UNIVERSITY OF NAIROBI School of Engineering



DEPARTMENT OF MECHANICAL ENGINEERING AND MANUFACTURING

ENERGY AUDITING IN AN INDUSTRIAL PLANT

(A Case of East Africa Cable Industries Ltd)

A Project Report Submitted in Partial Fulfillment of the

Requirement for The award of the Degree of Master of Science

in Energy Management of the University of Nairobi

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This Project Report is my original work and has not been submitted for examination to any university.

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ABSTRACT

Various studies in different countries have shown that significant energy efficiency improvement opportunities exist in the industrial sector, many of which are cost-effective. These energy-efficiency options include both cross-cutting as well as sector-specific measures. However, industrial plants are not always aware of energy-efficiency improvement potentials. Conducting an energy audit is one of the first steps in identifying these potentials. Even so, many plants do not have the capacity to conduct an effective energy audit. In some countries, government policies and programs aim to assist industry to improve competitiveness through increased energy efficiency. However, usually only limited technical and financial resources for improving energy efficiency are available, especially for small and medium-sized enterprises. Information on energy auditing and practices should, therefore, be prepared and disseminated to industrial plants

LIST OF ABREVIATIONS

PF	Power factor
kW	Kilowatt
EUI	Energy use Intensity
Kwh	Kilowatt hour
IRR	Internal Rate of Return
NPV	Net Present Value
ECM	Energy Conservation Measures
ECS	Electrical Energy Consumed
ELF	Electrical Load Factor
OLF	Occupancy Load Factor
Q	Discharge Capacity of Water
ES	Energy Savings
EACL	East African Cables Limited
M&V	Measurement and Verification
SFE	Stacking Fault Energy
тсо	Total Cost of Ownership

EXECUTIVE SUMMARY

An energy audit was conducted at East African cables Addis plant to investigate the energy potential of the facility and possible savings.

The main objective of this energy audit was to identify and analyse Energy Conservation Measures (ECMs) that could reduce energy costs as well as provide the client a means of better understanding energy use in the factory. The graph, figure 1 below presents the energy consumption at the factory during the baseline period. The period chosen for the factory was a 12-months from April 2014 to March 2015.



Figure 1: Electricity consumption over baseline period

Energy Saving Measures

The audit entailed interviews with site management and staff, measurement of energy parameters using various audit instruments, identification of energy efficiency opportunities and a financial analysis of the energy conservation (efficiency) measures that covered life cycle cost and IRR. This approach takes into account the energy savings and maintenance costs during the life of the project. The audit report provides financial justification for the key energy conservation measures which financial institutions can easily adopt with little or no change.

MEASURE	ELEC	TOTAL	CO2 EMISSIONS	MEASURE	IRR (OVER	NPV	SIMPLE PAYBACK
DESCRIPTION	SAVINGS	ANNUAL COST	REDUCTION	COST(KES)	LIFE OF		(YR)
	(KWH)	SAVINGS	(TONS)		MEASURE)		
		(KES)					
Solar		2,342,700.00	38	-	-	-	-
Leasing							
Power							immediate
Factor			-	200,000.0	-	-	
Correction		236,995.00		0			
Compressor	241244	4 976 999 00	79	1,250,000.		17 017 274	3 months
Leaks	241344	4,020,000.00		00	-	17,017,274	
Lighting	181247	3 624 946 00	60	4,858,200.	720%	7 203 181	1.34
	101277	5,027,770.00		00	/ 2 /0	7,275,101	
Totals				5,208,200.			
	539726	11,031,529.00	177	00	-	-	-

A summary of the recommended energy conservation measures, annual energy savings and cost savings are tabulated below. key energy conservation measures which financial institutions can easily adopt are also highlighted.

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CHAPTER ONE

1.0 Introduction

Energy Audit is defined as the verification, monitoring and analysis of Energy use including submission of technical report containing all the recommendations for improving energy efficiency with cost analysis and an action plan to reduce consumption. Most energy sources used in industry include Electricity, Natural gas, Oil and other fuels. Electrical energy is the most expensive and the most important form of purchased energy used at the factory. For this reason, its use must be confined to a minimum for efficient and economic operation. Because of its flexibility, electricity offers advantages over the conventional fossil fuels, and efforts to conserve electricity can result in significant cost savings.[1] In non-oil producing countries like Kenya, where energy resources are scarce and production of electricity is very costly, energy conservation studies are of great importance.

The primary objective of this energy report is to identify and evaluate opportunities for electrical energy conservation at East African Cables plant.

The factors to be considered when discussing and quantifying energy conservation measures include, electrical energy savings (kWh), electrical demand savings (kW), electrical energy cost savings (Kes) and Payback period (months)

Benefits of Audit in industrial facility will include:

- a) Financial benefits which contribute to reduction in operating costs or increase in the profits of the organization.
- b) Operational benefits that assist the management of industries site improve the comfort, safety and productivity.
- c) Environmental benefits like reduction in CO2 Concentrations or other greenhouse gases and emmission [2]

1.1Background of the Facility Audited

East African Cables Limited is a Kenya-based company. The Company is engaged in the manufacture and sale of electrical cables and conductors. The Company's main products are manufactured cables for applications in domestic and Industrial lighting, as well as transmission and distribution of electricity. It has four manufacturing facilities, two in Nairobi Kenya, one in Dar es Salaam Tanzania, and one in Eastern DRC. Its product portfolio includes Copper electrical cables and conductors for domestic as well as industrial applications PVC and XLPE based products, Aluminum conductors and cables used for power distribution and transmission over national gridlines AAC, ACSR and ABC products Telecommunication and data cables. Telecommunication and data cables include local area network cables, fiber optic cables and related accessories.



Figure 1.1 EACL Financials

The baseline period of 2014 to 2015 was found to be a good point of comparison for energy use. This is because co-incidentally from the financials above, this period had the highest sales revenue of the past three years. Despite enjoying a good market share and command in the cable manufacturing industry with an enterprise value of over 6.4 billion KS. EACL believes there is still room for improvement and this is what has motivated the company to undertake this energy audit.

1.2 Scope of the Audit

The audit is a general energy audit conducted in line with ISO 50001 standards. The audit was conducted over a two-month period of October,2015 to November 2015 and consisted of an analysis of energy use per machine as well as water and diesel consumption over the same twelve month period.

1.3 Objectives of the audit

The objectives of an energy audit can vary from one plant to another. In this case,, the energy audit was conducted to understand how energy is used within the plant and to find opportunities for improvement and energy saving. Sometimes, energy audits are conducted to evaluate the effectiveness of an energy efficiency project or program specifically;

- To clearly identify the types, sources and costs of energy used during the period 2014 to 2015.
- ii. To understand how energy is being used, and possibly wasted
- iii. To identify and analyse alternatives such as improved operational techniques and/or new equipment that could substantially reduce the energy costs.
- iv. To perform an economic analysis on alternatives identified, and determine the most costeffective option for the factory.

1.4 Major Energy Consuming Machines

The Organization has been incurring high expenditures on Energy use and wants to understand the reason for this major Energy Consuming .The major energy consuming machines were identified by a simple walkthrough.These machines include

- Factory Machines,
- Compressors,
- Storage and Lighting
- Extruders among others.

CHAPTER TWO

LITERATURE REVIEW:

2.0 Introduction to Industrial Energy Auditing

An energy audit is a key to assessing the energy performance of an industrial plant and for developing an energy management program. The typical steps of an energy audit are:

- i. preparation and planning
- ii. data collection and review
- iii. plant surveys and system measurements
- iv. observation and review of operating practices
- v. data documentation and analysis
- vi. reporting of the results and recommendations

2.1 Definition of energy auditing

There are several relatively similar definitions of an energy audit [3], defines energy auditing as "The verification, monitoring and analysis of the use of energy and submission of technical report containing recommendations for improving energy efficiency with cost-benefit analysis and an action plan to reduce energy consumption."

2.2 Types of Energy Audits

The type of industrial energy audit conducted depends on the function, size, and type of the industry, the depth to which the audit is needed, and the potential and magnitude of energy savings and cost reduction desired. Based on these criteria, an industrial energy audit can be classified into two types: a preliminary audit (walk-through audit) and a detailed audit (diagnostic audit).

a) Preliminary Audit (Walk-through Audit)

In a preliminary energy audit, readily-available data are mostly used for a simple analysis of energy use and performance of the plant. This type of audit does not require a lot of measurement and data collection. These audits take a relatively short time and the results are more general, providing common opportunities for energy efficiency. The economic analysis is typically limited to calculation of the simple payback period, or the time required paying back the initial capital investment through realized energy savings.

b) Detailed audit (Diagnostic audit)

For detailed (or diagnostic) energy audits, more detailed data and information are required. Measurements and a data inventory are usually conducted and different energy systems (pump, fan, compressed air, steam, process heating, etc.) are assessed in detail. Hence, the time required for this type of audit is longer than that of preliminary audits.

The information to be collected during the detailed Audit includes:-

- (a) Energy consumption by type, by department, by major items of process equipment, by enduse.
- (b) Material balance data
- (c) Energy cost and tariff data
- (d) Process and material flow diagrams
- (e) Generation and distribution of site services such as compressed air, steam.
- (f) Sources of energy supply, such as electricity from the grid or self generation.
- (g) Potential for fuel substitution, process modification and use of cogeneration systems. [4]

The results of these audits are more comprehensive and useful since they give a more accurate picture of the energy performance of the plant and more specific recommendation for improvements. The economic analysis conducted for the efficiency measures recommended typically simple payback period and usually include the calculation of an internal rate of return (IRR), net present value (NPV), and often also life cycle cost (LCC).

2.3 Making an Audit Plan

An audit plan outlines the audit strategy and procedure. The plan helps the auditors to check the consistency and completeness of the audit process and make sure nothing important is neglected or overlooked. The audit plan should provide the following (CIPEC 2009):

- i. Scope of the audit
- ii. Time of the audit and its duration as well as the timeline for each step of the audit process
- iii. Elements of the audit that have a high priority
- iv. Responsibilities and tasks of each audit team member

v. Format of the audit report and its outline

2.4 Preparing an Audit Checklist

The audit checklist helps the auditor to conduct the work in a systematic and consistent way. The checklist should include:

- i. Steps to be taken during the energy audit
- ii. Data and information that should be collected
- iii. Existing measurement instrument and the data recorded
- iv. Required measurements during the energy audit and the list of parameters to be measured
- v. Major equipment to be assessed in more detail
- vi. List of main components of the results section of the audit report, for guidance
- vii. Other major concerns and considerations

2.5 Conducting the initial walk-through visit

The purpose of the initial walk-through visit is for the energy audit team to become familiar with the facility to be audited. The auditors can go through the processes and utilities that they will audit in detail later.

2.6 Collecting Energy Bills and available Data and Information

Energy bills along with other current and historical energy- and production-related data and information should be collected at the beginning of the audit process. The more historical data available, the better the auditor can understand the performance of the plant at differing times of day, in various seasons, and under diverse production conditions. The data that can be collected at the beginning of an energy audit include the followings:

- i. Energy bills and invoices (electricity and fuels) for the last 2 to 3 years
- ii. Monthly production data for the last 2 to 3 years
- iii. Climatic data for the period in which the auditing is conducted
- iv. Possible archived records with measurements from existing records
- v. Architectural and engineering plans of the plant and its equipment
- vi. Status of energy management and any energy-saving measures implemented
- vii. General information about the plant (year of construction, ownership status, renovations, types of products, operation schedule, operating hours, scheduled shut-downs, etc.)

2.7 Conducting the Preliminary Analysis

The preliminary analysis helps the energy auditor to better understand the plant by providing a general picture of the plant energy use, operation, and energy losses. This effort provides enough information to undertake any necessary changes in the audit plan.

In the preliminary analysis, a flowchart can be constructed that shows the energy flows of the system being audited. An overview of unit operations, important process steps, areas of material and energy use, and sources of waste generation should be presented in this flowchart

2.8 Analyzing Energy Bills

Energy bills, especially those for electricity and natural gas, are very useful for understanding and analyzing a plant's energy costs.

2.9 Electricity Bills

Several costs are usually included in the electricity bill. Most electric rates include a fixed service (or customer) charge that is constant regardless of the amount of electricity used, and a per kilowatt-hour (kWh) rate for the amount of electricity consumed. Most electricity bills (except for very small facilities) also include a demand charge per kilowatt (KW). The demand charge is based on the highest (or peak) electricity use each month, averaged over a short time period (usually 15 minutes). On some bills, demand cost and kWh cost are combined and shown as a single cost.

There is also a time-of-use charge in most industrial consumer electric bills. Based on the time in which the electricity is used, prices per kWh and per KW will vary. The other item in industrial electric bills is the charge for "reactive power" which is based on the types of electrical loads in a plant. For example, facilities with many electric motors may pay a penalty due to the increased electric transmission capacity needed for large inductive loads. Understanding rates is also important for planning energy-efficiency retrofits. To predict energy cost savings with the highest accuracy, savings must be calculated based on the time they occur and the rates in effect during each time period (California Energy Commission 2000).

Based on the data and information derived from the electricity bills, several calculations can be made.

2.10 Calculating electricity use per day (kWh/day)

Electricity use in the period covered by the electricity bill can be divided by the number of the days given in the bill. Since reading periods in the bills can vary, kWh/day is more useful for

identifying consumption trends than the total billed kWh. This can be used later to accurately calculate the monthly electricity use and can also be used for graphical analysis.

2.11 Calculating the Load Factor (LF)

The load factor is the ratio of the energy consumed during a given period (in the electricity bill) to the energy which would have been consumed if maximum demand had been maintained throughout the period.

Load Factor(%) =
$$\frac{\text{Total kWh for the billing period x 100}}{\text{Peak Demand X no. of Days X 24 Hours}}$$

Maximum demand and total kilowatts – hours are obtained from past electricity bills normally the load factor is less than 100% that is the energy consumed is less than the maximum power demand at any time in the period multiplied by the total period time in general if the load factor in a plant is reduced the total cost of electricity will be higher (morvay and gvozdenac 2008) in other words the load factor is a useful method of determining if a plant is utilizing its energy consuming equipment on a consistence basis (higher lf) of using the equipment for the shortest duration (lower LF) thereby paying a demand penalty.

