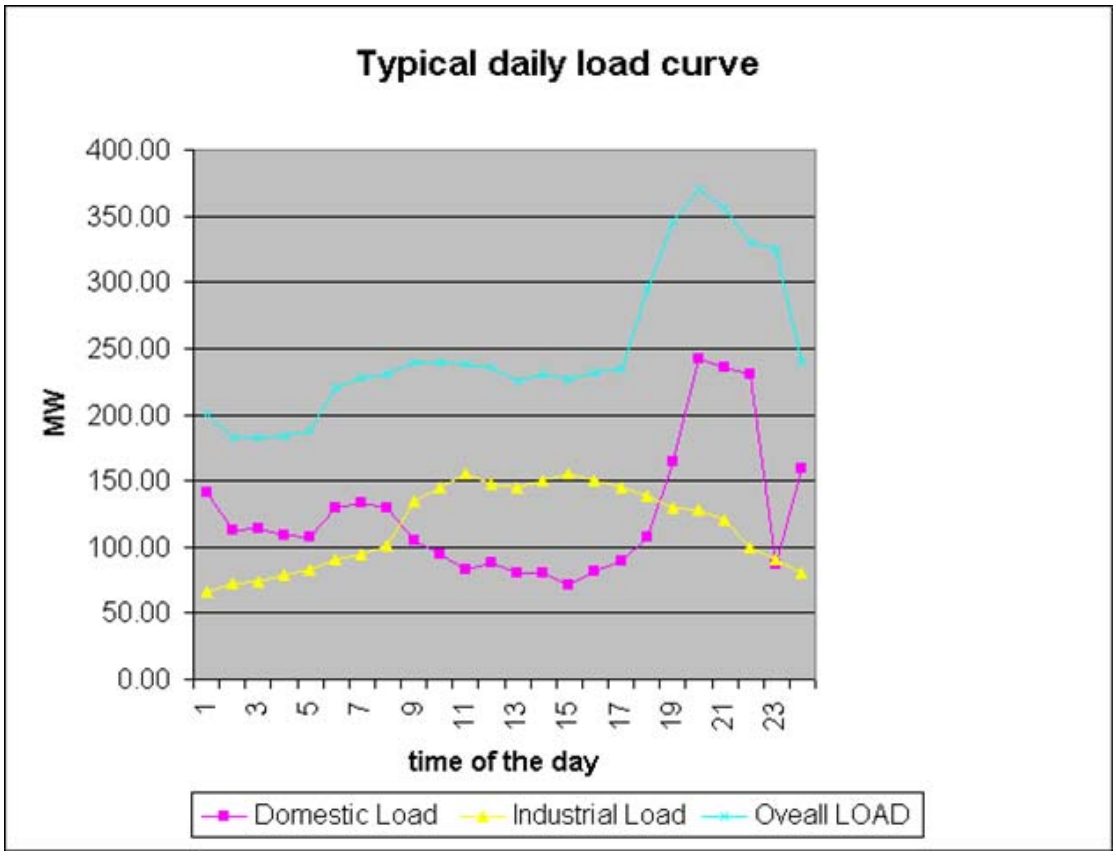
Time/Month	Aug	Sept	Oct	Nov	Dec	Total	**Monthly Average**	**%age**
Shoulder	28,916	27,733	34,262	20,723	30,138	141,772	**29,544**	**53.8**
Peak	10,550	13,900	11,473	8,834	10,004	54,761	**10,952**	**20.7**
Off – Peak	11,605	14,033	16,363	11,832	13,602	67,435	**13,487**	**25.5**
Total	51,071	55,666	62,098	41,389	53,744	263,968		**100**

Source: Umeme Ltd and Consultants own computation.

- The load analysis from the table above show that 53.8% of the energy is consumed during shoulder period while 20.7% and 25.5 is consumed in peak and off peak periods respectively. This implies that 54% of the total energy is consumed during the day and 46% of the load is experienced during the night. This has an implication on the capacity demand on the system, which cannot meet the current demand estimated to be at 370MW.

- The findings of the study also reveals that 53.1% of the industries surveyed have maximum demand of between 50 – 500 kVA, while 34% of the industries have maximum demand above 500 kVA. This maximum demand is registered during the shoulder period of the day, between 6.00 a.m – 6.00 p.m. at around 11.00 am in the morning.

- The daily load pattern, with the exception of Sunday, displays a constant pattern with a peak load starting to improve around 9.30a.m, reaching at peak at 11.00a.m. The load there after drops a bit at lunch time and picks up again, to reach its maximum at around 3.00 p.m. this can be seen from one of the typical daily load curves for the month of December 2005 as shown in the figure below.


Typical daily load curve
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
MW
1
3
5
7
9
11
13
15
17
19
21
23
time of the day
Domestic Load
Industrial Load
Oveall LOAD

5.3 The production structure of the Industries

- The study has also revealed that 60% of the power consumed in Uganda is used by the medium and large industries. The consumption pattern of these industries show that 53.8% of the energy used is consumed during the shoulder period while 20.7% is consumed in the peak period and 25.5% is used in the off peak period.

- The study has revealed that 30.8% of the firms operate one shift of eight hours a day. 14.8% of the firms operate two shifts of eight hours each a day and 54.4% work throughout 24 hours. Industry categories, which operate for over 16 hours, include Floriculture, Fish and Fish Farming, Edible oil, Foods and Beverages, Packaging, Health care, Tourism, Education services Iron and Steel, Mining and Diary and Diary products.

- The study has also revealed that of the 54.4% of the industries who work 24 hours contribute over 80% of the share of the electricity consumption in the medium and large industrial categories.

The consultant picked 11 among the biggest consumers of power in the industries surveyed and the analysis on their pattern of consumption for the month of October, November and December is shown in the table below.

Table 1.6 Power consumption[6] of selected industries

No	Company	Units consumed in Shoulder[7]	Units consumed in Peak[8]	Units consumed in Off peak[9]
1	Hima Cement	80,098,600	22,974,700	32,391,500
2	Tororo Cement	13,948,000	3,038,000	2,634,000
3	Steel Rollings	27,753,300	10,616,600	13,358,500
4	KCCL	1,563,200	970,457	630,399
5	Mukwano Industries	896,468	273,532	502,686
6	Mulago Hospital	4,922,105	2,765,921	1,252,112
7	Nytil	92,993,600	34,951,100	51,150,700
8	Sheraton Kampala Hotel	455,340	235,360	283,960
9	Oscar Industries	6,274,400	13,659,100	9,795,300
10	Shumuk Industries	912,800	323,600	410,800
11	National Water & Sewerage corp.	90,768,081	36,543,156	46,330,226
	Total units consumed	320,585,894	126,351,526	158,740,183
	% Consumption of Total	**53%**	**21%**	**26%**