The simplest method for reducing peak loads is to schedule production activities in a way that the big electricity power users do not operate at the peak time at all or at least some of them do not operate at the same time if possible machine scheduling is the practice of turning equipment on or off depending on the time of day, day of week day or other variables and production Coal and fuel oil bills[5]

The actual use of coal and fuel oil is difficult to track accurately because consumption is not usually metered. Monthly consumption is typically estimated based on fuel delivery dates and may not correspond to actual consumption. Coal consumption can be estimated from the combustion efficiency and energy output of coal-fired equipment. Oil consumption can be obtained from meters on the outflow of oil storage tanks if such meter exists. If the meter is not installed on fuel oil consuming equipment, then the same method for the estimation of coal consumption can also be used for fuel oil as well.

2.12 Graphical analysis of historical energy use

Graphical analysis of hourly/daily/monthly/yearly energy use for each type of energy used in a plant can help to better understand the energy use pattern in the plant. Sometimes the patterns are unexpected and can lead to opportunities to modify the way energy is used and save energy. For example, one might not normally expect a heavy process industry like cement industry to exhibit a seasonal variation in energy use because of weather changes. Despite this, if a seasonal pattern shows up in the graphical analysis, this may suggest the need to investigate for the possible sources of energy losses[3]

It is common for a plant's operating conditions or capacities to vary over the year. Therefore, the variation of energy use alone may not truly reflect the condition of energy efficiency in a plant. Thus, it is much better and more accurate to conduct this type of graphical analysis of a plant's energy intensity (EI), which is the energy use per unit of production. Energy intensity can be calculated by using monthly energy consumption data obtained from energy bills and the monthly production data.Energy

Energy Intensity (kWh or GJ/ tonne) = $\frac{\text{Energy consumption (kWh or GJ)}}{\text{Production (tonne)}}$

A pie chart is another type of chart that can be used for graphical analysis of historical energy use and cost data. A pie chart can be used to show the share of various types of energy use and their costs graphically. Both monthly and annual data can be used for plotting such graph (Hooke et al. 2003).

2.13 Inventory and measurement of energy use

Gathering data through an inventory and measurement is one of the main activities of energy auditing. Without adequate and accurate data, an energy audit cannot be successfully accomplished. Some data are readily available and can be collected from different divisions of the plant being audited. Some other data can be collected through measurement and recording. The energy audit team should be well-equipped with all of the necessary measurement instruments. These instruments can be portable or installed in certain equipment (CRES 2000). The most common data measured during the auditing process are:

- i. Liquid and gas fuel flows
- ii. Electrical measurements, such as the voltage, current intensity and power, as well as power factor
- iii. Temperatures of solid and liquid surfaces
- iv. Pressure of fluids in pipes, furnaces or vessels
- v. Exhaust gases emissions (CO2, CO, O2 and smoke)
- vi. Relative humidity
- vii. Luminance levels

2.13.1 Electrical load inventory

Making an inventory of all electrical loads in a plant aims to answer two important questions: where the electricity is used? How much and how fast is electricity used in each category of load? One way to prioritize the electricity-saving opportunities is by the magnitude of the loads. Therefore, identifying and categorizing different loads in a plant can be useful. Because the inventory of the loads also quantifies the demand (i.e. how fast electricity is used) associated with each load or group of loads, it is valuable for further interpretation of the demand profile.

2.13.2 Thermal energy use inventory

An energy flow diagram is helpful for identifying thermal energy flows. The energy flow chart can show all energy flows into the facility, all outgoing flows from the facility to the environment, and all significant energy flows within the facility. The purpose of an energy flow diagram is not to describe a process in detail. In fact, it will generally not show specific devices and equipment that are found in its various sub-systems. The sum of the

energy outflows should equal energy inflows. With this information, it is often possible to see opportunities for energy saving and recovery.

CHAPTER THREE

METHODOLOGY:

3.1 Energy Audit Procedure

The general energy audit focused on identifying sections with potential of energy savings at East African Cables Ltd. And was conducted between the month of September and December,2015. The general procedure undertaken throughout the whole process, from site visit through to energy audit submission, can be broken down into the following.

- i. Presentation and discussion of the audit and setting up of Energy Management Team.
- ii. Collection of site data for Desktop Analysis and determination of energy consuming loads in the facility.
- iii. Walk-through of Facility and Logging of loads to create an Energy balance
- iv. Development of Energy Cost saving measures.
- v. Presentation of Energy Cost saving Measures and discussion with client on proposed Energy Investment plan.

3.1.1 Presentation and discussion of the audit and setting up of Energy Management team This involved:-

- i. Getting together with the top management to give an overview of what the energy audit entails.
- An explanation of the Energy Management Regulations 2012 as aligned in the Energy Act.
- iii. Setting up an Energy management committee.

3.1.2. Desktop Analysis, collection of site data and determination of energy consuming loads at the facility.

This involvesd three major steps outlined below:

 Gathering preliminary data about the facility. This included obtaining the facility's layouts, equipment list and operating hours, identifying the largest energy consuming loads and collecting water and energy bills for the last 12 months.

- ii. Gathering relevant tools required for the audit based on types of energy consuming equipment.
- iii. Creating a record of energy use over the baseline period and co-relating this to the major energy drivers such as production.

3.1.3 Walk-through of the Facility and Logging Loads to Create an Energy Balance.

In this phase, a tour of the entire facility was carried out and operational patterns and equipment usage examined. This phase entailed:

- i. Installation of Data loggers at the main incomer and the specific machine MCBs at the distribution board.
- ii. ASHRAE level II walk through audit including staff interviews and taking of nameplate data of equipment at the site.

	STAFF	INFORMATION NEEDED	
1.	Maintenance	Walk through of the facility	
	Manager	Responsible : Johnston kanene	
	and Assistant	& Augustine Mutunga.	
2.	Production Manager	Understanding Machine operation and operational hours.	
		Responsible :Mr.Kiragu	
3.	On site Intern	Assistance on understanding the site electrical installation.	
		Responsible : Japheth Musyoki	

Table 3.0 Information Sources

3.1.4 Development of Energy Cost Saving Measures.

- i. This step involved research (utilizing the current logged data and the equipment data sheets) in order to come up with feasible Energy Saving Implementation ideas.
- ii. Once these are identified, the energy savings were identified and total cost of ownership analysis was carried out to see, if the ECM made any financial sense.

- **3.1.5** Presentation of Energy Cost saving Measures and formulation of Energy Investment plan.
 - i. Once the ECMs have been finalized and tabulated. A presentation meeting with the client to develop an investment plan.
- ii. At the meeting the ECMs are discussed in detail with the client and a finalized investment plan is tabulated to complete the report.

3.2 Equipment used for the audit

Table 3.1 below gives the equipment used and the measurement outputs.

Tool	Measurement Output
Power Logger	Power Factor, Electricity Consumption,
	Harmonics,
Thermal Imager	Thermal profile of motors
Ultrasonic	Compressed Air leaks
Leak Detector	
Real Time monitor	Energy Consumption in real time.

 Table 3.1 Equipment used for the audit

3.3 Data Analysis

The following is the information that was analysed in computing energy consumption in the plant, among others:

- i. Analysis of metered data and respective energy cost on electricity and water consumption.
- ii. 2. Analysing the respective electricity and water production, based on the production needs.
- Analysing a 48 hours recording of energy consumption on each of the high energy consuming machine.

3.4 Assumptions :-

3.4.1 Measurement Assumptions

Systems are operating at their peak

3.4.2 Calculation Assumptions

- (i) Only significant energy using areas were considered for energy savings
- (ii) Conversion of diesel to kWh was assumed to be 11 kWh/Litre of diesel

3.4.3 Carbon Dioxide Emissions

 $1 \quad kWh \ of \ electricity \ produces \ 0.4454 \ kg \ of \ CO_2 \ emission$

3.4.4 Financial and Economic Analysis Assumptions

- (i) Installation cost are assumed to be the current market rates
- (ii) Inflation and bank interests are not factored in the calculations
- (iii) Projects with more than a 4 year payback were ignored

CHAPTER FOUR

OBSERVATION AND ANALYSIS.

4.1 Demand and load profile analysis

From the demand graph below we see that the month with the highest consumption June 2014 had a relatively low peak as compared to the highest peak demand month of June 2014, which had a max demand of 452 kva.



Figure 4.0 : Demand EACL Addis over the baseline period

4.2 Load Factor Curve

Load factor, in essence, means efficiency. It is the ratio of actual kilowatt-hours used in a given period, divided by the total possible kilowatt -hours that could have been used in the same period, at the peak kW level established by the customer during the billing period.

A high load factor is "a good thing," and a low load factor is a "bad thing." A low load factor means that you are using electricity inefficiently relative to what you could be using if you were controlling your peak demand.



Figure 4.1: Load factor EACL Addis over the baseline period

The graph above shows the load factor profile of the facility, the facility uses between **25** and **45%** of the **available energy** provided by the utility company. This is quite low. Better measures need to be put in place to ensure that the machines running match the available energy. In other words a machine with a large load demand should be scheduled to run for a longer while even if the production demand dictates that it should be run for a short period during the billing period. The surplus produced can be used for future production needs.

The other option would be to utilize load demand shaving where there is a cap to the daily max demand over the billing period. Both these measures will bring significant overall savings to the facility and will help the facility manage their opex better.





Figure 4.2: PF over the baseline period

The facility has not done a good job in containing their real versus apparent power above the recommended limit of 0.9. There are several instances where the PF falls below the 0.9 and as a result the facility was surcharged.

Table4.0: Cost of PF surcharge over baseline period

	Pf surcharge Period	Amount Paid (KShs)
1.	Jan-15	22,554.00
2.	Feb-15	55,816.00
3.	Mar-15	158,625.00
4.	Total	236,995.00

So far the facility has lost over 230,000kes in power factor surcharge to the utility company.

This cost can easily be avoided by installation of capacitor banks to provide the necessary reactive power.

4.4Energy Supply and End

The main source of energy to support daily activities in the factory is electricity. Kenya Power and Lighting supplies the East African Cables Ltd plant with electricity at 11kV that is stepped down by a single transformer to 415V. KPLC serves EACL Addis under the CI2 commercial tariff.

The facility has a 750 Kva generator.



The graph below shows the co-relation between diesel use and power failure hours.

Figure 4.3: Power failure hours and Litres of diesel used over the baseline period

There is an almost perfect co-relation however after contacting the energy officer it was found that this are estimated values based on the run hours. EACL should do a better job of diesel management and install a fuel-monitoring gauge that should be recorded before every re-fill.

With this data it is **impossible to calculate the efficiency** of the generator. The results of the calculation are shown below.



4.5Carbon Dioxide Emission

Figure 4.4: Carbon Foot print EACL Addis

The figure above shows the environmental carbon footprint of East African cables ton Co2/ton aluminium produced. The range varies from 0.33 to 2.2. This wide range could be an indication that:-

(i)Aluminum production is not the key energy driver at the facility.

(ii)The facility does not have good energy measures in place to optimize production.

4.6WATER CONSUMPTION



Figure 4.5 : Water use over the baseline period

The graph above shows the water use in the factory over the baseline period.

The graph below shows the co-relation between water usage in the factory versus production.



Figure 4.6 : Co-relation Water Versus Production

(Note: The water meter in the facility is not working. For this reason the water data cannot be trusted.)

4.7 FINDINGS AND DATA ANALYSIS

We have studied energy use; at East African Cables Addis. In addition to electricity and diesel use we also studied the water consumption at the factory to gain insight on how to conserve the same.

In this report we have confined our analysis of metered data to electricity data, diesel genset logs, lighting measurements, water bills and data gathered from several site visits.

From this data we were able to get an idea of the energy use and check for any preliminary energy conservation measures.

4.7.1 Comparative Electricity Use.

Analysis of the metered data and energy cost at the factory gave the following indices.



Figure 4.7 : Electricity costs over baseline period



Figure 4.8: Water costs over baseline period

Using these data we performed an analysis over the baseline period to find out the energy needs and the energy cost based on electricity and water consumption.



4.7.2 PRODUCTION NEEDS

Figure 4.9: Production needs EACL Addis

The annual average energy need for production is about **1.25 kwh//kg and 1.88 cbm of water per ton of production**.



Figure 4.10 : Cost of Production Needs EACL Addis

The respective electric and water production costs based on the production needs are about **23.39 kes** for every kilogram of aluminium wire output and **160 kes** for every ton of aluminium wire produced at the facility.

4.7.3 Summary of Findings: -

4.7.3.1 Energy Consuming Areas/Machines

The pie chart below shows the percentage share of the energy by the various areas in the facility.


Figure 4.11: Consumption by Equipment group

- (i) The factory has the largest share at **51.24%**
- (ii) Switchboard F2 has the second largest share at **22%**. This switchboard serves the compressor primarily.
- (iii) The Upper deck (that houses the engineers), the store and factory lights take up 14% of the energy.
- (iv) The Admin that houses management offices takes up **13%** of the energy.



Figure 4.12 : Energy cost of each Area

- The factory has the highest monthly cost estimate at **1,361,856 kes**.
- Switchboard f2 has the second highest monthly cost estimate at **582,479 kes**.

For the factory the Energy balance is:-

The main advantage of an energy balance diagram is that all energy inputs can be quantified and balanced against all energy outputs.[6]



Figure 4.13 : Energy balance at the Factory



Figure 4.14 : monthly machine cost

Admin Energy Balance



Figure 4.17 Energy Balance : Administration Block

There is potential of significantly bringing down these costs and these ECMs have been highlighted in chapter 5.



Figure 4.18 monthly costs on sub board A1

4.7.3.2 Areas logged

It took a 48-hour recording of energy consumption on each machine in the factory. These have been highlighted below.



I. Main Incomer

Figure 4.19; Kw Demand



Figure 4.20 : Power Factor

II. 15 die Drawer



Figure 4.21:Power log on 15 Die Drawer Machine

III. Cortinovis



Figure 4.22: Power logg on Cortinovis Machine

The Cortinovis should be integrated with soft starters/ capacitors on the load side of the motor.

As seen here the starting demand can go up to **30 Kw** while the running load only runs at **lower than 10 kw**. This results in a low overall PF and also the large in-rush current increases the maintenance cost of the machine and lowers the overall efficiency.





Figure 4.23 Power log on 1 n bobbin Machine

V. Pioneer tubular strander



Figure 4.24 Power Logg on Pioneer Strander Machine

VI. Compressor 45kw



Figure 4.25 Power log on Compressor Machine

The compressor is fully loade is high the efficiency since it runs a d going above the 45KW rating. Going as high as 49 kw. This means that of the motor t above 85% loading.

VI EACL subswitch a1



Figure 4.26 Power log on Subswitch a1

This serves the main administration building the cafeteria and the customer care section. The maximum kw demand is about 40 KW.

VII. Cafeteria and warehouse





The phases in the cafeteria are unbalanced, EACL should undertake re-balancing and shift some loads to the first phase. This will help in demand management as well as power factor.



Figure 4.28 : Kw Demand Profile for Cafeteria.

There is a base load of 10Kw at night, which must be the warehouse load since the cafeteria is closed at night. The load picks up at about 6 am to 25 kw which is around the time the cafeteria staff gets in.

VIII. Admin Ground floor



Figure 4.29 : Administration Ground Floor

There is a pump that turns on every four hours. This pump should be checked since it may be pumping water when there is no need. EACL should also invest in a soft start for this pump motor since as can be seen from the graph the inrush current is quite large at start up.

IX. Admin First floor



Figure 4.30 : Administration First Floor

X. Admin Second floor



Figure 4.31 Administration Second Floor

XI. Lighting



Figure 4.32 : Out door Lighting

CHAPTER FIVE

DISCUSSIONS OF RESULTS

5.1 General Energy Saving Recommendations

The following Energy Saving opportunities at the facility were identified:

5.2 Compressor

Compressed air is sometimes regarded as the fourth utility after electricity, water and gas, however it is usually an expensive resource for a business. Producing compressed air takes more than 10 units of electrical power to provide 1 equivalent unit of compressed air. This means a small decrease in compressed air usage can result in significant electricity savings. Compressors that are usually left on when there is no demand can waste energy as power is used to supply air through the leaks in the distribution system, and even when off-load compressors can use up to 20-70% of the full load power. In addition fewer run-hours will reduce maintenance costs. Typical compressed air systems are capable of up to 30% energy savings by better control, maintenance schedules, a comprehensive leak detection and repair scheme, machine selection and heat recovery. Further savings can be achieved by reviewing the current end users of compressed air and identifying suitable alternatives which may be more energy efficient.[7]

The facility at Addis Ababa road has a GA45+ air compressor. The process map below highlights the complete compressed air system.



Figure 5.1 compressed air system flow sketch diagram

Compressed air is one of the most expensive uses of energy in a manufacturing plant. About eight horsepower of electricity is used to generate one horsepower of compressed air.

Energy Saving Recommendation: -

5.1.2 Reducing Pressure supplied to Machines.

At EACL Addis Ababa road the compressor controls are set up as shown below:-

Current	bar
Load	6.1
Unload]	7.2

This large range causes the compressor to be unloaded frequently. This is poor compressor control and leads to increased maintenance cost as well as higher energy costs.



The graph below shows the recommended compressor control settings.

Figure 5.2 recommended new pressure settings.

A walk through of the individual equipment revealed that the highest-pressure demand required by the machines was about 6 bar (15-die).

Reducing the pressure required by the machines significantly cuts on the energy cost.

Controls as shown below at the plant and so far the energy savings have been highlighted in the graphs below. Compressor with reduced pressure band



Figure 5.3 : Reduced Pressure

After Pressure change (unload changed to 6.6 bar) – Energy consumption 465 kwh.



Figire 5.4 Before Pressure change at 7.2 bar 512 kWh



Savings by reducing Air compressor settings to	bar	
Load		5.9
Unload		6.2

Energy Savings: -

Energy Use compressor before	349,488.00
Savings	32,081.91

The next step would be looking at reducing the number of load/unload cycles. The more frequently a compressor cycles within a given time period, the less efficient it is.

This can either be done by incorporating a larger receiver or by increasing the pressure band.

5.1.3 Compressed Air Leaks

With the help of the Energy Officer at EACL Addis, Ms. Lydia Mugure, it was possible to carry out a leak analysis test, which should now be a part of the Maintenance schedule at the plant going forward.

The results of the test are summarized below.

Leakage Rate EACL		%
Test 1		
Loading	43	65%
Unloading	23	
Test 2		
Loading	35	65%
Unloading	19	
Test 3		
Loading	48	74%
Unloading	17	
Test 4		
Loading	42	72%
Unloading	16	
	Average	69%
	kwh	kes
Contributions by leaks over entire year	241,344.42	4,826,888.45

Figure 5.5: Compressed Air Leak Contribution at EACL Addis Ababa Road

The leaks at the facility contribute to an average of 69% of the energy used by the compressor. This is a huge amount of wasted energy and should be addressed immediately. The cost contribution of these leaks annually is over **4,826,000 kes**.

Best practices recommend that the leakage rate be less than 10%.

The pictures below show some of the areas with Leaks in the facility.



For joint leaks, the facility should look into push to connect pipe joints instead of threaded joints.





Lighting:

Lighting is essential for making the work environment safe and for allowing staff to perform their tasks comfortably. It can be a significant energy user accounting for up to 40% of an organisation's electricity bill. Even making small adjustments to lighting can significantly improve the working environment, help reduce electricity consumption and, at the same time, minimise CO2 emissions and save money.[7]

A complete retrofit of the lighting equipment at EACL Addis factory is proposed. The existing fluorescent fixtures, sodium Parking Lamps and HFS et.al will be retrofitted with more efficient equipment, primarily Light Emitting Diodes (LEDs). Energy savings and demand savings will result from this retrofit. An additional benefit will be enhanced quality of lighting, as the new fixtures will provide improved color rendering and reduced flicker.

A location-by-location inventory of fixture counts and types was made. This inventory of all existing lighting equipment, including their ratings, is provided in the table below. During the lighting survey, fixture types (lamp/ballast combinations) present in this facility were identified. Samples of the most common fixture types were measured to determine the fixture power under actual operating conditions.

Lighting at EACL Current Addis

KEY;

Table 1: Inventory Current Lighting EACL Addis

A1 1500mm, 1X58W SINGLE BATTEN FLUORESCENT SURFACE MOUNTED LUMINAIRE

A1E As above but with emergency kit

A2 1500mm, 2X58W TWIN BATTEN FLUORESCENT SURFACE MOUNTED LUMINAIRE

R1 1500 mm, 1X58W SINGLE STANDARD WATER PROOF IP65 FLUORESCENT LUMINAIRE

R2 1500 mm, 2X58W SINGLE STANDARD WATER PROOF IP65 FLUORESCENT LUMINAIRE

D1	1500mm,1X58W SINGLE FLUORESCENT LUMINAIRE WITH STEEL LACQUERED LOUVRED- SURFACE MOUNTED
D2	1500mm,2X58W SINGLE FLUORESCENT LUMINAIRE WITH STEEL LACQUERED LOUVRED- SURFACE MOUNTED
B1	1200mm, 1X36W SINGLE BATTEN FLUORESCENT SURFACE MOUNTED LUMINAIRE COMPLETE WTH LAMP AND GEAR
B1E	As above but with emergency kit
B2	1200mm, 2X36W SINGLE BATTEN FLUORESCENT SURFACE MOUNTED LUMINAIRE COMPLETE WTH LAMP AND GEAR
V	600mm, 18W SINGLE FLUORESCENT LUMINAIRE WITH OPAL ACRYLIC DIFFUSER
V1	1200mm, 36W SINGLE FLUORESCENT LUMINAIRE WITH OPAL ACRYLIC DIFFUSER
EXIT	MAINTAINED 8W FLUORESCENT WITH PORLYCARBONET DIFFUSER
Ν	16W 2D LUMINAIRE WITH WHITE POLYCARBONATE BODY WITH OPAL DIFFUSER AND 2D LAMP
LC	SUSPENDED 250W LOW BAY LUMINAIRE _ actual 290
а	70W VANDAL RESISTANT WALL MOUNTED SECURITY LIGHT
PL	PENDANT LUMINAIRE WITH LAMP AND SHADE
J4	600x600 mm 4X 1 8W RECESSED FLUORESCENT LUMINAIRE WITH CAT2 ALUMINIUM LOUVRE
JJ4	1200X600mm 4X140W RECESSED FLUORESECENT LUMINAIRE WITH CAT2 ALUMINUM LOUVRE
Р	300X300mm, 2X 1 8W SURFACE MOUNTED FLUORESCENT LUMINAIRE
PE	As above but with emergency kit
FL	Flood light with sodium light
Z	400mm CITYSPACE FITTING WITH 70W HPS LAMP MOUNTED ON A 3.5m HIGH
Z1	As above but mounted on top of a 300m SPIGOT atop the boundary wall
HB	SUSPENDED 250W HIGH BAY LUMINAIRE
СН	Chandalier
G1	1200mm,1X36W SINGLE RECESSED MODULAR FLUORESCENT LUMINAIRE WITH METAL GRID LOUVRES
G2	1200mm,2X36W SINGLE RECESSED MODULAR FLUORESCENT LUMINAIRE WITH METAL GRID LOUVRES

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Led	LED lights
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	Daily Operational Hours	kwh		Daily Operational Hours	kwh	
Warehouse Grnd Floor			Finished Goods Store			Security Office
40(A2)	24	111.36	18(A2)	16	33.408	2(B2)
			12(J4)	16	13.824	3(Q1)
		111.36			47.232	•
Admin Second Floor			Upper Level Plant			Plant Grnd Floor
32(J4)	18	41.472	88(J4)	18	41.472	67(A1)
15(N)	18	4.32	15(B1)	18	9.72	14(AIE)
1(B1)	18	0.648	2(BIE)	18	1.296	1(P.E)
2(V)	18	0.648	2(P.E)	18	1.296	2(P)
15(P)	18	9.72	10(N)	18	2.88	2(A2)
15(LV)	18	4.86	2(VT)	18	0.648	18(A)
36(L)	18	11.664				
2(P.E)	18	1.296				

Table 2 : Lighting and Operational Hours



Table 3: Cost of Current Lighting at EACL Addis

	Daily	Monthly	Annual	Annual cost
Admin	270.072	8,214.69	98,576.28	1,971,525.60
Dining	69.96	2,127.95	25,535.40	510,708.00
Security	117.18	3,564.23	42,770.70	855,414.00
Plant	172.868	5,258.07	63,096.82	1,261,936.40
Storage	158.592	4,823.84	57,886.08	1,157,721.60
				5,757,305.60

The table below summarizes the proposed lighting upgrades

	Proposed Replacement
A1	DirecT8 LEDS
A1E	
A2	DirecT8 LEDS
R1	DirecT8 LEDS
R2	DirecT8 LEDS
D1	DirecT8 LEDS
D2	DirecT8 LEDS
B1	DirecT8 LEDS
B1E	
B2	DirecT8 LEDS
V	DirecT8 LEDS
V1	DirecT8 LEDS
EXIT	
RADIALED®	
The fit and forget 2D replacement	

Table 4 : Proposed Lighting Up	ograde
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G1	DirecT8 LEDS
G2	DirecT8 LEDS
Led	No Replacement Required

Total Cost of Ownership Analysis

Table 5: TCO Lighting

	Cost	Annual Savings	Payback
Admin	2,161,500.00	862,772.40	2.51
Dining	215,000.00	422,524.00	0.51
Security	133,300.00	777,304.00	0.17
Plant	1,984,000.00	813,891.60	2.44
Storage	364,400.00	748,454.40	0.49
	4,858,200.00	3,624,946.40	1.34

The table above gives a summary of the savings that can be achieved by retrofitting the current lighting at the plant.
5.3 Solar Leasing:

Under a solar leasing arrangement a third party provider will be contracted to provide a solar power plant to EAC for use on an operational lease basis. Solar leases can typically be negotiated to require no up-front payments. A solar lease would allow EAC to replace part of its current grid electricity consumption with on-site generated solar electricity, which will be priced below current grid rates, thus generating savings on electricity expenses.

Below is a graph of the integration of a 300 kW solar power plant at the EAC Kitui Road site. Losses (red) would not be significant as most generated solar electricity (yellow) would be consumed (green) by the prevalent load (blue) at the site.



Figure 2 : Solar potential EACL

The Weekly graph below compares the minimum weekly load curve as derived from our onsite measurements, overlaid with the average, minimum and maximum solar power output over the course of a year from a 300 kW solar power plant.

The savings to be realized by adopting this measure are highlighted below: -

Technical parameters				
Size of color plants	140	1344	Sola	2
Size of solar plant:	100	KVV	2/1,1	40, 4
Annual production:	271,140	kWh		
Your current consumption:	1,268,810	kWh	KPLC, 997,670,	
Future solar share:	21.4%	of total	79%	
Type of installation:	roof mounted,	fixed angle, l	ow-voltage three phase int	erconnectio
Location of installation:	roof area of pr	oduction hall		
Financial parameters				
Our later selected	0.115			
Our 1st year solar rate:	0.115		(inflates at 4 % per year)	
Your current rate:	0.130	USD/kWh	(average Cl2 tariff over past 12 mc	onths ex. VAT)
Discount of solar rate:	11./%	less per kW	n and a second se	_
1 st year solar bills:	31,181	USD	0.130	0.115
Cost at current rate:	35,322	USD	0.130	01225
1st year savings:	4,141	USD		
			KPLC	Solar
Current KPLC bills:	165,292	USD/year	(at 12 month average rates and co	nsumption)
1st year KPLC bills:	129,969	USD	(at 12 month average rates and co	nsumption)
1st year solar bills:	31,181	USD	(at 12 month average rates and co	nsumption
1st year total bills:	161,151	USD	in the month of analysis and and co	in the second second
1st year cost reduction:	2.5%	of total elec	tricity expenses	
25 year average savings:	23,427	USD/year		
25 year total savings:	585,673	USD over 2	5 vears	

The 1st Year savings by adopting this measure are projected at about **414,100 KES**. The average savings over the term of the lease factoring in inflation are projected to be over **2,342,700 KES** per year.

5.4 Power Factor Correction:

Currently the facility has poor power factor. An analysis has been carried out and the report of the PF fix is highlighted below.

						Required
Kw	kva	PF	PHI	phi degrees	Phid	KVAR
352	451	0.780487805	0.675350615	38.69473992	0.348166021	119.4625241
308	377	0.816976127	0.614648621	35.21677189	0.348166021	84.07629623
304	350	0.868571429	0.518484048	29.70694771	0.348166021	52.28320834
392	441	0.888888889	0.47588225	27.26604445	0.348166021	50.33875875
299	354	0.844632768	0.564917502	32.36738863	0.348166021	65.84306563
374	423	0.884160757	0.486101773	27.85158	0.348166021	51.917656

The minimum required capacitance is about 150 kvar.

5.5 Monitoring and verification:

A critical (and often overlooked) step to ensure on-going energy optimization projects is measurement and verification of your energy performance and savings. Energy savings cannot be measured directly, as savings are the absence of something, a void, and you cannot measure a void. Measurement and Verification or M&V is a process used to construct an energy baseline. An energy baseline is the characterization and visualization of energy consumption given certain energy drivers (like production, climatic conditions, occupancy, etc.