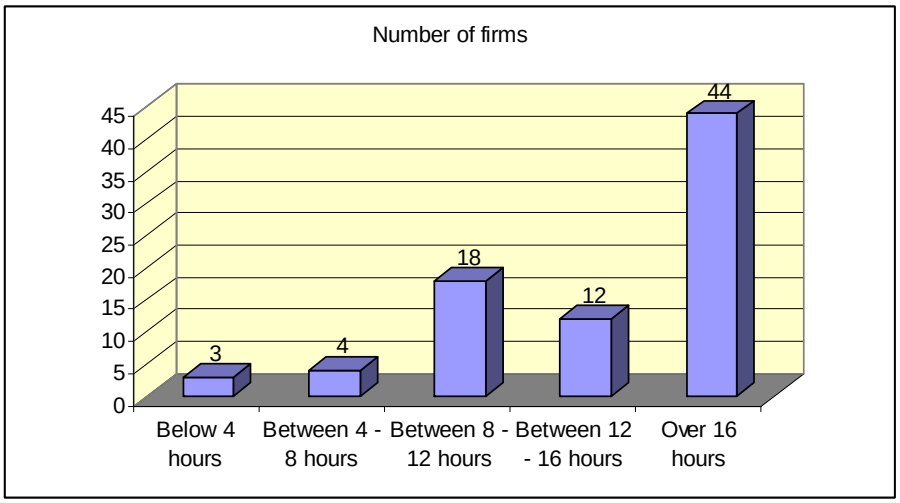
Source: Consultants Own Computations

From the above table it is very clear that most of the industries operate during the day. Of the eleven firms the consultant has analysed, 53% of energy is consumed in shoulder time and 21% in peak and 26 % in off peak. This implies that these industries have taken advantage of the low tariff in the off peak period and plan their operations through out the day.

[6] Consumption is for the months of October, November and December 2005
[7] Shoulder preriod is between 6.00a.m- 6.00p.m.
[8] Peak period is between 6.00p.m – 11.00pm.
[9] Off peak period is between 11.00p.m- 6.00 a.m

- Over 95 percent of the firms surveyed register maximum demand during shoulder hours (between 6.00 am – 6.00 pm), at around 11.00 a.m. in the morning. Forty-four out of the eighty-two firms surveyed, which constitutes over 54% of all firms, operate for over 16 hours (see figure 1.5 below).

  Figure 1.5 Firms operation in 24hours.



  Source: Computed from the survey data

  Note: Figures on the y-axis represent number of firms.

When asked whether they are willing to change their production from shoulder and peak periods to off-peak periods, over 94% of the firms which responded to this question indicated that its not possible to shift their operations to off-peak periods. The reasons given by the industries include the following:

- The production patterns of some industries dictate that they have to start heating the machines in shoulder and have final production in off - peak so it is very difficult for such industries to change their pattern of production and these include, Iron and Steel mills, Cement industries.
- That the efficiency of production at night is very low , the safety of the operators and the machinery is compromised and proves to be very expensive to supervise people at night.
- The nature of business the firm does dictate that they have to produce in a certain period of time for example banks will have to operate during the day while Hotels, Floriculture firms, Hospital and Educational institutions have to operate at peak time of the day.

5.4 Nature of back-up sources of energy

Most of the surveyed firms, which responded, use generators as their back-up source of energy. The capacity out puts of these generators is estimated to be 39,800 kVA (see the capacity of generators in the industries in appendix 7.4)

Table1.7 Capacity output of generators

Capacity of generator	Number of firms	Generation capacity in kVA. (Estimated)
Below 50 kVA	8	400
Between 51 – 200 kVA	25	3,900
Between 201 – 500 kVA	31	15,500
Between501 – 1000 kVA	9	6,000
Over 1000 kVA	9	14,000
Total	82	39,800

Source: Consultants Own computation.

Although the majority of the surveyed industries have standby generators, only 36.6% use them at full capacity while 18.3% of the firms use below 30% and 45.1% use between 30 – 75% of the capacity of the installed generators. The explanation we got when we asked the industries why they don't use their generators at full capacity is that these generators are kept for priority loads to keep running some operations as they wait for power to come back. Another reason given was that running generators on full loads was very expensive which firms would not manage.

- The estimated total generation capacity of these standby generators for the surveyed industries was found out to be around 40MVA.

- It was also found out that these generators couldn't singly run the operations in some industries when Umeme power is off. Industries affected are cement industries, cotton and textile, metal and metal products, iron and steel building and construction. Only a few of the industries like Bank of Uganda with 1500kVA generator, Britannia Industries with 2000kVA, Sheraton Kampala hotel with 1200 kVA, and Mukwano industries with 4000kVA could run all their operations on their Standby generators.

- The study has revealed that the industries spend a total of almost 640 million shillings running the generators to supplement the power from the main grid system in a month, which is 30% of the total cost of the energy bill in the firms.

- 98% of the industries are not willing to sell part of the energy from their standby generators; reason being:
    - That there will be a lot of difficulties on how to meter the energy that will be supplied to other customers.
    - The tariffs that the industry will charge other customers.
    - That the firms that have generators may not be able to establish exactly the requirements of other customers in order to come up with the sufficiency of the generated energy.
    - That the industries are not in the business of selling power and that they have to concentrate on their core business.

The Consultants interpretation of the above findings is that these industries have backup generators for the purpose of having power to run their operations when power is off. Heavy consumers of power like Steel Rollings, Nytil, and National Water have no generators while UGMA engineering and Hima cement factories have generators of capacity of 130 kVA and 400kVA respectively to run priority operations. This implies that large industries cannot rely on generators for production in their industries.

5.5 The effect of tariffs on overall industrial competitiveness

- The effect of the tariff on the industries was found in the contribution of different costs in the total cost of production and it was found out that electricity tariffs accounts for 15.3 % in the total cost of production in the surveyed industries. The effect of tariffs in different categories of industries is shown in the table below which shows the percentage contribution in the total costs of production in the firms.

- It has been established from the study that the most affected industries are pharmaceutical companies with electricity accounting for 22% in the total cost of the firms, followed by Packaging with 20% and by floriculture, dairy and dairy industries, iron and steel, and foods and beverages with 18%. Fish and fish farming with 16%, and metal and metal product with 14 %. Other categories are in the range below 10%, which does not affect the costs of production greatly. The different percentages show how the industries are affected differently.

Table1.8 Effect of tariff on industry categories

Index	Industry category	No. of responses from the industrial category	%age cost of energy in total production costs of the firm
1	Floriculture	4	18%
2	Forestry	0	N/A
3	Fruits and Vegetables	0	N/A
4	Fish and Fish Farming	5	16%
5	Livestock	0	N/A
6	Mining	3	8 %
7	Cotton and Textiles	4	9 %
8	Edible oil	4	8 %
9	Foods and Beverages	9	6 %
10	Leather	3	8%
11	Dairy and Dairy products	5	18%
12	Electronics	0	N/A
13	Packaging	6	20%
14	Pharmaceuticals	2	22%
15	Metal and metal products	5	14%
16	Iron and steel	4	18%
17	Building and construction	5	9%
18	Energy	0	N/A
19	Storage	0	N/A
20	Transport and Communication	5	6%
21	Financial services	5	4%
22	Health care	5	8%
23	Tourism	4	11%
24	Education services	3	8%

Source: Consultants computations

- Majority of the industries use electricity as the major source of energy and hence it would be assumed that tariffs have a big impact on their production process. However the study has revealed that the impact comes in when electricity accounts for a big percentage in the production process. For example in industries where electricity accounts more than 15% in the total cost, an increase of 10% on the tariff will affect the profit margin of the industries substantially. Such industries include Pharmaceuticals, Packaging, Floriculture, Dairy and Dairy products Iron and Steel industries and Fish and fish farming.
- It should be noted that any increase in the tariff affects industries differently because the effect of an increase in the tariff will be born by the final consumers of the product.