Once a baseline has been established one can effectively evaluate performance. A direct comparison between energy usage year-on-year is not a direct comparison because production volumes, occupancy, climatic conditions could differ widely between one year and the next.

Energy Auditors will adopt a Measurement and Verification system for each Energy conservation measure proposed. The standard to be used for this is IPMVP:-

5.5.1 Lighting:

(IPMVP Option A: Estimated and Short Term Measurements.)

The variables affecting savings from this lighting project are fixture powers and hours of operation. Fixture powers will be measured on a sample of the most common fixture types. For less common fixture types, fixture power will be based on a table of standard fixture powers or manufacturer's data.

Operating hours will be measured on a sample of space types during the Detailed Energy Survey. The measured hours will then be used to estimate the energy and demand savings during performance period and will not be adjusted even if the actual operating schedules change. Equipment numbers and locations will not vary, and operating hours are not projected to change after the project is implemented.

The M&V Plan for this retrofit assumes:

- (i) Operating hours will be measured before the retrofit. The hours for the lighting fixtures will be the same before and after the equipment retrofit for the purpose of energy savings calculations.
- (ii) Interactive effects on heating and cooling equipment from the lighting retrofit will not be considered.
- (iii) Lighting levels will not decrease as a result of the lighting equipment retrofit. Existing lighting levels have been measured and recorded for each area.

5.5.2 Solar Leasing.:

(IPMVP Option C: Whole Facility Analysis.)

Savings are determined by measuring energy use at the whole facility level. This will be accomplished by using real time monitoring at the main incomer and analysis of utility bills to determine the savings achieved.

5.5.3 compressed air leaks:

(IPMVP Option A. Partially Measured Retrofit Isolation Savings are determined by partial field measurement of the energy use of the system(s) to which an ECM was applied,)

a monitor was installed at the circuit breaker serving the compressor. This logged data will be compared to the data before the measure to obtain the savings,

CHAPTER SIX

CONCLUSIONS.

The results from the energy audit revealed that there is a great potential for energy savings at East African Cables Ltd Factory Addis Road.

Our energy experience over many years has shown that an organization's attitude to energy management has a fundamental effect on the way that it uses energy. Although it is possible to save energy through technical 'fixes' alone, in the long term, it is the attitude of the people working in the organization that has the biggest impact.

We advise East African Cables Ltd to follow the following action points;

Action Points

- Attitudes are worth more than technology. The best technology will not reduce energy use unless attitudes are right – new equipment badly run is less effective than old equipment well run.
- Tenant involvement and consultation should be the first priority with an enthusiastic client, the rest is easy.
- A well-run suggestion scheme can pay big financial dividends.

5.4.1 Motivation and Training:

The long-term success of any energy management program will be ultimately dependent on the people who operate it. Sustaining the momentum of an energy management program is a continuing challenge and depends to a large extent on maintaining a general ethos of energy *awareness* throughout the organization. Top level *commitment* to the challenge is an essential component, providing the driving force behind any campaign. Without the full backing of management, little is likely to be achieved in the long-term. In addition to commitment, *leadership* is required at all levels - high level leadership to authorize necessary resources and to act as a corporate 'champion'. Furthermore, for energy management to be truly effective, energy reduction needs to be the responsibility of everybody. Energy Efficiency can be considered as an effective option for increasing profit and competition as well as creating an attractive marketing case for East African Cables Ltd. Having listed all the different remedies that can lead to electrical energy conservation, the implementation of these recommendations is very crucial to realize any savings.

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APPENDICES

Appendix A:



Table 6: ELF And OLF

IVLAGE MEASUREMENTRANCERESOLUTION*ACCURACY (% of Reading)B0000Hrs42.5 6 691±-4.011tFinde-hase MKS Voltages10 1000/ms0.11 to 1V4.02% Rdg ± 0.4VA000Hc340 to 400HcSinde-hase MKS Voltages17 to 1700/ms0.11 to 1V±0.2% Rdg ± 0.4VFinde-hase MKS Voltages10 to 600/ms0.11 to 1V±1% Rdg ± 1VPhase-ho-Phase RMS Voltages17 to 1200/ms0.11 to 1V±1% Rdg ± 1VPhase-ho-Phase RMS Voltages10 to 1000/ms0.01 Vb 0.1V±1% Rdg ± 1VPhase-ho-Phase RMS Voltages10 to 1000/ms0.01 Vb 0.1V±1% Rdg ± 1VPhase-ho-Phase RMS Voltages10 to 100/ms10 to 100/ms±1% Rdg ± 10CURENT MEASUREMENT200/mA to 100/ms10 to 100/m±1.2% ± 50mACURENT MEASUREMENT200/mA to 100/ms10 to 100/m±1.2% ± 50mACT Ratios0.01 to 1A±1.2% ± 50mAPower Rower (%)-2 to 23/m0.001 W±1.2% Mdg ± 0.00% PomReactive Power (%)-2 to 23/m0.001 W±0.5% Rdg ± 0.00% PomReactive Power (%)-2 to 23/m0.001 W±0.5% Rdg ± 0.00% PomReactive Power (%)-2 to 23/m0.001 W±0.5% Rdg ± 0.00% PomReactive Power (%)-1 to 1-10.001 W±0.5% Rdg ± 0.00% PomReactive Power (%)0 to 4 x 10^m±0.5% Rdg ± 0.00% PomReactive Power (%)0 to 4 x 10^m±0.5% Rdg ± 0.00% PomReactive Power (%)0 to 4 x 10^m±0.5% Rdg ± 0.00% PomReactive	ELECTRICAL												
60x60Hz 44.5 b 68Hz ±0.1Hz Single-Phase RMS Voltages 10 b 1000Vms 0.1 V ±0.2% Rdg ± 0.2V A00Hz 340 b 460Hz Single-Phase RMS Voltages 10 to 600Vms 0.1 to 1V ±1% Rdg ± 0.4V Phase MS Voltages 10 to 600Vms 0.1 to 1V ±1% Rdg ± 1V Phase MS Voltages 10 to 6000Vm 0.1 to 1V ±1% Rdg ± 3V (tpica) Phase MS Voltages 10 to 1000V 0.1 V ±1% Rdg ± 3V (tpica) Phase MS Voltages 10 to 1000V 0.1 V ±1% Rdg ± 3V (tpica) Portains 200m Ab 100Arms 10 to 100mA ±1.2% ± 0.2A CI Ratios 200m Ab 100Arms 10 to 100mA ±1.2% ± 0.2A CI Ratios Porgarmande from SU to 50000H 0.1 to 10A ±1.2% ± 0.2A POWE MESUREMENTS 200 Ab 100Arms 10 to 100mA ±1.2% ± 0.3 Ractive Power (0* -2 to 26% Par 0.001Va ±0.5% Rdg ± 0.005% Par Power Factor -1 to 4.1 0.001VA ±0.5% Rdg ± 0.005% Par Power Factor -1 to 4.1 <td< th=""><th>VOLTAGE MEASUREMENT</th><th>RANGE</th><th>RESOLUTION</th><th>* ACCURACY (% of Reading)</th></td<>	VOLTAGE MEASUREMENT	RANGE	RESOLUTION	* ACCURACY (% of Reading)									
Single-Phase RMS Voltages 10 to 100Vms 0.1V ±0.2%, Rdg ± 0.2V Phase-Phase RMS Voltages 17 to 1700Vms 0.1to IV ±0.2%, Rdg ± 0.4V Single-Phase RMS Voltages 10 to 600Vms 0.1V ±1%, Rdg ± 1V Phase-D-Phase RMS Voltages 10 to 600Vms 0.1V ±1%, Rdg ± 1V Phase-D-Phase RMS Voltages 17 to 1200Vms 0.1to IV ±1%, Rdg ± 1V Phase-D-Phase RMS Voltages 17 to 1200Vms 0.1to IV ±1%, Rdg ± 3V (pical) Programmable from 50V to 65,0000V 0.01V to 0.1V - - CURRENT MEASUREMENT 200mA to 100Ams 10 to 100mA ±1.2%, ± 30mA CURRENT MEASUREMENTS 200mA to 100Ams 0.1 to 10A ±1.2%, ± 1A POWER MEASUREMENTS 200 to 1000Ams 0.01 to 10A ±1.2%, to 2A Active Power (Q)* -2 to 26% 0.001W ±0.5%, Rdg ± 0.005%, Storn Power Factor -1 to +1 0.001 ±0.5% Power (Q)* -2 to 26% 0.001W ±0.5%, Rdg ± 0.005%, Storn Power (Q)* -1 to +1 0.001 ±0.5% Power (50/60Hz	42.5 to 69Hz	-	±0.1Hz									
Phase-bo-Phase RMS Voltages 17 to 1700 kms 0.1 to 1V ±0.2% Rdg ± 0.4V A00H2 340 to 460H2 - - - Single-Phase RMS Voltages 110 to 600/rms 0.1 to 1V ±1% Rdg ± 1V Phase-bo-Phase RMS Voltages 17 to 1200 kms 0.1 to 1V ±1% Rdg ± 1V PT Ratios Programmable from 50V to 65,0000V 0.01V to 0.1V ±1% Rdg ± 3V (picita) PT Ratios Programmable from 50V to 65,0000V 0.01V to 0.1V - CURRENT MEASUREMENT 200mA to 100Arms 1b 010mA ±1.2% ± 50mA 0.84 to 4000ms 0.1 to 1A ±1.2% ± 0.2A 0.84 to 4000ms 0.1 to 1A ±1.2% ± 0.2A 0.84 to 4000ms 0.1 to 1A ±1.2% ± 0.2A 0.84 to 4000ms 0.1 to 1A ±1.2% ± 0.2A 0.84 to 4000ms 0.1 to 1A ±1.2% ± 0.2A 0.84 to 4000ms 0.1 to 1A ±1.2% ± 0.2A 0.84 to 4000ms 0.1 to 1A ±1.2% ± 0.2A 0.84 to 40000ra ± 0.50 to 50.005 (proto 50.005	Single-Phase RMS Voltages	10 to 1000Vrms	0.1V	±0.2% Rdg ± 0.2V									
400Hz340 to 460HzSingle-Phase RMS Voltages10 to 600Vms0.1V±1% Rdg ± 1VPhase-to-Phase RMS Voltages117 to 1200Vms0.1V±1% Rdg ± 1VDC100 to 1000V0.1V±1% Rdg ± 1VProgrammable from S0V to 65,0000V0.01V to 0.1VCURRENT MEASUREMENTCurrent Probe: MiniFiers Sensor MA193***200mA to 100Arms1 to 100mA±1.2% ± 50mA0.8A to 400Arms10 to 100mA±1.2% ± 0.2A-4.4A to 200Arms0.1 to 1A±1.2% ± 1A20A to 100,000Arms0.1 to 1A±1.2% ± 1A20A to 10,000Arms0.1 to 1A±1.2% ± 1A20A to 00,000Arms0.1 to 1A±1.2% ± 0.2AAth to 2000Arms0.1 to 1A±1.2% ± 0.2APOWER MEASUREMENTS±0.5% Rdg ± 0.005% PromActive Power (9)*-2 to 20sar0.0011va±0.5% Rdg ± 0.005% SromPower (5)*0 to 20s/A0.0011vA±0.5% Rdg ± 0.005% SromPower (5)*0 to 4 x 10*11Wh±0.5% RdgApparent Power (5)*0 to 4 x 10*11Wh±0.5% RdgReactive Power (9)0 to 4 x 10*11Wh±0.5% RdgPower Source/Charge Time-±0.5% Rdg10W25W (10%) 6 50/60Hz, 400HzReactive Power Source/Charge Time-±0.5% Rdg10W25W (10%) 6 50/60Hz, 400HzReactive Power Source/Charge Time-±0.5% Rdg10W25W (10%) 6 50/60Hz, 400HzReactive Fower Source/Charge Time-10.08 x 4.5% X 1.4% (26	Phase-to-Phase RMS Voltages	17 to 1700Vrms	0.1 to 1V	±0.2% Rdg ± 0.4V									
Single-Phase RMS Voltages10 to 600/ms0.1V±1% Rdg ± 1VPhase-Phase RMS Voltages17 to 1200/ms0.11 to 1V±1% Rdg ± 1VDC0100 to 1000/0.10V0.11 V±1% Rdg ± 1VPT RatiosProgrammable from 50V to 65,0000V0.01V to 0.1V-CURRENT MEASUREMENTCurrent Probe MiniFiex-Sensor MA193***200mA to 100Arms1 to 100mA±1.2% ± 50mAAdvonte MiniFiex-Sensor MA193***200mA to 100Arms1 to 100mA±1.2% ± 0.2AAdvonte MiniFiex-Sensor MA193***200mA to 100Arms1 to 100mA±1.2% ± 0.2ACURRENT MEASUREMENTSOWER MASUREMENTSOWER MASUREMENTSActive Power (Q)*-2 to 20var0.001W±0.5% Rdg ± 0.005% SronnPower Factor-1 to +10.001±0.5% Rdg ± 0.005% SronnAdvice Earry (EP)0 to 4 × 10*1 to +14.05% RdgAdvice Earry (EP)0 to 4 × 10*1 to +14.05% RdgAdvice Earry (EP)0 to 4 × 10*1 to +14.05% Rdg <th< th=""><th>400Hz</th><th>340 to 460Hz</th><th>-</th><th>-</th></th<>	400Hz	340 to 460Hz	-	-									
Phase-to-Phase RMS Voltages 17 to 1200Vms 0.11 to 1V ±1% hdg ± 1V DC 100 to 1000V 0.1V ±1% hdg ± 1V Phases Programmable from S0V to 65,0000V 0.11V to 1V - CURRENT MEASUREMENT 200m A to 100Ams 1 to 100m A ±1.2% ± 50m A Querent Probe: MiniFiex- Sensor MA193*** 200m A to 100Ams 1 to 100m A ±1.2% ± 0.2A Add to 200ms 0.01 to 1A ±1.2% ± 0.2A ±1.2% ± 0.2A Add to 200m 0.1 to 1A ±1.2% ± 0.2A Add to 200m 0.1 to 1A ±1.2% ± 0.2A CT Ratios 0.1 to 1A ±1.2% ± 0.2A CT Ratio	Single-Phase RMS Voltages	10 to 600Vrms	0.1V	±1% Rdg ± 1V									
Index DC 100 to 1000// 0.11V ±1% Rdg ± 30 (typical) PT Ratios Programmable from 50V to 65,0000 0.01V to 0.1V CURRENT MEASUREMENT 200mA to 100Arms 1 to 100mA ±12% ± 50mA 0.8A to 400Arms 10 to 100mA ±12% ± 0.2A 44 to 2000Arms 0.1 to 10 ±12% ± 0.2A 4 A to 2000Arms 0.1 to 10 ±12% ± 0.2A 44 to 2000Arms 0.1 to 10 ±12% ± 0.2A CT Ratios Programmable from 1:1 to 25,000:1 (probe dependent) 20 to 25% A 0.01 tw 0.001W ±0.5% Rdg ± 0.05% Proom Reactive Power (P)* -2 to 25W 0.001W ±0.5% Rdg ± 0.05% Proom Reactive Power (Q)* -2 to 25W 0.001VA ±0.5% Rdg ± 0.05% Proom Power Factor -1 to +1 0.001 ±0.05 Power Factor -1 to +1 0.001 ±0.02 Reactive Facery (EP) 0 to 4 x 10^n 1 warh ±2% Rdg Reactive Energy (EQ) 0 to 4 x 10^n 1 warh ±2% Rdg Reactive Energy (EQ) 0 to 4 x 10^n 1 warh ±2% Rdg Reactive En	Phase-to-Phase RMS Voltages	17 to 1200Vrms	0.1 to 1V	±1% Rdg ± 1V									
PT Ratios Programmable from 50V is 65,0000V 0.01V is 0.1V - CURRENT MEASUREMENT - - - - - CURRENT MEASUREMENT -	DC	100 to 1000V	0.1V	±1% Rdg ± 3V (typical)									
CURRENT MEASUREMENT Current Probe: MiniFlex- Sensor MA183*** 200mA to 100Arms 1 to 100mA ±1.2% ± 0.0A 0.8A to 400Arms 10 to 100mA ±1.2% ± 0.2A 4A to 200Arms 0.1 to 1A ±1.2% ± 0.A 4A to 200Arms 0.1 to 1A ±1.2% ± 1A 20A to 10,000Arms 0.1 to 1A ±1.2% ± 1A 20A to 10,000Arms 0.1 to 1A ±1.2% ± 1A ± 2M CT Ratios Programmable from 1:1 to 25,000:1 (probe dependent) POWEN MEASUREMENTS Active Power (0)* ± 0.5% Rdg ± 0.005% Pnom Reactive Power (0)* -2 to 2GVar 0.001Var ± 1% Rdg ± 0.01% Gnom Apparent Power (5)* 0 to 2GVA 0.001VA ± 0.5% Rdg ± 0.005% Pnom Power Factor -1 to +1 0.001 ± 0.5% Rdg ± 0.005% Snom Power factor -1 to +1 0.001 ± 0.02 Tangent () (active/reactive power ratio) -3.2 to +3.2 0.001 ± 0.02 ENGY MEASUREMENTS Entergy (EP) 0 to 4x 10^n 1Wh ± 0.5% Rdg Apparent Energy (ED) 0 to 4x 10^n 1Wh ± 0.5% Rdg ± 0.5% Rdg <tr< th=""><th>PT Ratios</th><th>Programmable from 50V to 65,0000V</th><th>0.01V to 0.1V</th><th>-</th></tr<>	PT Ratios	Programmable from 50V to 65,0000V	0.01V to 0.1V	-									
Current Probe: MiniFlex- Sensor MA193*** 200mA to 100Arms 1 to 100mA ±12% ± 50mA 0.8 to 400Arms 10 to 100mA ±12% ± 0.2A 4A to 2000Arms 0.1 to 10A ±12% ± 0.2A 4A to 2000Arms 0.1 to 10A ±12% ± 1A 20A to 10,000Arms 0.1 to 10A ±12% ± 1A 20A to 10,000Arms 0.1 to 10A ±12% ± 1A 20A to 10,000Arms 0.0 to 10A ±12% ± 1A 20A to 10,000Arms 0.0 to 10A ±12% ± 1A Power Rower (P)* -2 to 26W 0.001W ±0.5% Rdg ± 0.005% Prom Reactive Power (Q)* -2 to 26War 0.001Va ±0.5% Rdg ± 0.005% Prom Power Factor -1 to +1 0.001 ±0.5% Rdg ± 0.005% Prom Reactive Energy (EP) 0 to 4 x 10* 1Wh ±0.5% Rdg Reactive Energy (EP) 0 to 4 x 10* 1Wh ±0.5% Rdg Apparent Energy (ES) 0 to 4 x 10* 1Wh ±0.5% Rdg Reactive Energy (EP) 0 to 4 x 10* 1Wh ±0.5% Rdg Reactive Energy (EP) 0 to 4 x 10* 1Wh ±0.5% Rdg <tr< th=""><th>CURRENT MEASUREMENT</th><th></th><th></th><th></th></tr<>	CURRENT MEASUREMENT												
0.8A bb 400Ams 10 bb 100mA ±1.2% ± 0.2A 4A bb 2000Ams 0.1 bb 1A ±1.2% ± 1A 2CT Ratios Programmable from 1: bb 25,000:1 (probe dewellent) POWER MEASUREMENTS Active Power (P)* 2 bb 25W 0.001 W ±0.5% Rdg ± 0.005% Proom Reactive Power (Q)* -2 bb 26W 0.001 W ±0.5% Rdg ± 0.005% Proom Apparent Power (S)* 0 bb 26WA 0.001 W ±0.5% Rdg ± 0.005% Srom Power Factor -1 tb +1 0.001 ± 0.05 ±0.05 Tangent () (active/reactive power ratio) -3.2 tb +3.2 0.001 ± 0.05 ±0.02 Power Factor -1 tb +1 0.001 ± 0.05 ±0.02 ±0.02 ENERGY MEASUREMENTS	Current Probe: MiniFlex• Sensor MA193***	200mA to 100Arms	1 to 100mA	±1.2% ± 50mA									
44 to 2000Arms 0.1 to 1A $\pm 1.2\% \pm 1A$ 204 to 10,000Arms 0.1 to 10A $\pm 1.2\%$ CT Ratios Programmable from 1: to 25,000:1 (probe dependent) POWER MEASUREMENTS - Active Power (P)* -2 to 2GW 0.001W $\pm 0.5\%$ Rdg $\pm 0.005\%$ Pnom Reactive Power (Q)* -2 to 2GW 0.001Var $\pm 1\%$ Rdg $\pm 0.01\%$ Onom Apparent Power (S)* 0 to 2GVA 0.001Var $\pm 0.5\%$ Rdg $\pm 0.005\%$ Snom Power Factor -1 to +1 0.001 ± 0.02 Tangent ϕ (active/reactive power ratio) -3.2 to +3.2 0.001 ± 0.02 Reactive Energy (EP) 0 to 4 x 10* 1Wh $\pm 0.5\%$ Rdg Apparent Energy (EP) 0 to 4 x 10* 1Vah $\pm 2.5\%$ Rdg Apparent Energy (EQ) 0 to 4 x 10* 1Vah $\pm 2.5\%$ Rdg Individual Harmonics 1 to 50 displayed in pre-entage; 1 to 7 at 400Hz External Supply 1 to 50 displayed in pre-entage; 1 to 7 at 400Hz External Supply 1 to 0.8 x 4.9 2 x 1.4 4* (256 x 125 x 37mm) / <1kg Battery Life 30 minutes minimum, 60 minutes typical		0.8A to 400Arms	10 to 100mA	±1.2% ± 0.2A									
20A to 10,000Arms 0.1 to 10A ±1.2% CT Ratios Programmable from 1:1 to 25,000:1 (probe dependent) POWER MEASUREMENTS -2 to 25W 0.001W ±0.5% Rdg ± 0.005% Prom Reactive Power (0)* -2 to 25W 0.001Wa ±0.5% Rdg ± 0.015% Prom Apparent Power (S)* 0 to 26VA 0.001VA ±0.5% Rdg ± 0.005% Snom Power Factor -1 to +1 0.001 ± 0.02 Power Factor -1 to +1 0.001 ± 0.02 ENERGY MEASUREMENTS - - - Active Energy (EP) 0 to 4 x 10* 1Wh ± 0.5% Rdg Active Energy (EQ) 0 to 4 x 10* 1Wah ± 0.5% Rdg Apparent Power (S)* 0 to 4 x 10* 1Wah ± 0.5% Rdg Reactive Energy (EQ) 0 to 4 x 10* 1Wah ± 0.5% Rdg Apparent Energy (EQ) 0 to 4 x 10* 1Wah ± 0.5% Rdg Individual Harmonics 1 to 50 displayed in percentage; 1 to 7 at 400Hz ± 25% Rdg External Supply 0 to 4 x 10* 100/250V (10%) © 50%0hz; 400Hz 5 hours Battery Life <th></th> <th>4A to 2000Arms</th> <th>0.1 to 1A</th> <th>±1.2% ± 1A</th>		4A to 2000Arms	0.1 to 1A	±1.2% ± 1A									
CT Ratios Programmable from 1:1 to 25,000:1 (probe dependent) POWER MEASUREMENTS ± 0.5% Rdg ± 0.005% Pnom Active Power (P)* -2 to 26W 0.001W ± 0.5% Rdg ± 0.005% Pnom Reactive Power (Q)* -2 to 26W 0.001War ± 1% Rdg ± 0.005% Pnom Reactive Power (Q)* -2 to 26War 0.001War ± 0.5% Rdg ± 0.005% Dnom Power Factor -1 to +1 0.001 ± 0.05 Tangent (active/reactive power ratio) -32 to 4.3.2 0.001 ± 0.05 Power Factor -1 to +1 0.001 ± 0.07 ± 0.02 ENERY MEASUREMENTS		20A to 10,000Arms	0.1 to 10A	±1.2%									
POWER MEASUREMENTS Active Power (P)* -2 to 25W 0.001W ±0.5% Rdg ± 0.005% Pnom Reactive Power (Q)* -2 to 26var 0.001Wa ±1% Rdg ± 0.005% Snom Apparent Power (S)* 0 to 26GVA 0.001VA ±0.5% Rdg ± 0.005% Snom Power Factor -1 to +1 0.001 ±0.5% Rdg ± 0.005% Snom Power factor -1 to +1 0.001 ± 0.02 ENERGY MEASUREMENTS 0.001 ± 0.02 Active Energy (EP) 0 to 4 x 10* 1Wh ± 0.5% Rdg Apparent Energy (EQ) 0 to 4 x 10* 1Wh ± 0.5% Rdg Apparent Energy (EQ) 0 to 4 x 10* 1Vah ± 0.5% Rdg Individual Harmonics 1 to 50 displayed in percentage: 1 to 7 at 400Hz External Supply External Supply 1100/250V(10%) © 50/60Hz; 400Hz External Supply Soloshipa: 400Hz Back-Up Power Source/Charge Time Rechargeable 8.4V MMH battery pack / Approximately 5 hours Soloshipa: 400Hz Back-Up Power Source/Charge Time Soloshipa: 400 K2 x 1.46* (256 x 125 x 37mm) / < 1Kg Communication Ports USB 2.0, Ethernet (RJ45), Wireless Bluetooth Class 1 ** <th< th=""><th>CT Ratios</th><th colspan="12">Ratios Programmable from 1:1 to 25,000:1 (probe dependent) WER MEASUREMENTS</th></th<>	CT Ratios	Ratios Programmable from 1:1 to 25,000:1 (probe dependent) WER MEASUREMENTS											