Our analysis show that the Iron and Steel industries and Cement industries will be affected substantially because they use a lot of power in their production process. These industries' goods compete with goods coming from Kenya and South Africa where industries are subjected to comparatively lower tariffs and they don't face problems of unreliable power which increase the costs of production compared to their Ugandan counterparts.

5.6 Price signals in time of use tariffs and changes to off peak.

- The purpose of time of use tariff is to encourage Consumers to use more electricity during the off-peak period rather than peak period. The study investigated the level of price signal in time of use that can

lead to changes to off peak hour's consumption. The result reveals that 54% of the industries operate 24hours and 38% of the industries operate for 16 hours in a day. Only 8% of the industries work in shoulder time only. The amounts of energy consumed by these industries in the three period of the day are 53.8% in shoulder, 20.7% in peak and 25.5% in off peak.

- At least 90% of the industries are taking advantage of the low off peak tariff. However the consultant found out that the current tariff level and price signals are not high enough or prohibitive enough to cause a change in production hours. For instance medium scale industry's retail price for off peak consumption is 55% lower than the normal consumption hours. For large industries the retail cost of off peak consumption is 59% more than the normal hours price.

- The above is attributed to the fact that production expenses are not dependant on electricity expenses and that any change in the production pattern of the industries is attributed to increase in the production target due to growing demand in the market rather than taking advantage of the low tariff in off peak.

- The price signal that would cause large and medium industries to reduce consumption during peak would be a tariff equivalent to the one charged commercial consumers because they pose a great strain the network during peak hours. However, the price signal should be adjusted to take care of inflation.

5.7 The industrial cost structure

- The industrial cost structure of industries was determined and it was found out that energy related costs (electricity and backup sources) take 22% in the total cost of production in the industries (electricity 15.3% and backup sources 6.7%).

- The findings of the study shows that raw materials accounts for the biggest percentage in the total cost of the firms with 39.8% followed by labour with 18.4 %; electricity and backup sources take 15.3% and 6.7% respectively. Transport and taxes each account for 5.4%, Telephone and communication account for 3.1% and water accounts for 2.3%. Other overhead costs in the firm take 4.0%. The different percentage shares of the costs in the industries are shown in the table 1.9 and figures 1.6 below.

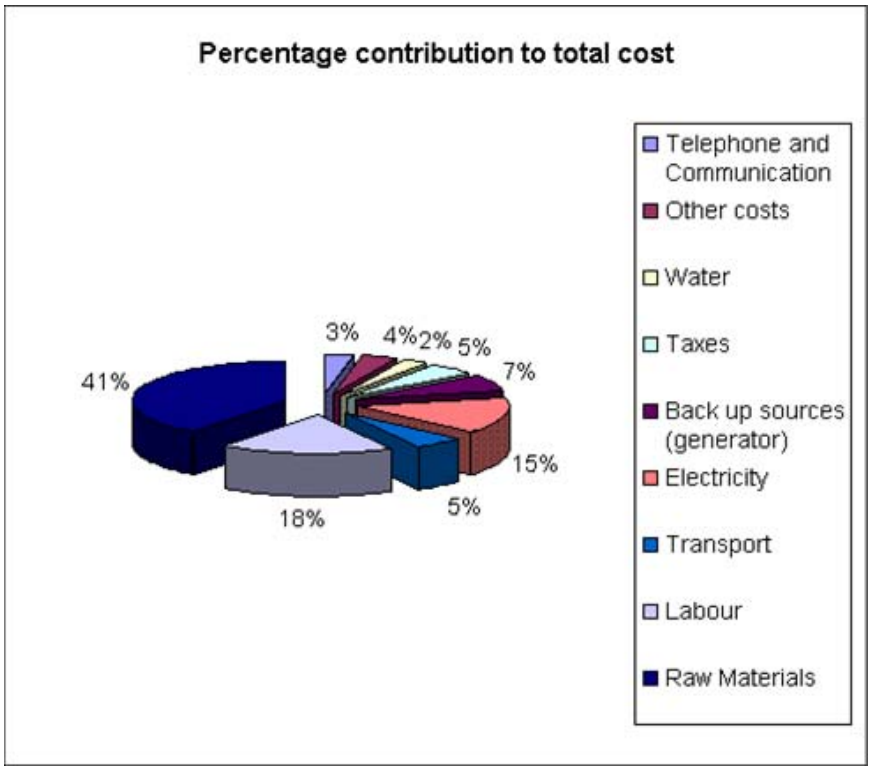
Table1.9 Percentage cost structure in the industries

Cost category	Percentage
Water	2.3%
Telephone and Communication	3.1%
Other costs	4.0%
Transport	5.4%
Taxes	5.4%
Back up sources (generator)	6.7%
Electricity	15.3%
Labour	18.4%
Raw Materials	39.8%

Source: Consultants Own Computations

The cost structure of the industries depends on the production process of the industry but generally raw materials will take the biggest percentage in any industry.

1.6 Percentage cost structure in industries.



5.8 Cost of centralised thermal against alternative sources of energy

- The study has revealed that the industries spend a total of almost 640 million shillings every month to run generators to supplement the power from the main grid system. This translates to an average of 8 millions per firm per month when the generators are run for 4 hours each day for three days in a week.

- The findings show that firms are using back up generators as the only alternative sources of energy. The cost of one kWh was calculated from the costs of running the generator in terms of fuel, spare parts and other maintenance costs. It was found out that generators are run for 92 hours in a month. Fuel cost was taking 70% of the cost of a kWh while spare parts and maintenance took 30% of the cost of a kWh and the average cost of one kWH for these industries with back up sources is estimated at about 800/= per unit.

- The centralised thermal we took the costs at Aggreko (the company which is running a 50MW generator at Lugogo substation in Kampala). The Consultant found out that Aggreko is selling an average of 22 million units per month. The total energy cost is estimated at US $ 0.295 per unit cost which translates to USHS 540/= per a kWh of which US $0.113 is Government subsidy, which is equivalent to Ushs 205/=(at an exchange rate of 1835 per US dollars.)

Company	Cost per kWh	Subsidy	Total cost per kWh
Surveyed Industries	800/=	-	800/=
Centralised Thermal/ Aggreko	540/=	205/=	335/=

- This implies that the firms' energy cost is very expensive at 800/= per kWh compared to the centralised thermal at 540/= per kWh. Centralised thermal is the best alternative because its unit price is considered cheaper, environmental issues can be mitigated, subsidies can be administered and Government can monitor fuel consumption easily.