Active Power (P)* -2 to 2SW 0.001W ±0.5% Rdg ± 0.005% Pnom Reactive Power (Q)* -2 to 26var 0.001var ±1% Rdg ± 0.01% Onom Apparent Power (S)* 0 to 2GVA 0.001VA ±0.5% Rdg ± 0.005% Snom Power Factor -1 to +1 0.001 ±0.05 Tangent (active/reactive power ratio) -3.2 to +3.2 0.001 ±0.02 BRERGY MEASUREMENTS U V ±0.02 Exercise Rdg Active Energy (EP) 0 to 4 x 10* 1Wh ±0.5% Rdg Apparent Energy (ES) 0 to 4 x 10* 1Vah ±0.5% Rdg Apparent Energy (ES) 0 to 4 x 10* 1Vah ±0.5% Rdg Individual Harmonics 0 to 4 x 10* 1Vah ±0.5% Rdg Back-Up Power Source/Charge Time Reachargebel & 4V MiM I battery pack / Approximate/ Shours Shours Battery Life 30 minutes minimum, 60 minutes typical Shours Battery Life 30 minutes minimum, 60 minutes typical Shours Battery Life 30 minutes minimum, 60 minutes typical Shours Battery Life 30 minutes minimum, 60 minutes ty	POWER MEASUREMENTS												
Reactive Power (0)* -2 to 2Gvar 0.001var ±1% Rdg ± 0.01% Qnom Apparent Power (S)* 0 to 2GVA 0.001VA ±0.5% Rdg ± 0.005% Snom Power Factor -1 to +1 0.001 ±0.5% Rdg ± 0.005% Snom Power Factor -3.2 to +3.2 0.001 ±0.05 Tangent () (active/reactive power ratio) -3.2 to +3.2 0.001 ±0.02 ENERGY MEASUREMENTS	Active Power (P)*	-2 to 2GW	0.001W	±0.5% Rdg ± 0.005% Pnom									
Apparent Power (§)*0 to 2GVA0.001VA±0.5% Rdg ±0.005% SnomPower Factor-1 to +10.001±0.02Tangent (active/reactive power ratio)-3.2 to +3.20.001±0.02ENERGY MEASUREMENTSActive Energy (EP)0 to 4 x 10*1Wh±0.5% RdgReactive Energy (EQ)0 to 4 x 10*1varh±2% RdgApparent Energy (ES)0 to 4 x 10*1Varh±2% RdgIndividual Harmonics0 to 4 x 10*1Varh±0.5% RdgIndividual Harmonics10 to 50 displayed in percentage; 1 to 7 at 40HzExternal Supply110W/250V (10%) © 50/60Hz; 400HzBack-Up Power Source/Charge TimeRechargeable 8.4V NiMH battery pack / Approximately 5 hoursBattery Life30 minutes minimum, 60 minu	Reactive Power (Q)*	-2 to 2Gvar	0.001var	±1% Rdg ± 0.01% Qnom									
Power Factor -1 to +1 0.001 ± 0.05 Tangent () (active/reactive power ratio) -3.2 to +3.2 0.001 ± 0.02 ENERGY MEASUREMENTS	Apparent Power (S)*	0 to 2GVA	0.001VA	±0.5% Rdg ± 0.005% Snom									
Tangent () (active/reactive power ratio)-3.2 to +3.20.001± 0.02ENERGY MEASUREMENTSActive Energy (EP)0 to 4 x 10*1 Wh±0.5% RdgReactive Energy (EQ)0 to 4 x 10*1 Vah±2% RdgApparent Energy (ES)0 to 4 x 10*1 Vah±2% RdgApparent Energy (ES)0 to 4 x 10*1 Vah±0.5% RdgIndividual Harmonics1 to 50 displayed in percentage; 1 to 7 at 400HzExternal SupplyExternal Supply1 101//250V (10%) © 50/60Hz; 400HzBack-Up Power Source/Charge TimeRechargeable 8.4V NiMH battery pack / Approximately 5 hoursBattery Life30 minutes minimum, 60 minutes typicalMECHANICALCommunication PortsUSB 2.0, Ethernet (RJ45), Wireless Bluetooth Class 1 **Dimension/Weight0 ouble insulated, rubber over-molded, polycarbonate UL94 V1 rated / IP54 non operatingMounting/SecurityEmbedded magnets on back side, keyhole slot on back side / Kensington anti-theft systemDisplay Type for Model PEL 1032.63 x 2.16* (67 x 55mm), four line, monochrome, backlit LCD with adjustable brightness and contrastENVIRONMENTAL / SAFETY50° to 122°F (10° to 50°C) / up to 85%Operating Temperature/Relative Humidity50° to 122°F (-20° to 50°C) / up to 85%Storage Temperature-4° to 122°F (-20° to 50°C) / with batteries; -4° to 158°F (-20° to 70°C without batteries)	Power Factor	-1 to +1	0.001	± 0.05									
ENERGY MEASUREMENTS Active Energy (EP) 0 to 4 x 10° 1 Wh ±0.5% Rdg Reactive Energy (EQ) 0 to 4 x 10° 1 varh ±2% Rdg Apparent Energy (ES) 0 to 4 x 10° 1 Vah ±2% Rdg THD ±0.5% Rdg ±0.5% Rdg Individual Harmonics 0 to 4 x 10° 1 Vah ±0.5% Rdg External Supply 0 to 4 x 10° 1 vah ±0.5% Rdg Back-Up Power Source/Charge Time Acting Rechargeable 8.4V NiMH battery pack / Approximately 5 hours Battery Life 30 minutes minimum, 60 minutes typical Back-Up Power Source/Charge Time Rechargeable 8.4V NiMH battery pack / Approximately 5 hours Battery Life 30 minutes minimum, 60 minutes typical MECHANICAL USB 2.0, Ethernet (RJ45), Wireless <i>Bluetoath</i> Class 1 ** Dimension/Weight 10.08 x 4.32 x 1.46° (256 x 125 x 37mm) / <1kg	Tangent ϕ (active/reactive power ratio)	-3.2 to +3.2	0.001	± 0.02									
Active Energy (EP)0 to 4 x 10*1 Wh±0.5% RdgReactive Energy (EQ)0 to 4 x 10*1 varh±2% RdgApparent Energy (ES)0 to 4 x 10*1 Vah±0.5% RdgIndividual Harmonics0 to 4 x 10*1 Vah±0.5% RdgIndividual Harmonics0 to 4 x 10*1 Vah±0.5% RdgExternal Supply0 to 4 x 10*± 655%100Back-Up Power Source/Charge TimeRechargeable 8.4V NiMH battery pack / Approximately 5 hoursBattery Life30 minutes minimum, 60 minutes typicatBattery Life0 USB 2.0, Ethernet (RJ45), Wireless Bluetooth Class 1 **Dimension/Weight10.08 x 4.92 x 1.46' (256 x 125 x 37mm) / <1kg	ENERGY MEASUREMENTS												
Reactive Energy (EQ)0 to 4 x 10*1 varh±2% RdgApparent Energy (ES)0 to 4 x 10*1 Vah±0.5% RdgTHD-±655%Individual Harmonics-±655%External Supply-1 to 50 displayed in percentage; 1 to 7 at 40HzExternal Supply-1 10V/250V (10%) © 50/60Hz; 400HzBack-Up Power Source/Charge TimeRecharge>b 8.4V NiMH battery pack / Approximately 5 hoursBattery Life-0 100 minutes minimum, 60 minutes typicalBattery Life-0 100 minutes minimum, 60 minutes typicalMECHANICALUSB 2.0, Ethernet (RJ45), Wireless Bluetooth Class 1 **Dimension/Weight10.08 x 4.92 x 1.46' (256 x 125 x 37mm) / <1kgCase/Index of ProtectionDouble insulated, nuber over-molded, polycarbonate UL94 VI rated / IP54 non operatingMounting/SecurityEmbedded magnets on back side, keyhole slot on back side / Keyhole slot on back side / Keyhole slot on back side / IP54 non operatingDisplay Type for Model PEL 1032.63 x 2.16' (67 x 55mm), four line, monochrome, backit LCD with adjustable brightness and contrastENVIRONMENTAL / SAFETY	Active Energy (EP)	0 to 4 x 10ª	1Wh	±0.5% Rdg									
Apparent Energy (ES)0 to 4 x 10*1Vah±0.5% RdgTHD±655%Individual Harmonics1 to 50 displayed in percentage; 1 to 7 at 400HzExternal Supply110W/250V (10%) @ 50/60Hz; 400HzBack-Up Power Source/Charge TimeRechargeable 8.4V NiMH battery pack / Approximately 5 hoursBattery Life30 minutes minimum, 60 minutes typicalMECHANICALUSB 2.0, Ethernet (RJ45), Wireless Bluetooth Class 1 **Dimension/Weight10.08 x 4.92 x 1.46* (256 x 125 x 37mm) / <1kgCase/Index of ProtectionDouble insulated, rubber over-molded, polycarbonate UL94 V1 rated / IP54 non operatingMounting/SecurityEmbedded magnets on back side, keyhole slot on back side / Kensington anti-theft systemDisplay Type for Model PEL 1032.63 x 2.16* (67 x 55mm), four line, monochrome, backlit LCD with adjustable brightness and contrastENVIRONMENTAL / SAFETYOperating Temperature/Relative Humidity-102°F (-0° to 50°C) with batteries; -4° to 158°F (-20° to 70°C without batteries)	Reactive Energy (EQ)	0 to 4 x 10*	1 varh	±2% Rdg									
THD± 655%Individual HarmonicsI to 50 displayed in percentage; 1 to 7 at 400HzExternal Supply110V/250V (10%) @ 50/60Hz; 400HzBack-Up Power Source/Charge TimeRechargeable 8.4V NIMH battery pack / Approximately 5 hoursBattery Life30 minutes minimum, 60 minutes typicalMECHANICALUSB 2.0, Ethernet (RJ45), Wireless Bluetooth Class 1 **Dimension/Weight0.08 x 4.92 x 1.46 ' (256 x 125 x 37mm) / <1kg	Apparent Energy (ES)	0 to 4 x 10*	1Vah	±0.5% Rdg									
Individual Harmonics1 to 50 displayed in percentage; 1 to 7 at 400HzExternal Supply110V/250V (10%) @ 50/60Hz; 400HzBack-Up Power Source/Charge TimeRechargeable 8.4V NIMH battery pack / Approximately 5 hoursBattery Life30 minutes minimum, 60 minutes typicalMECHANICALUSB 2.0, Ethernet (RJ45), Wireless Bluetooth Class 1 **Dimension/Weight0.08 x 4.92 x 1.46' (256 x 125 x 37mm) / <1kg	THD		± 655%										
External Supply1101//250V (10%) @ 50/60Hz; 400HzBack-Up Power Source/Charge TimeRechargeable 8.4V NiMH battery pack / Approximately 5 hoursBattery Life30 minutes minimum, 60 minutes typicalMECHANICALUSB 2.0, Ethernet (RJ45), Wireless Bluetooth Class 1 **Dimension/Weight10.08 x 4.92 x 1.46' (256 x 125 x 37mm) / <1kg	Individual Harmonics	1 to :	50 displayed in percentage; 1 to 7 at 4	00Hz									
Back-Up Power Source/Charge Time Rechargeable 8.4V NiMH battery pack / Approximately 5 hours Battery Life 30 minutes minimum, 60 minutes typical MECHANICAL USB 2.0, Ethernet (RJ45), Wireless Bluetooth Class 1 ** Dimension/Weight 10.08 x 4.92 x 1.46* (256 x 125 x 37mm) / <1kg	External Supply		110V/250V (10%) @ 50/60Hz; 400Hz										
Battery Life 30 minutes minimum, 60 minutes typical MECHANICAL USB 2.0, Ethernet (RJ45), Wireless Bluetooth Class 1 ** Dimension/Weight 10.08 x 4.92 x 1.46' (256 x 125 x 37mm) / <1kg	Back-Up Power Source/Charge Time	Rechargeab	le 8.4V NiMH battery pack / Approxima	itely 5 hours									
MECHANICAL Communication Ports USB 2.0, Ethernet (RJ45), Wireless Bluetooth Class 1 ** Dimension/Weight 10.08 x 4.92 x 1.46' (256 x 125 x 37mm) / <1kg Case/Index of Protection Double insulated, rubber over-molded, polycarbonate UL94 V1 rated / IP54 non operating Mounting/Security Embedded magnets on back side, keyhole slot on back side / Kensington anti-theft system DISPLAY Display Type for Model PEL 103 2.63 x 2.16' (67 x 55mm), four line, monochrome, backlit LCD with adjustable brightness and contrast ENVIRONMENTAL / SAFETY Operating Temperature/Relative Humidity 50° to 122°F (10° to 50°C) / up to 85% Storage Temperature -4° to 122°F (-20° to 50°C) with batteries; -4° to 158°F (-20° to 70°C without batteries)	Battery Life	3	0 minutes minimum, 60 minutes typic	al									
Communication Ports USB 2.0, Ethernet (RJ45), Wireless Bluetooth Class 1** Dimension/Weight 10.08 x 4.92 x 1.46* (256 x 125 x 37mm) / <1kg Case/Index of Protection Double insulated, rubber over-molded, polycarbonate UL94 V1 rated / IP54 non operating Mounting/Security Embedded magnets on back side, keyhole slot on back side / Kensington anti-theft system DISPLAY Display Type for Model PEL 103 2.63 x 2.16* (67 x 55mm), four line, monochrome, backlit LCD with adjustable brightness and contrast ENVIRONMENTAL / SAFETY Operating Temperature/Relative Humidity 50° to 122°F (10° to 50°C) / up to 85% Storage Temperature -4° to 122°F (-20° to 50°C) with batteries; -4° to 158°F (-20° to 70°C without batteries)	MECHANICAL												
Dimension/Weight 10.08 x 4.92 x 1.46' (256 x 125 x 37mm) / <1kg Case/Index of Protection Double insulated, rubber over-molded, polycarbonate UL94 V1 rated / IP54 non operating Mounting/Security Embedded magnets on back side, keyhole slot on back side / Kensington anti-theft system DISPLAY Embedded magnets on back side, keyhole slot on back side / Kensington anti-theft system Display Type for Model PEL 103 2.63 x 2.16' (67 x 55mm), four line, monochrome, backlit LCD with adjustable brightness and contrast ENVIRONMENTAL / SAFETY Operating Temperature/Relative Humidity 50° to 122°F (10° to 50°C) / up to 85% Storage Temperature -4° to 122°F (-20° to 50°C) with batteries; -4° to 158°F (-20° to 70°C without batteries)	Communication Ports	USB 2.0	Ethernet (RJ45), Wireless Bluetooth C	lass 1 **									
Case/Index of Protection Double insulated, rubber over-molded, polycarbonate UL94 V1 rated / IP54 non operating Mounting/Security Embedded magnets on back side, keyhole slot on back side / Kensington anti-theft system DISPLAY Embedded magnets on back side, keyhole slot on back side / Kensington anti-theft system Display Type for Model PEL 103 2.63 x 2.16' (67 x 55mm), four line, monochrome, backlit LCD with adjustable brightness and contrast ENVIRONMENTAL / SAFETY Operating Temperature/Relative Humidity 50° to 122°F (10° to 50°C) / up to 85% Storage Temperature -4° to 122°F (-20° to 50°C) with batteries; -4° to 158°F (-20° to 70°C without batteries)	Dimension/Weight	10.08	3 x 4.92 x 1.46" (256 x 125 x 37mm) /	<1kg									
Mounting/Security Embedded magnets on back side, keyhole slot on back side / Kensington anti-theft system DISPLAY Comparison Display Type for Model PEL 103 2.63 x 2.16' (67 x 55mm), four line, monochrome, backlit LCD with adjustable brightness and contrast ENVIRONMENTAL / SAFETY Comparating Temperature/Relative Humidity Storage Temperature -4° to 122°F (-20° to 50°C) / up to 85%	Case/Index of Protection	Double insulated, rubber	over-molded, polycarbonate UL94 V1 i	ated / IP54 non operating									
DISPLAY Display Type for Model PEL 103 2.63 x 2.16' (67 x 55mm), four line, monochrome, backlit LCD with adjustable brightness and contrast ENVIRONMENTAL / SAFETY Operating Temperature/Relative Humidity 50° to 122°F (10° to 50°C) / up to 85% Storage Temperature -4° to 122°F (-20° to 50°C) with batteries; -4° to 158°F (-20° to 70°C without batteries)	Mounting/Security	Embedded magnets on ba	ck side, keyhole slot on back side / Ke	nsington anti-theft system									
Display Type for Model PEL 103 2.63 x 2.16' (67 x 55mm), four line, monochrome, backlit LCD with adjustable brightness and contrast ENVIRONMENTAL / SAFETY -40° to 122°F (10° to 50°C) / up to 85% Storage Temperature -4° to 122°F (-20° to 50°C) with batteries; -4° to 158°F (-20° to 70°C without batteries)	DISPLAY												
ENVIRONMENTAL / SAFETY Operating Temperature/Relative Humidity 50° to 122°F (10° to 50°C) / up to 85% Storage Temperature -4° to 122°F (-20° to 50°C) with batteries; -4° to 158°F (-20° to 70°C without batteries)	Display Type for Model PEL 103	2.63 x 2.16" (f	37 x 55mm), four line, monochrome, b adjustable brightness and contrast	acklit LCD with									
Operating Temperature/Relative Humidity 50° to 122°F (10° to 50°C) / up to 85% Storage Temperature -4° to 122°F (-20° to 50°C) with batteries; -4° to 158°F (-20° to 70°C without batteries)	ENVIRONMENTAL / SAFETY												
Storage Temperature -4° to 122°F (-20° to 50°C) with batteries; -4° to 158°F (-20° to 70°C without batteries)	Operating Temperature/Relative Humidity		50° to 122°F (10° to 50°C) / up to 85%	0									
	Storage Temperature	-4° to 122°F (-20° to 50	°C) with batteries: -4° to 158°F (-20° f	o 70°C without batteries)									
Safety Rating/CE Rating Complies with IEC 61010-1:Ed3. and IEC 61010-2-030:Ed1 for 1000V CAT III / 600V CAT N. Pollution Degree 2 / Yes	Safety Rating/CE Rating	Complies with IEC 61010-1:Ed3. and II	EC 61010-2-030:Ed1 for 1000V CAT III	/ 600V CAT IV, Pollution Degree 2 / Yes									