5.9 Measures undertaken to reduce power bills

75% of the firms surveyed are aware of the energy efficient mechanisms to save the electricity and about 70% of the industries had adopted energy saving initiatives, and the percentage of industries using the method is shown in the table below. These initiatives have been able to help some of these industries save on their bill and become efficient in use of the power.

Table 2.0 Methods used by firms to save energy

No.	Method of energy saving	% Of firms using the method
1	Use of Capacitor banks (Power factor correction)	60%
2	Energy saving tubes	90%
3	Sensitive electric heaters	40%
4	Off peak power usage	70%
5	Proper planning of operations	80%
6	Switching off machines not in use	26%
7	Using modern equipment with low power consumption	22%
8	Regular maintenance of electric equipments	50%

- It should be noted from the table that majority of firms have adopted the use of energy saving bulbs, the use of capacitor banks and proper planning of their operation in order to save on their energy usage. The Consultant found out that there is no method that can be used in isolation to improve energy efficiency; it needs the use of multiple methods to be efficient in energy usage.

- It was also found out that 17 of the firms surveyed seemed not to be aware of the energy saving mechanisms. Although the number of firms who are not aware seems to be small (25%), compared to the firms that are aware, this is a bit worrying given that these are in the large to medium scale category of industries. Firms in this category

consume a lot of power and failure to use power efficiently can translate into significant amounts of power wastage.

On power factor the consultant investigated and found out that 20% of the industries had power factor below 0.75. While 70% had power factor of 0.9.which is very good. This implies that those industries try to maintain their power factor very high as a measure of minimising costs of electricity.

5.10 The Quality of service and its impact on production costs.

- The survey revealed that almost 70% of the power interruptions are due to load shedding while 30% is due to outages due to technical faults.

- 79% of the firms surveyed were not happy with the quality of service while 21% of the firms were happy with the quality of service from Umeme. The industries are not happy with the quality of service because of the customer service delivery.

- 74% of the surveyed industries get power cuts three times a week, while 28% of the firms get power cuts five times a week, which last between 4 – 8 hours a day. This power failure is reported to have consistently occurred for 15 days in a month for the last one year. The most affected industries are those located far off from Kampala like Hima Cement industries located in Kasese, Rwenzori commodities and Mpanga tea estate in Fort Portal.

- When asked on the response of Umeme on the restoration of power 54% of the firms said it took 1-4 hours and 26% of the firms said it took after 8 hours to have power restored depending on the magnitude of the problem.

- When asked whether they get prior information before power cuts 34.6 % of the firms get informed while 65.4 % do not get informed before power cuts but all industries accepted that they get information through newspapers on load shedding schedule.

- On the power voltage Fluctuations, 80% of the firms said that they had experienced low voltage while 90% had experienced high voltage and 25% have permanent fluctuating voltages.

- Currently there is a power shortage of 158 MW; this has led Umeme to resort to load shedding 90MW for 12 hours during the day and 150MW for 12 hours during the night to last for fourteen days in a month. This is going to affect the industries more severely.

5.11 Availability of Time Of Use meters

- The study has revealed that the majority of the firms over 80% are conversant with time of use meters and their managers know the importance of time of use meters. All the large industries had time of use meters fixed on their premises and are billed on time of use meters.
- The study has revealed that 90% of the firms are billed on time of use meters. The 10% of the industries have had their meters fixed on their industries but not yet billed, and these were mainly educational institutions.
- The findings show that 92.8% of the firms consider time of use meters an advantage.

CHAPTER SIX

6.0 Conclusions and Recommendations

6.1 Conclusions

The challenge for the industrial sector today is the reliability and availability of electricity rather than the cost of electricity. For the industrial consumers, power outages rather than high tariffs are big problem affecting the productivity of the industrial enterprises. An erratic and irregular supply of electricity (power surging and widespread load shedding) interrupts operations and creates under capacity. Power cuts appear three times in a week and it can last up to three hours to be restored. About 74% of the industries surveyed loose above three hours every week due to power failure. This translates to almost 156 days in a year when these industries don't have power for three hours in a day and this has got an adverse effect on the production structures of these industries.

This increases costs of production through loss of production time. Industries also incur higher costs due to losses when there is power outage by using alternative energy source (Diesel). That is why the industries can be able to spent over 30-50% of the cost of electricity on generator to help them continue running their industries whenever power goes off.

The quantitative results of the study reveal that electricity tariffs do not pause a high cost on the production processes of industries. For instance a 10% increase on the present tariff will not have much effect on the final cost of the product because electricity in some industries is no taken as the biggest ingredient in the production process.

The firms have not changed much their production pattern to take advantage of the off peak tariff rates implying that the price signal for time of use is not effective. The working of some industries in off peak is dictated by other factors rather than the price signal.

6.2 Recommendations

The recommendations of the study are given depending on the following areas as below:

(A): Addressing supply deficit

- There is an urgent need to address the power supply deficit by increasing the generation capacity in the country through putting up more thermal generators in the short run to address the current power crisis.
- There is need to start the development of Bujagali power station and future development of other power stations in a phased manner.
- Government should encourage and assist the private developers in development of mini hydro power stations, which can be able to increase on the generation capacity.
- The Distribution Company should be given a target to reduce the technical and non-technical losses from the present 35% to levels below 25%. This will put almost 30MW into the system, which is

claimed to be lost and it will be available to the paying customers than being consumed by the illegal consumers.

(B): Quality of Customer service

- Load shedding is the major cause of low quality of service in the industries. We recommend that Consumers should be given an explanation on the rationale for load shedding and what immediate actions are being taken to address the problem.
- We recommend that there should be an amicable synchronised system among the players in the power sector. Noting that Generation, Transmission and Distribution systems all contribute to the satisfaction of the consumers and therefore all the organs responsible for these systems should be synchronised in their delivery of service. For example increased generated power may not be delivered efficiently if the transmission and distribution companies are weak.
- ERA can institute and enforce the quality standards of electricity supply codes as measured by internationally recognized reliability indices. The utility companies should be measured against these international standards in order to keep track of their performance.

(C): Back up sources (Self-generation)

- The government should give concessions and subsidies on importing generators and tax waivers on fuel to those members of UMA who can afford to import generators for their own use since Umeme cannot meet the current demand of power in the country. If government has

to give subsidies on fuel there should be a strong monitoring mechanism in those isolated industries to ensure that the tax-free fuel does not find its way back in the market.

- There is need to change the policy framework on self-generation such that those that have generators could supply other customers when there is a shut down. Presently the legislative framework is a single buyer model; allowing only the Transmission company to sell in bulk to the Distribution Company. The ability to change this framework lies entirely on government. Even if this legislation was in place there is need to develop the infrastructure to supply the power from private self-generators.

- In the medium term we recommend a centralised thermal generation because it offers flexibility in its supply schedules, a lower tariff rate, a higher degree of safety, and a cleaner environment and its subsidy is very easy to implement and monitor due to a one centralised control point.

(D): Industrial Tariffs

- It is our recommendation that tariffs should be raised for peak up to the level of forcing industrialists not to operate in that period because they cause a strain on the capacity of the systems. For example they can be increased to what domestic consumers pay.

- An increase of 10% in tariffs can also be effected on industries to cater for the capacity costs in generation.