Appendix B: Details of instrumentation used –Parameters monitored Duration: 2 Weeks









Figure ?

Appendix C: data and perfomance plots of Machines audited

Compressor: -

ae (COMPRESSOR DAT	FA SHEET	
usv	Rotary Compressor:	Fixed Speed	
	MODEL DATA - FOR CO	MPRESSED AIR	
1	Manufacturer: Atlas Copco		
	Model Number: GA45-125 AP	Date:	6/15/2012
2	X Air-cooled Water-cooled	Type:	Screw
	X Oil-injected Oil-free	# of Stages:	1
	Rated Capacity at Full Load Operating		
3*	Pressure ^{a, e}	271	acfm ^{a,e}
4	Full Load Operating Pressure b	125	psig ^b
5	Maximum Full Flow Operating Pressure c	132	psig ^c
6	Drive Motor Nominal Rating	60	hp
7	Drive Motor Nominal Efficiency	93.9	percent
8	Fan Motor Nominal Rating (if applicable)	3.9	hp
9	Fan Motor Nominal Efficiency	85.0	percent
10*	Total Package Input Power at Zero Flow ^e	13.2	kW ^e
11	Total Package Input Power at Rated Capacity and Full Load Operating Pressure ^d	55.3	$\mathbf{k}\mathbf{W}^{d}$
12*	Specific Package Input Power at Rated Capacity and Full Load Operating Pressure	20.4	kW/100 cfm ^e

Figure ?

Appendix D: Author taking some Measurementsd



Figure ?







Figure ?

APPENDIX E

POWER FACTOR CALCULATIONS

Calculation of the energy savings

In order to calculate power factor correction for your installation, your should follow the steps below: Step 1 – Calculate Actual Load (kW) (Load) Power kW = Volts V x $\sqrt{3}$ x Current I x Power factor Pf

Step 2 – Calculate Required Power Factor Correction (kVAr)

Power Factor Correction kVAr = Power $kW (Tan\Phi i - Tan\Phi d)$

Φi = Cos⁻¹ Initial Power Factor Pf Φd = Cos⁻¹ Required Power Factor Pf Step 3 – Calculate Actual Power Factor Correction [kAVrl Actual Power Factor Correction Pf = Cos (Tan⁻¹ (TanΦi – Correction kVAr/Power kW))

Typical Power Factor Correction available in multiples of 25kVAR's.

At the end of the spreadsheet you will get the calculation of the energy savings for above power factor correction.

- 1. Initial Current (Amps)
- 2. Original Load (kVA)
- 3. Corrected Current (Amps)
- 4. Corrected Load (kVA)

- 5. Reduction in Current (Amps)
- 6. Reduction in Load (kVA)
- 7. Annual CO2 Savings (kg CO2)

Calculation of the energy savings

In order to calculate power factor correction for your installation, your should follow the steps below:

Step 1 – Calculate Actual Load (kW) (Load) Power kW = Volts V x $\sqrt{3}$ x Current I x Power factor Pf

Step 2 – **Calculate Required Power Factor Correction** (kVAr) Power Factor Correction kVAr = Power kW (TanΦi – TanΦd)

 $\Phi i = Cos^{-1}$ Initial Power Factor Pf

 $\Phi d = \cos^{-1}$ Required Power Factor Pf

Step 3 – Calculate Actual Power Factor Correction [kAVrl

Actual Power Factor Correction $Pf = Cos (Tan^{-1} (Tan\Phi i - Correction kVAr/Power kW))$

Typical Power Factor Correction available in multiples of 25kVAR's, for further details please Contact Blakley Electrics Technical Department.

At the end of the spreadsheet you will get the calculation of the energy savings for above power factor correction.

- 1. Initial Current (Amps)
- 2. Original Load (kVA)
- 3. Corrected Current (Amps)
- 4. Corrected Load (kVA)
- 5. Reduction in Current (Amps)
- 6. Reduction in Load (kVA)
- 7. Annual CO2 Savings (kg C02)

APPENDIX F

COPIES OF ELECTRICITY BILLS FOR THE FACILITY

APPENDIX G

COPIES OF WATER BILLS FOR THE FACILITY

EACL FACTORY LAYOUT PLAN



	F	Con1	7 act No . 1	Elec Account NAIRO	ELFICAN FRICAN 18243 BI	7 Bill CABLES	LY SQUARE DLY Y
ON MANA OW RATE, I	PF)	Naritikin	k Awthorise	d Load (KW)	: Date	of issue: 209 / 8176 ADDIS	AND AND RD
Aethod of Charge No.:	i ang h			1	Sup	ply Location:	
	CON	SUMPTIC	DATA	line Parters		BAS NO BERO TOD S TRUE I IN	
Consumption Type	Meter	Previous	Current	Conversion	Consumption	FIXED CHARGE BILLING CONCEPT	4.500.00 AMOUNT IN SHILLINGS
HIGH RATE (C2)	8083213	2313850	2367020	Factor	53170	HIGH RATE CONSUMPTION	398,775.00
LOW RATE (C2)	8083213	2114970	2169640	1	54670	LOW RATE CONSUMPTION	410,025.00
						FUEL COST CHARGE 519.9 cents/kwh	559,689.60
			1 1			FOREX ADJ. 5.0 cents/kwh	5,392.00
			1 1			INFLATION ADJ. 9.9	9,705.60
			1 1			FRC Levy 3.9 rents/kut	5,392.00
			1 1			DED I and 5 00 %	3,235,20
DEMAND KVA (C2)	8083213		406	4	406	MAXIMUM DEMAND KVA	914 120 00
DEMAND KW (C2)	8083213		383		383	POWER FACTOR SURCHARGE	6.00
			1 1			{ Dkwh } VAT 15.00 %	255 873 15
						20140324-PAYMENT	-2,203,512.60
						20140324-ADVANCE PAYMENT	-0.40
	28/02/2014 - 27/03/2	014 (Act)	0.94				
(VAh/KWh :	Consumption	Periodishs	1.9000	Factor :			
	and a strength of the		1				
.01 EMAIL.20140329_03.03.21a	; 1361 (1176	20	in an an Shawar an			
This electricity bill is payable Notice is hereby given t days from 05/04/2014, i.e to disconnection without any Should the supply be discor- outstanding amount, you	e before 05/04/20 hat if this bill on 19/04/2014 y further notice t inected, in additi will be req	14. Is not pa your suppoyou. on to settling uired to pr	id within fi ply shall be the ay the app	ourteen Iable olicable		Round Adjustment	0.05
Reconnection (RC) fe as follows: Sh580 for Sh13,920 for service line RC of an 16% VAT charge. In ad top up your deposit to 2 time	e before rec cut-out RC o .The said RC fee dition, you will a te your average r	onnection.Th r Sh3,828 s are inclusiv Iso be require nonthly bill	e RC fee for pole e ed to	is are RC or		namensi sena per sianen dan menintan kenalam menintangan	1,904,147.20
All enquiries	to Customer S	ervice For	NAIRORI	SOUTH PO	BOX 30177	NAIROBI Tetal Amount	7
customercareasi	robi@kole.ce.l	ce	12624(16644)	CHEMICALL LAN	Land Swill	NUMBER OF STREET, LABOR MANYALING, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STRE	
A TO LATION POLICITION	a search a barren o a						
e 	EAST AFRI	CAN CABL	ES	Moheita	nar kale a-	PO ROY 19949	
		and the star had		THOUSING. W	ww.spic.co.	NU 10240	1.11.010.00.010

1A7A6698B52D4F71F5F6C6CF6B7F757045607DCA 0926 00483562 1403311252 AIP06000761



Electricity Bill

Contract No. / Account No: 2544023-01

APRIL 2014



EAST AFRICAN CABLES PO BOX 18243 NAIROBI

CITY SQUARE DLY

dwanjiru@eacables.com Bill Number : 2544023-01-27/04/2014-1 Maximum Authorised Load (KW) :

1.815

ituonsea Load (K

Date of Issue: 29/04/2014

Date Due: 06/05/2014

Method of Charge No.: CI2 (HIGH/LOW RATE, PI	F)	Deposit:	KShs. 0.00		Supp	PLT / 209 / 8176 ADDIS	ABABA RD
	CON	SUMPTIC	ON DATA			BILLIN	G DETAILS
Consumption Type	Meter Number	Previous Reading	Current Reading	Conversion Factor	Consumption	BILLING CONCEPT	AMOUNT IN SHILLINGS
						BALANCE BROUGHT FORWARD	1,904,147,10
						FIXED CHARGE	4.500.00
HIGH BATE (C2)	8083213	2367020	2421380	1	54360	HIGH RATE CONSUMPTION	407.700.80
LOW RATE (C2)	8063213	2109640	2229650	1	60010	LOW RATE CONSUMPTION	450,075.00
						FUEL COST CHARGE 519.0 cours/kwh FOREX ADJ	593.580.30 0.80
						INFLATION ADJ. 9.8	10,293.30
						WARMALEVY 50	5.718.50
						ERC Levy 3.0 cents/kwh	3,431,10
						REP Levy 5.00 %	42,888,75
DEMAND KVA (C2)	8083213		428	1	428	MAXIMUM DEMAND KVA	222,560.00
DEMAND KW (C2)	8083213		388	1	388	POWER FACTOR SURCHARGE	0.00
						(0KWh) VAT 16.00 %	270,193.37
						20140417-PAYMENT	-1,904.147.10
KVAh/KWh :	Consumption	Period :	Pou	ver Factor :		20140417-ADVANCE PAYMENT	-0.35
2	7/03/2014 - 27/04/2	014 (Act)	0.91				
	the mostil	y bill is KShi	s. 2,010,9	40.30			
2,01 EMAIL.20140429_02.58.46ac	1083	0176	20				
This electricity bill is payable Notice is hereby given t days from 06/05/2014. i.e to disconnection without any	e before 06/05/21 hat if this bil on 20/05/2014 y further notice t	914. Il is not p your sup to you.	aid within oply shall t	fourteen ne liable			
Should the supply be discon outstanding amount. you Reconnection (RC) fe	inected, in addit will be rec e before rec	ion to settlin pilired to p connection.T	githe pay the a he RC fi	pplicable ses are		Round Adjustment	0.03
as follows. Sh580 for Sh13.920 for service line RC of an 16% VAT charge. In ad top up your deposit to 2 time	cut-out RC in The said RC fee dition, you will a es your average	or Sh3,828 as are inclusi also be requi monthly bill	for pole ive red to	RC or		Total Amount:	2,010.940.00
All enquiries	to Customer	Service En	g. NAIRO	BI SOUTH P	.O. BOX 3017	7. NAIROBI TEL. 020-321154	47
		a gang ngalaka kan ti ya kan dingi ta ka ta ta		Website	www.kplc.cc	ke	

E-mail. customercarenairobi@kplc.co.ke ALL CHEQUES PAYABLE TO KENYA POWER & LIGHTING COMPANY LIMITED To be posted with cheque payments. Postal Address: PO BOX 18243 NAIROBI EAST AFRICAN CABLES Customer's Name: Form Serial Number Amount: **Bill Number:** Date Due: KShs, 2,010,940.00 2544023-01-27/04/2014-1 06/05/2014 accession) accessioned

13F467625A8D22F894D461EE96E43C3902AC3A70 0241 03531183 1404300528 ALP06000705

Kenya Power	Ele *2544	ctricity Bill (D 023*	uplicate) Contract No 2544023 - EAST AFRICAN	. / Account 01 CABLES	No.; ADS 1
Sill Number : 544023 - 01 - 30/06/2014 - 1 Tethod of Charge No. : Cl2 HIGH/LOW RATE, PFy ustomers' Name : EAST AFRICAN CABLES	Billing Frequency : MONTHLY	01/07/201 Maximum Authorised Los 1815 Supply Location : PLT / 209 / 8176 ADDIS	PO BOX 18243 NAIROBI 4 D: ad (KVA) :	9/07/2014	JUNE 2
hese are the calculations fo	r your bill.				
	CONSUMPTION DATA		BILLING	DETAILS	
Consumption Type	Meter Previous Current Reading Co	eading Consumption onstant (Units) BALA	BILLING CONCEP	PTS	Amount (Ksh) 4,210,952,71
DEMAND KW	008083213 365 427	1 427 HIGH	D CHARGE		4,500.00 448,200.00
DEMAND KVA	008083213 405 452	1 452 LOW (un	RATE CONSUMPTION its billed: 62150 kwh)		466,125.00
OW RATE	008083213 2285330 2347480	1 62150 FUE	EX ADJ.	28.0 cts/kwn	34,134.80
IGH RATE	008083213 2474870 2534630	1 59760 INFL	ATION ADJ.	9.0 cts/kwh	10,971,90
		WAF	RMALEVY	5.0	6,095.50
WAh/KWh :	Consumption Period : Power Fa 27/05/2014 - 30/06/2014 (Act) 0.94	ictor:	Levy Levy GMUM DEMAND KVA	3.0 cts/kwi 5.00 %	3,657.30 45,716.25 235,040.00
The monthly bill is KShs. 24672	36.85	POV	VER FACTOR SURCHARC		00.
As per ti Order, 19 "As per Electrific Legal No	ne Electricity Regulatory Board Levy 198, Legal Notice No. 95. the Electric Power (Rural ation Programme Levy) Order, 1998, tice No. 96.	VAT 30/0 25/0	05/2014-PAYMENT X8/2014-PAYMENT	16.00 %	-2,010,339 99 -2,200,012,70
S.S.		Ro	und adjustment		-0.03
			Total Am	ount :	2,467,296.87
SSUE Date : 01/07/2014	PIN : P000591096X E = Estin	nated Consumption			
Customers' Name : EAST AFRICAN CABLES		Supply Location : PLT / 209 / 8176 ADDIS	ABABA RD		
A REAL PROPERTY AND A REAL	nt exception of the state of th				