- Tariff codes for industries may be changed to cater for big consumers of power such that there is a step in charges for instance all consumers who consume more than 40,000 units in the month can have a lower tariff for units consumed above this consumption.
- When reviewing tariffs ERA is advised to try and to use the long run marginal cost principle rather than the short run marginal cost principle because the former is cost reflective.
- ERA needs to come up and sensitise the public and consumers on how tariffs are set such that they can appreciate what they are paying for.

(E): Other Recommendations

- The study also recommends that in order to improve the performance of the industries the following should be done;

  - The industries should be encouraged to integrate energy efficient management in their organisations and inefficient lighting systems in the factories should be replaced with modern energy saving lighting system.

  - Various stakeholders should work together to improve energy efficiency; this will require capacity building in UMA, power companies and industries.

  - The dialogue between UMA, ERA, Private Sector and other stakeholders should be strengthened to streamline the information

flow. There is need to create rapport and provide them with information on the Electricity Sector such that any information communicated to the public is based on actual facts.

- ERA and UMA should sensitise the industries about energy efficient mechanisms to save the electricity and these include the following;
    - Use of Capacitor banks (Power factor correction)
    - Use of Sensitive electric heaters
    - Use of Energy saving tubes.
    - Moving production to off peak.
    - Proper planning of operations in the industries.
    - Switching off machines not in use.
    - Using modern equipment with low power consumption.

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7.1 Survey questionnaire

THE IMPACT OF ELECTRICITY ON INDUSTRIAL SECTOR IN UGANDA.

Please help to fill in this questionnaire. The information given will be purely for facilitating the **Consultan**t to accomplish his study and it will be treated with confidence it deserves.

1.0 Industry Biodata

1.1 Name of the Industry/Firm ……

1.2 Address of the Firm……

1.3 Location of the Firm ……

1.4 Plot No: ……

1.5 Street: ……

1.6 Town: ……

1.5 Date when the Firm was established……..

1.6 Is the industry privately owned or government owned? ……

1.7 What percentage of shareholding is government?…….

2.0 Capacity utilization

2.1 What is you maximum capacity demand in a month?……

1. Below 50KVA
2. Between 51 - 200KVA
3. Between 201 – 500KVA
4. Between 501 – 1000KVA
5. Above 1000KVA

2.2What time of the day do you register this maximum demand?

1. Between 6.00 am - 6.00 pm (Shoulder)

2. Between 6.00pm - 11.00pm(Peak)
3. Between 11.00pm – 6.00am (Off Peak)

2.3 What is the Installed Capacity of the Transformer in the industry?

2.4 What is the current capacity utilization? ……

2.5 Why is all installed capacity not being utilized? (Reasons for under-utilization)

1. Unavailability of inputs.
2. Unavailability of spare parts,
3. Insufficient skilled staff
4. Insufficient Labour,
5. Insufficient capital
6. Power failure or frequent fluctuations,
7. High electricity tariffs,
8. Other factors (specify)…….

3.0 Industrial Production

3.1 How many hours do you operate in a day? ……

1. Below 4 hours
2. Between 4- 8 hours
3. Between 8- 12 hours
4. Between 12 – 16hours
5. Above 16 hours

3.2. Does the hydro power supply from the main grid meet your energy requirement

1. Yes
2. No

3.3. How many times do you get power cuts in a week

1. Once a week
2. Twice a week
3. Three times a week
4. Four times a week
5. Above Four times a week

3.4How many hours do you remain off supply due to power failure

1. Below 4 hours
2 Between 4- 8 hours
3 Between 8- 12 hours
4 Between 12 – 16hours
5 Above 16 hours

3.5. How much do you lose in man hours because of power cuts

1. Below 4 hours
2 Between 4- 8 hours
3 Between 8- 12 hours
4 Between 12 – 16hours
5 Above 16 hours

3.6. How reliable is the power?

1. Below 30%
2. Between 30% and 50%
3. Between 50% and 75%
4. Between 75% and 100%

4.0 Alternative sources of Energy

4.1What is the capacity output of your back up sources (generator) of energy?…….……

1. Below 50KVA
2. Between 51 - 200KVA
3. Between 201 – 500KVA
1. Between 501 – 1000KVA
2. Above 1000KVA

4.2 What % of your capacity back up (generator) do you utilize?

1. Below 30%
2. Between 30% and 50%
3. Between 50% and 75%
4. Between 75% and 100%

4.3 How much do you spend on running a generator in a month?……

4.4 How much do you spend on Electricity from UMEME…….

4.5 What is the percentage cost of the alternative power in the energy bill? ……

1. Below 30%
2. Between 30% and 50%
3. Between 50% and 75%
4. Between 75% and 100%

4.6 Would you consider selling unused capacity of your back up source nergy?

1. Yes
2. No

4.7 What incentives would you need from ERA to sell your unutilized capacity……

4.8 How may Days in week do you run your back up source (generator)…

1. Once a week
2. Twice a week
3. Three times a week
4. Four times a week
5. Above Four times a week

5.0 **Tariff effect on the industry**

5.1 Are you familiar with the Off Peak Industrial tariff?…….…….

1. Yes
2. No.

5.2 What is your industrial rate ……

5.3 How many units in your monthly bill are charged in these categories

Category	Units charged in month	% Contribution to the bill
Shoulder 6.00am-		

6.00pm		
Peak 6.00pm-11.00pm		
Off peak 11.00pm - 6.00a.m		

5.4 Do you benefit from different tariff rates? …….

5.5 How does the tariff rates affect your cost of your industrial production?

5.6 How much saving would you get from using off peak tariff

5.7 How does this tariff improve your competitiveness with other industries

6.0 **Industrial cost structure**

6.1 Estimate the proportions of your monthly industrial input costs

No	Item	Input Cost	%
1	Electricity		
2	Back up power sources		
3	Labour and administrative expenses		
4	Raw materials		
5	Transport & Haulage		
6	Taxes		
7	Water,		
8	Telephone and communication		
9	Other overheads		

7.0 **Energy efficiency and Quality service**

7.1 re you aware of energy efficiency mechanism that exist in the sector

1. Yes
2. No

7.2. What is your power factor ……

7.3 What energy efficiency mechanism do you have in place?

……

7.4Are you happy with the quality of service from UMEME

a. Yes
b. No

7.5How long does it take to rectify power problem after reporting

a. After four hours
b. After eight hours
c. After Twenty Four hours
d. After Two days
e. After A week

7.5 Do you normally get prior information before power cuts

1 Yes
2 No

8.0 Time of Use Meter

8.1 Are you conversant with Time of Use meter?

1. Yes
2. No

8.2 Are you billed on Time of Use Meters?

1. Yes
2. No

8.3 Would you consider Time of Use meters an advantage to your industry? ☐

1. Yes
2. No

8.4 Are you willing to change your production from peak and shoulder to off peak hours? ☐

1. Between 6.00 am - 6.00 pm (Shoulder)
2. Between 6.00pm - 1.00pm (Peak)
3. Between 11.00pm – 6.00am (Off Peak)

8.5 What incentives would you require to change production from shoulder and Peak periods to Off Peak? ……

8.6 What recommendation would you suggest to improve the service delivery of electricity to industries?

……

Thank you very much for participating in this exercise

Questionnaire answered by…….

Designation……..

Official Stamp

7.2 The industries where the consultant was able to get data are here below:

1	Simba Blankets Ltd	P. O. Box 689 Kampala	Industrual Area, Old Port Bell Road
2	Century Bottling Co Ltd	P.O.Box 3990 Kampala	Namanve Ind Area
3	Phenix Logistics (U) Ltd	P.O.Box 4378 Kampala	100/02 5th St Industrial area
4	Uganda Fish Packers	P.O.Box 7409 Nakawa	Nakawa Industrial Area
5	Britania Industries	P.O.Box 7518 Kampal	Ntinda Indus Area
6	Oasis Nursury Ltd	P.O.Box 1177 Kampala	Kyungu
7	Hwan Sung Ltd	P.O.Box 86234 kampala	Ntinda industrial Area
8	Poly Pack Limited	P.O.Box 2348 Kampala	Crest Road Ntinda Industrial Area
9	Uganda Co-operative Transport Union	P.O.Box 5486 Kampala	Kawempe
10	Sheraton Kampala Hotel	P.O. Box 7041 Kampala	Ternan Avenue
11	MTN Uganda Ltd	P.O.Box 24624 Kampala	Hannington Road
12	Roko construction Ltd	P.O.Box 172 Kampala	Kawempe
13	Standard Chartered Bank	P.O.Box 7111, Kampala	5 Speke Road, Kampala
14	Imperial Resort Beach Hotel	P.O.Box 895 Entebbe	Bugonga Village Entebbe
15	Roofings Ltd	P.O.Box 7169 Kampala	Lubowa Estate Entebbe Road
16	Shelter Limited	P.O Box 15182 Kampala	Nalukolongo
17	Dairy Corporation Ltd	P.O.Box 7078 Kampala	Kampala Industrial Area
18	Victoria Flowers Ltd	P.O.Box 5398 Kampala	Katabi Busambaga
19	National Insurance Corporation	P.O.Box 7138 Kampala	Kampala
20	Kampala Pharmacetical Industries	P.O.Box 7551 Kampala	Ntinda Industrial Area
21	Gomba Fishing Industry	P.O.Box 633 Jinja	Jinja
22	Steel Corporation of E.A Ltd	P.O.Box 1023, Jinja	Masese Jinja
23	BIDCO(U) Ltd	P.O.Box 1136 Jinja	Jinja Masese Industrial Area
24	Southern Range Nyanza Ltd	P.O.Box 1025 Njura	Jinja
25	Main trader LTD (MTL)	P.O Box 7190 Kampala	Plt 46 Pausa Road
26	UKI (U) Ltd	No 1 Mawku Road	Mbale
27	Tembo Steel Mills	P.O.Box 622 Iganga	Kasolo Village Iganga
28	Mbale Hospital	P.O.Box 921 Mbale	Mbale

29	Tororo Cement Industry	P.O.Box 74 Tororo	Tororo
30	African Textile Mill	P.O. Box 242 Mbale	Mbale
31	Premier Packaging	P.O.Box 72495 Kampala	Ntinda Industrial Area
32	Oscar Industries	P.O.Box 1229 Kampala	Nakawa Industrial Area
33	Hotel Africana Ltd	P.O.Box 10208 Kampala	Kampala
34	Mukwano Industries (U) Ltd	P.O.Box 2621 Kampala	Plot 30 Mukwano Road
35	Nice House of Plastics	P.O.Box 5961	Bugolobi Industrial Area
36	Hot Loaf Bakery Ltd	P.O.Box 2283 Kampala	Jinja Road
37	Uganda Christian University	P.O.Box 4 Mukono	Mukono
38	United Assurance	P.O.Box 7185 Kampala	1 Kimathi Avenue
39	GM Tumpeco Ltd	P.O Box 5571 Kampala	Industrial Area Kampala
40	Colline Hotel Ltd	P.O.Box 7 Kampala	Mukono Town
41	Uganda Clays (U) Ltd	P.O.Box 3188 Kampala	Kajjansi
42	Namilyango College	P.O.Box 7039 Kampala	Namilyango
43	CICO Shoe Company	P.O.Box 6585 Kampala	Seeta
44	Gayaza High School	P.O. Box 7029 Kampala	Gayaza
45	Allied and Clay Ltd	P.O.Box 22766 Kampala	Kitetika Kasangati
46	Sterling International	P.O.Box 796 Kampala	Mbalala Mukono
47	Ugma Eng Company Lugazi	P.O.Box 130 Lugazi	Factory Road Lugazi
48	Midifarm Industries (E.A)	P.O.Box 6218 Kampala	Kakajo Bweyogere
49	Rwenzori Beverages	P.O.Box 10241 Kampala	Namanve
50	Zimwe Stone Quary	P.O.Box 8228 Kampala	Kiwugu
51	Shumuk Enterprises	P.o.Box 6552 Kampala	Nakawa Industrial Area
52	Rocky Industries	P.O.Box 4331 Kampala	Seeta
53	Royal Van Zanten	P.O.Box 29040 Kampala	Namaiba
54	African Polysack	P.O Box 4886 Kampala	Nvumwa Seeta
55	Muddu Oils Refinary Ltd	P.O.Box 8646 Kampala	Kingu Mukono
56	Rwenzori Commodities Buzirasagama	P.O.Box 564 Fort portal	14km F/P Road
57	Hima Cement	P.O.Box 37 Kasese	Block C Hima Township
58	Jesa Mixed Farm	P.O.Box 3248 Kampala	Busunju

59	Tanary and Leather Improvement U (Ltd)	P.O.Box 234 Masaka	Masaka Indistrial Area
60	GBK Dairy Products	P.O.Box 511 Mbarara	70/80 Kabale Road
61	Mbarara Hospital	P.O.Box 867 Mbarara	Mbarara Municipality
62	K.C.C.L	P.O.Box 524 Kasese	Muhokya Kasese
63	Mpanga Tea Estates	P.O.Box 585 Fort Portal	15km Fort Portal – Kampala Road
64	BMTS Mbarara	P.O.Box 956 Mbarara	Kakoba
65	Alpha Dairy Products	P.O.Box 121 Mbarara	Ruti-Mbarara
66	Mulago Hospital	P.O.Box 7051 Kampala	Mulago
67	Rubaga Hospital	P.O.Box 14130	Rubaga
68	St Francis Hospital Nsambya	P.O.Box 7146 Kampala	Nsambya
69	Kajjansi Roses Ltd	P.O.Box 2341 Kampala	Nakigalala Road
70	Roof Clad (U) Ltd	P.O.Box 4641 Kampala	5th street Industrial Area
71	Road Master Cycles	P.O.Box 1335 Kampala	Nalukolongo
72	Crown Bottlers Ltd	P.O.Box 20021 Kampala	Nakawa Ind Area
73	Polythyn Pack (U) Ltd	P.O.Box 21084	Ntinda Industrial Area
74	Bakhresa Grain Milling	P.O.Box 22844 Kampala	Namanve
75	Uganda Railways Corporation	P.O.Box 7150 Kampala	Nassar Road
76	National Social Security Fund	P.O.Box 1185 Kampala	Pilkington Road
77	White Nile Diaries	P.O.Box 663 Jinja	Jinja
78	Uni Foods Ltd	P.O.Box 996 Jinja	Jinja
79	Posta Uganda	P.O.Box 7160 Kampala	Kampala Road plot 35
80	Nile Agro Indus Ltd	P.O.Box 996 Jinja	Jinja
81	Bank Of Uganda	P.O.Box 7120 Kampala	Plot 37/43 Kampala road
82	National Water and Sewerage Corp.	Plot 39 Jinja Rd. Gaba II, III	

7.3 Present Umeme Tariff structure

UMEME RETAIL TARIF FOR 2005

2005	**Quarter 4**				
	BST	peak 84	shoulder 62.2	off-peak 34	
	Code 10.1 Dom-estic	Code 10.2/10.3 Comm-ercial	Code 20 Medium Industrial	Code 30 Large Industrial	Code 50 Street-lights
Standing & max demand charges					
Monthly fee	2,000	2,000	20,000	30,000	
Max demand 1				3,300	
Max demand 2				3,000	
Power supply (UGXkWh)					
Average	100.2	100.2	100.2	72.6	98.9
Peak		129.9	129.9	112.9	
Shoulder		96.2	96.2	112.9	
Off-peak		52.5	52.5	45.7	
Distrib charge (UGX/KwH)					
Average	150.2	140.1	128.6	28.6	138.5
Peak		168.1	154.3	34.4	
Shoulder		140.1	128.6	28.6	
Off-peak		80	73.5	16.4	
Tarrif relief					
Government tarrif relief	34.3	32.7	46.8	28	32.8
Generation levy					
Generation levy	0.7	0.7	0.7	0.3	0.7
Total energy tarrif (UGX/kWh)					
Average	216.9	208.3	182.8	73.6	205.3
Peak		265.9	238.2	119.6	
Shoulder		204.3	178.8	84.6	
Off-peak		100.6	80	34.3	

7.4 Generator capacities in the industries surveyed

	Name of Industry	Location	Generator Capacity (KVA)
1	Simba Blankets Ltd	Old Port Bell Road	50
2	Century Bottling Co Ltd	Namanve Ind Area	830
3	Phenix Logistics (U) Ltd	100/02 5th St Industrial area	363
4	Uganda Fish Packers	Nakawa Industrial Area	750
5	Britania Industries	Ntinda Indus Area	2000
6	Oasis Nursury Ltd	Kyungu	50
7	Hwan Sung Ltd	Ntinda industrial Area	450
8	Poly Pack Limited	Crest Road Ntinda Ind. Area	375
9	Uganda Co-operative Transport Union	Kawempe	126
10	Sheraton Kampala Hotel	Ternan Avenue	1200
11	MTN Uganda Ltd	Hannington Road	2300
12	Roko Construction Ltd	Kawempe	150
13	Standard Chartered Bank	5 Speke Road, Kampala	150
14	Imperial Resort Beach Hotel	Bugonga Village Entebbe	350
15	Roofings Ltd	Lubowa Estate Entebbe Rd	750
16	Shelter Limited	Nalukolongo	N/A
17	Dairy Corporation Ltd	Kampala Industrial Area	350
18	Victoria Flowers Ltd	Katabi Busambaga	90
19	National Insurance Corporation	Kampala	250
20	Kampala Pharmacetical Industries	Ntinda Industrial Area	250
21	Gomba Fishing Industry	Jinja	350
22	Steel Corporation of E.A Ltd	Masese Jinja	N/A
23	BIDCO(U) Ltd	Jinja Masese Industrial Area	1000
24	Southern Range Nyanza Ltd	Jinja	N/A
25	Main trader LTD (MTL)	Plt 46 Pausa Road	350

26	UKI (U) Ltd	Mbale	250
27	Tembo Steel Mills	Kasolo Village Iganga	250
28	Mbale Hospital	Mbale	125
29	Tororo Cement Industry	Tororo	750
30	African Textile Mill	Mbale	350
31	Premier Packaging	Ntinda Industrial Area	N/A
32	Oscar Industries	Nakawa Industrial Area	50
33	Hotel Africana Ltd	Kampala	125
34	Mukwano Industries (U) Ltd	Plot 30 Mukwano Road	4000
35	Nice House of Plastics	Bugolobi Industrial Area	125
36	Hot Loaf Bakery Ltd	Jinja Road	350
37	Uganda Christian University	Mukono	125
38	United Assurance	1 Kimathi Avenue	125
39	GM Tumpeco Ltd	Industrial Area Kampala	350
40	Colline Hotel Ltd	Mukono Town	350
41	Uganda Clays (U) Ltd	Kajjansi	350
42	Namilyango College	Namilyango	125
43	CICO Shoe Company	Seeta	N/A
44	Gayaza High School	Gayaza	50
45	Allied and Clay Ltd	Kitetika Kasangati	400
46	Sterling International	Mbalala Mukono	700
47	Ugma Eng Company Lugazi	Factory Road Lugazi	130
48	Midifarm Industries (E.A)	Kakajo Bweyogere	100
49	Rwenzori Beverages	Namanve	1000
50	Zimwe Stone Quary	Kiwugu	350
51	Shumuk Enterprises	Nakawa Industrial Area	305
52	Rocky Industries	Seeta	50
53	Royal Van Zanten	Namaiba	2500
54	African Polysack	Nvumwa Seeta	110
55	Muddu Oils Refinary Ltd	Kingu Mukono	400

56	Rwenzori Commodities Buzirasagama	14km F/P Road	500
57	Hima Cement	Block C Hima Township	400
58	Jesa Mixed Farm	Busunju	425
59	Tanary and Leather Improvement U (Ltd)	Masaka Indistrial Area	N/A
60	GBK Dairy Products	70/80 Kabale Road	250
61	Mbarara Hospital	Mbarara Municipality	350
62	K.C.C.L	Muhokya Kasese	750
63	Mpanga Tea Estates	15km Fort Portal – Kampala Road	500
64	BMTS Mbarara	Kakoba	N/A
65	Alpha Dairy Products	Ruti-Mbarara	350
66	Mulago Hospital	Mulago	350
67	Rubaga Hospital	Rubaga	100
68	St Francis Hospital Nsambya	Nsambya	300
69	Kajjansi Roses Ltd	Nakigalala Road	150
70	Roof Clad (U) Ltd	5th street Industrial Area	200
71	Road Master Cycles	Nalukolongo	150
72	Crown Bottlers Ltd	Nakawa Ind Area	300
73	Polythyn Pack (U) Ltd	Ntinda Industrial Area	375
74	Bakhresa Grain Milling	Namanve	2500
75	Uganda Railways Corporation	Nassar Road	400
76	National Social Security Fund	Pilkington Road	1200
77	White Nile Diaries	Jinja	150
78	Uni Foods Ltd	Jinja	275
79	Posta Uganda	Kampala Road plot 35	750
80	Nile Agro Indus Ltd	Jinja	750
80	Bank Of Uganda	Plot 37/43 Kampala road	1500
82	National Water and Sewerage Corp.	Plot 39 Jinja Rd. Gaba II, III	N/A
	Total		**39,800**

7.5 Industries who did not respond to our Questionnaire.

No	Name	Location
1	Roseburd, Flower farm	Entebbe
2	Trister – Apparels	Bugolobi
3	Lather and Tannery	Jinja
4	Bata Shoe Company	5th Street Industrial area
5	Uganda Pharmaceuticals	Jinja
6	Victoria Engineering	Kawempe
7	Speke Resort Munyonyo	Munyonyo
8	Entebbe Imperial resort beach	Entebbe
9	Makerere University	Makerere
10	Makerere Business School	Nakawa
11	Pearl Flowers	Entebbe
12	Kyambogo University	Kyambogo
13	Gentex Enterprises Ltd	Ntinda Industrial Area
14	Bugisu corporative union	Mbale

7.6 TERMS OF REFERENCE

ELECTRICITY REGULATORY AUTHOURITY

STUDY ON THE IMPACT OF ELECTRICITY SECTOR ON THE INDUSTRIAL SECTOR

1 Background

The power sector in Uganda has undergone various reforms in the recent past. These reforms were aimed at making the power sector financially viable and able to perform without subsidies from the Government budget; increasing the sector's efficiency; improving the sector's commercial performance; meeting the growing demand for electricity and increasing coverage; improving the reliability and quality of electricity supply; attracting private capital and entrepreneurs; and taking advantage of export opportunities after satisfying local demand.

The Electricity Regulatory Authority (ERA) was established by the Electricity Act 1999 as an independent statutory body responsible for regulating the electricity industry in Uganda. The functions of the Electricity Regulatory Authority as stated in section 76 of the Electricity Act (1999) include among others; to establish a tariff structure and to investigate tariff charges, whether or not a specific complaint has been made for a tariff adjustment; and approve rates of charges and terms and conditions of electricity services provided by transmission and distribution companies.

The Authority first approved an increase in end –user electricity tariffs in 2001 after the unbundling of the vertically integrated Uganda Electricity Board (UEB) into three independent companies. This was the first tariff adjustment in eight years the last having been carried out by UEB in 1993. Since then, the authority has been approving tariff adjustments annually.

The Uganda Investment Authority (UIA) was established by the enactment of the Investment Code 1991. The functions of UIA include; to promote, facilitate and supervise investments in Uganda; to receive all applications for investment licences for investors intending to establish business enterprises in Uganda; and assist to secure other licenses and secondary approvals for investors; to recommend to the Government national policies and programmes designed to promote investment; to provide first hand information on investment opportunities in Uganda; to assist potential

investors in identifying and establishing investment projects in Uganda; and to deal with complaints received from investors. One of the core goals of UIA, which is central to the study, is to continuously advocate for an attractive investment climate.

The Uganda Manufacturers Association (UMA) was established in the 1960s, at a time when Uganda was having a young but robust industrial sector. However, the political social and economic turmoil of the 1970s interrupted the smooth growth of the Association. Therefore for the period that followed until April 1988, UMA was dormant. Today the Association is the largest Business Member Organisation representing the broad industrial and commercial sectors of Uganda's economy and an important forum for the private sector in the country. UMA has a membership comprising of close to 750 small, medium and large enterprises drawn from largely private sector. The main objectives of UMA include; to promote, protect and coordinate the interests of industrialists in Uganda; to act as a watchdog and an effective mouth piece for its members; to initiate discussions and exchange of information amongst members on industrial issues; to advise Government on key policies affecting the industry.

In a bid to establish the typical energy mix and costs imposed due to tariffs and quality of service on our manufacturing and other industries, Electricity regulatory Authority (ERA), Uganda Investment Authority (UIA), and Uganda Manufacturers Association (UMA) are conducting a study of the medium and large industries. This study is an important input to electricity demand planning and tariff setting processes.

2 Objectives of the study

The main objective of the study is to assess the impact of electricity and in particular the electricity quality and tariffs on the industrial sector. The study seeks to establish the typical energy mix, and costs imposed due to tariffs and quality of service on the manufacturing and other industries.

3. Scope of work

The study will cover at least 120 representative firms sampled from the different categories and regions of Uganda. The study will be jointly undertaken by ERA, UMA and UIA.

The scope of work will include:

i. Determine the load profiles of the industrial consumers.

ii. Analyse the production structures of the firms by industry category. In particular, examine the possibility of the industry categories to shift their load profiles off the peak period.

iii. Identify the nature of the back-up sources of energy for the industrial consumers; determine the generation capacity of these standby sources of energy and assess the total energy needs of each firm. Assess the feasibility of self-generation and selling to the grid.

iv. Assess the effects of the electricity tariffs on overall industrial competitiveness and by industry category.

v. Investigate the level of price signals in time of use tariffs that can lead to changes to off-peak hours consumption and/ or alternatively sources of consumption, and whether the current price signals in the electricity tariff structure, as a tool for demand side management is effective.

vi. Identify the industry cost structure and the percentage share of each cost category. In particular, determine the monthly expenditure on the alternative sources of energy relating to total expenses of the firm.

vii. Work out and compare the costs of centralised thermal visa-a vie the costs of the identified alternative sources of energy for the firms.

viii. Assess the measures that firms can employ to reduce the power bills.

ix. Assess the impact of quality of service on the costs and patterns of industrial production.

x. Analyse the current level in the quality of service and identify the areas of weakness.

xi. Determine how many of the firms have time of use (ToU) metres and how many of these are billed based on ToU.

4. Methodology

The consultant should present a methodology for undertaking the whole study, and in particular the instrument for data collection and data analysis techniques. In addition, a reporting format that covers the entire terms of reference should be presented.

5. Mode of work

The consultant is foreseen to work closely with the team from ERA, UIA, and UMA and report to the same team.

6. Reporting

The consultant shall present an Inception Report in two weeks of the project, listing the initial findings and details of work to be carried out and build consensus among stakeholders on the issues addressed in this assignment. The consultant shall present the inception report to the team for their comments and observation to be considered by the consultant in the study.

The consultant shall present to the Team the Draft Report two months after the inception report. The consultant will also present the Draft Report to the stakeholders one week later, after incorporating the comments of the Team. The consultant shall present the Final Report (10 bound copies and four CD-ROM computer versions of the report) within 2 weeks after incorporating comments of the stakeholders.

The Final Report is supposed to have the following sections

i. The Executive Summary
ii. The main body of the report, inclusive of methods of research and analysis carried out on field data and the consultant's conclusions and recommendations.
iii. Appendices of raw data and other relevant materials as appropriate

7. Staffing

The consultant shall have an in-depth knowledge of the current regulatory issues of the electricity sector in Uganda. The consultants must be highly qualified in tariff issues and having local and international experience. The consultant's team should preferably have strong industrial power engineering and economic background. The consultant (team) is expected to provide the related work accomplished in the recent years.