Kenya Pow	/er	Cor 2 5 4 4 0	2 3 ×	Account EAST PO BO NAIRO	No: AFRICAN X 18243 BI	CABLES	Y SQUARE DLY 7	AD!
2544023-01-27/07 ill Number : (HIGH/LOW RATE,	/2014-1 PF)	1.815 Maximu Deposit: I	m Authorise KShs. 0.00	d Load (KW)	: Date	07/2014 Date of issue: Date	6/08/2014 9 Due: ABABA RD	JULY 20
		NOUNT	ONDAT	anti-construction of the second second	oup	ny Location.		
Consumption Type	Meter	Previous	ON DATA Gurrent	Conversion	Consumption	BILLING		
antan anti-antana - si - s	Number	Reading	Reading	Factor		BALANCE BROUGHT FORWARD	2,467,296.90	
						FIXED CHARGE	4,500.00	
RATE (C2)	8083213	2534630	2578540	1	43910	HIGH RATE CONSUMPTION	362,257.50	
(ATE (C2)	8083213	2347480	2384940	1	37460	LOW RATE CONSUMPTION	309,045.00	
						FUEL COST CHARGE 722.0 cents/kwh	587,491.40	
						FOREX ADJ, 30,0 cents/kwh	24,411.00	
						WARMA LEVY 6 0	14,546.60	
						ERC Levy 3,0 cents/kwh	2.441.10	
						REP Levy 5.00 %	33 565 12	
D KVA (C2)	8083213		418	1	418	MAXIMUM DEMAND KVA	217 360 00	
ND KW (C2)	8083213		388	1	388	POWER FACTOR SURCHARGE (0kwh)	0.00	
Ah/KWh	Consumptio	on Period ·	Bow	or Easter :		20140725-PAYMENT	243,153.84 -2 467 296 87	
			FOR	or racion .				
	30/06/2014 - 27/07/2	2014 (Act)	0.93					
	The monthly	y bill is KShs.	1,803,75	3.80				
IAIL.20140730_13.17.27	253	0176	20					
ectricity bill is payable	e before 06/08/20	014.						
is hereby given t from 06/08/2014, i.e	hat if this bil on 20/08/2014	l is not paid , your supp	d within fo ly shall be	liable				
the supply be discon	inected, in additi	ion to settling	the			Round Adjustment	0.04	
nding amount, you nection (RC) fe	will be req e before rec	uired to par connection.The	y the app RC fee	licable s are		Total Amacunt		
llows: Sh580 for 20 for service line RC 6% VAT charge. In add	cut-out RC of The said RC fee	s are inclusive	for pole F	RC or			1,803,753.80	
your deposit to 2 time	es your average	monthly bill						
mail:	4- 0		**************	Website: w	ww.kplc.co.k	nn uru sur e e e e e e e e e e e e e e e e e e e		
To be posted with o	cheque payme	nts. A	LL CHEQU	ES PAYABL	E TO KENY	A POWER & LIGHTING COM	PANY LIMITED	
customercarenai ustomer's Name:	robi@kplc.co.	ke		Postal	Address:			
				en las formadores	ten esterteidage das "redgessenden sonde			
100 111101	- Bill Nun	IBGE OADLE	0	Amoun	t	po perm Seria	al Number:	

Kenya Power			*2	544023*		Contrac 25440 EAST AFRIC PO BOX 182 NAIROBI	t No. / Accoun 23 - 01 CAN CABLES 243	It NO. : AD ERF F
500 Sill Number : 1544023 - 01 - 28/08/2014 -	1	Billing F MONTH	requency : LY		28/0	8/2014	05/09/2014	
lethod of Charge No. : Cl2 HIGH/LOW RATE, PFv				Maximu 1815	m Authorise	d Load (KVA) :		
ustomers' Name : EAST AFRICAN CABLES				Supply PLT / 20	Location : 9 / 8176 AD	DDIS ABABA RD		
hese are the calculations	for your bill.							
	CONSUMP		1			BILL	ING DETAIL	S
Consumption Type	Meter Number	Previous Reading	Current Reading	Reading Constant	Consumption (Units)	BILLING CON	ICEPTS	Amount (Ksh)
EMAND KW IEMAND KWA OW RATE IGH RATE IGH RATE	008083213 008083213 006083213 008083213	388 418 2384940 257854	421 451 2442430 26397000000000000000000000000000000000000	1 1 1 Factor :	421 451 57490 61160	BALANCE BROUGHT FOI FIXED CHARGE HIGH RATE CONSUMPTIX (units billed: 611601 LOW RATE CONSUMPTIX (units billed: 57490) FUEL COST CHARGE FOREX ADJ. INFLATION ADJ. WARMA LEVY ERC Levy REP Levy MAXIMUM DEMAND KVA POWER FACTOR SURCH VAT 25/08/2014-PAYMENT 25/08/2014-ADVANCE PA	RWARD DN (wh) 722.0 cts/kw 28.0 cts/kw 5.0 3.0 cts/kw 5.0 3.0 cts/kw 5.00 % IARG 16.00 %	1,803,753.76 4,500.00 504,570.00 474,292.50 856,853.00 33,222.00 21,357.00 5,932.50 1 3,559.50 48,943.12 234,520.00 .00 340,658.32 -1,803,753.80 -20
Sue Date : 28/08/2014 VAT Reg. No. : 00106085	PIN : P0005	91096X	E = E:	Supply Lc PLT / 209	nption cation : / 8176 ADD	Round adjustment Total /	Amount :	0 2,528,207.70

Bill Number : 2544023 - 01 - 27/09/2014 - 1 Method of Charge No. : Cl2 HIGH/LOW RATE, PFv Customers' Name :				Incy : 28/09/2014 Maximum Authorised Load (KVA) : 1815						
Customers' Name : EAST AFRICAN CABLES				Supply PLT / 2	Location : 09 / 8176 AL	DDIS ABABA RD				
These are the calculations f	for your bill.									
	CONSUMP	TION DAT	٩			BILLING	DETAIL	S		
Consumption Type	Meter Number	Previous Reading	Current Reading	Reading Constant	Consumption (Units)	BILLING CONCEP	TS	Amount (Ksh)		
DEMAND KW DEMAND KVA LOW RATE HIGH RATE KVAh/KWh : The monthly bill is KShs. 22284	008083213 008083214 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	421 451 2442430 2639700 Period : 7/09/2014 (A gulatory Board > No. 95. er (Rural e Levy) Order,	329 382 2499510 2699210 2699210 Power ct) 0.86	1 1 1 • Factor :	329 382 57080 59510	FIXED CHARGE HIGH RATE CONSUMPTION (units billed: 59510 kwh) LOW RATE CONSUMPTION (units billed: 57080 kwh) FUEL COST CHARGE FOREX ADJ. INFLATION ADJ. WARMA LEVY ERC Levy REP Levy MAXIMUM DEMAND KVA POWER FACTOR SURCHARG VAT 24/09/2014-PAYMENT	571.0 cts/kw 17.0 cts/kw 18.0 cts/kw 5.0 3.0 cts/kw 5.00 %	4,500.00 490,957.50 470,910.00 665,728.90 19,820.30 20,996.20 5,829.50 3,497.70 48,093.37 198,640.00 .00 299,446.86 -2,528,207.00		
SSUE Date : 28/09/2014 VAT Reg. No. : 00106085 Customers' Name : EAST AFRICAN CABLES	PIN : P0005:	91096X	E = E:	stimated Consu Supply L PLT / 209	mption ocation : / 8176 ADD	Round adjustment Total Amo	unt :	0.03		





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Γ		Con	tract No.	/ Account	No: 25440	10.60	ADDIS	
derster					2.0 MM U .	$\lambda \tau c$	ENAREA 2	11
Kenya Pow	er			EAST	AFRICAN	CABLES DEC	LIVIDER Z	DIT
		25440	23 *	NAIRC	16245 IBI	같아요. 이는 이상은 명신을 가지 않는다. 이는 이는 것은 것이 있는 것이 있는 것이 있다. 이는 이는 것은 것이 있는 것이 있는 것이 있는 것이 있다.	CITY SULARIANA	
SKaminju@eacables	.com;dwanjiru(@eacables.co	an A				W	
2544023-01-27/	12/2014-1	1,815	n Authorise	a rosa (ww)	: Date 30/	of issue: 12/2014	Date Due: 06/01/2015	
Method of Charge No.	* *				Sup	ply Location:		
CI2 (HIGHLOW RATE	-, rr)	Ueposit:	KShs. 0.00			PLT / 209 / 8176 ADD	IS ABABA RD	
Consumption Type	Meter	Previous	Current	Conversion	Consumption	BILLING CONCEPT		
	Number	кезану	Reading	Factor			AWOOH! W SHILLINGS	
						BALANCE BROUGHT FORWAN	D 4,533,913,30	
HIGH RATE (C2)	8083213	2817300	2864390	4	44000	HIGH BATE CONCUMPTION	4,500,00	
LOW RATE (C2)	8083213	2611810	2656620		34210	LOW RATE CONSUMPTION	303,742.50	
						CHEL PART PURPER NETA	204.122.20	
						cents/kwh	253,421.00	
						INCLASSION ADD. 180	29.139.00	
						INPERTION AUG, 16.0	15.894.00	
						ERC I and 3.0 math fresh	4,415.00	
						ence many are concerning	1,643.00	
DEMAND HVA 102	0003142					REP Levy 5.00 %	36,423.75	
DEMAND KW	8083213		304	1	354	MAXIMUM DEMAND KVA	184,080.00	
	19403-0.10		283	1	299	BUNCHARGE 8.06 (9kwh)	0.00	
						20143202.BAYMENT	194,481.44	
KVAh/KWh:	Consumptio	n Period :	Pow	er Factor :		WALLER FRANCE IN CONT. (C)	12,328,298,99	
	27/11/2014 - 27/12	2/2014 (Act)	0.84					
	The month	while in Kenn	4 452 43	10 00				
	1 1122 1135/1110	ny lone is mores	. 1,400,47	0.20				
v2.01 EMABLEP.20141230_05.4	0.13 265	0176	20					
X - Your account is in am	ears and you are	due for discon	nection					
without any further warning	112.							
					•			
						Round Adjustment	0.01	
							이 이 요즘 집중 이 말했다.	
						Total Amoun	L: 3.459,183.50	
All amountain		al pr	A.7 B. 100, AL 844	an an t-freide to see an				
E mail	ra to customer	SELVICE ENG.	MAIRUBI	Wahelta	L HOX 30177.	NAJKOBI TEL. 020-3211	<u>×47</u>	
customercarer	aitobi@kpls.c.	o.ke Nationalistication		website: W	ww.spic.co.k			
Customer's Name:	EAST AF	RICAN CARL	is onego	Postal A	Address:	A POWER & LIGHTING		
Date Duri		and the second second second second				FU DUA 102	HOUTINE CE	
06/01/2015	Bill Num	307: 2.04.634-210-		Amount	· · ·	Form	Serial Number:	
UNIVERSES.	204402	5-01-21112120	148-1	KShs.	3,459,183,5	U .	~	
							Apresident	

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nted Payes and Extra						EAST AFRICAN C/ PO BOX 18243 NAIROBI	ABLES	2
Number : 4023 - 01 - 30/01/2015 - 1		Billing F MONTHL	requency : Y		30/01/:	2015 07/)2/2015	
thod of Charge No. : HIGH/LOW RATE, PFv				Maximun 1815	n Authorised	Load (KVA) :	Ŷ	
stomers' Name :				Supply L PLT / 209	ocation : / 8176 ADI	DIS ABABA RD		
ese are the calculations for y	our bill.			Englished generality of the				
cc	NSUMPT	ION DAT	A			BILLING	DETAILS	
Consumption Type	Meter Number	Previous Reading	Current Reading	Reading Constant	Consumption (Units)	BILLING CONCEPT	S Amount (Kst) 3,459,183.	n) 47
						FIXED CHARGE	4,500	.00
MAND KW	008083213	299	392	1	392	HIGH RATE CONSUMPTION (units billed: 60220 kwh)	496,815	.00
MAND KVA	008083213	354	441	1	441	LOW RATE CONSUMPTION (units billed: 48680 kwh)	401,610 253.0 cts/kw 275,517	.00
WRATE	008083213	2656020	2704700	1 1	48680	FOREX ADJ.	29.0 cts/kwi 31,581	00.1
SH RATE	008083213	2861390	2921610	1	60220	INFLATION ADJ.	23.0 cts/kwi 25,047	7.00
						WARMA LEVY	5.0 5,445	5.00
		Period :	Power	Factor :		ERC Levy	5.00 % 44,92	1.25
/Ah/KWh : 27	/12/2014 - 3	30/01/2015 ((Act) 0.89			MAXIMUM DEMAND KVA	229,32	0.00
and the second		and Andrew Andrew Andrew Andrew		a far her in start and a start and a start a st A start a start		POWER FACTOR SURCHARG	22,55	4.90
e monthly bill is KShs. 1778489	.33	Sale Controls in a	Constant Constant	and the second		29/12/2014-PAYMENT	-2,005,91	10.00
*As per the	Electricity R	egulatory Boa	rd Levy	2		21/01/2015-PAYMENT	-1,453,27	73.50
Order, 199 **As per the Electrificati	e Electric Por	wer (Rural ne Lew) Orde	er, 1998,			21/01/2015-ADVANCE PAYME	NT20)4.69
C Legal Notic	e No. 96.				- A-			
- Change - C		Æ				Point adjustment		0.01
					•	Total Am	ount : 1,778,28	4.61
sue Date : 30/01/2015		the second se						
VAT Reg. No. : 00106085	PIN : P00	0591096X	E=	Estimated Cons	sumption	1		
				and the second se				
ustomers' Name : EAST AFRICAN CABLES				Supply PLT / 20	Location : 9 / 8176 AE	DDIS ABABA RD		
		and the second			Contraction of an advantage of the	First Cor	al Number :	
Kenya Powe	r J	2 5 4 4 0		EAST PO BO NAIRO	AFRICAN OX 18243 OBI	CABLES	TY SQUARE DLY 7	
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SKaminju@eacables.co iill Number : 2544023-01-27/02/	m 2015-1	Maximur 1,815	m Authorise	ed Load (KW): Date	of Issue: D	Date Due:	
lethod of Charge No.: CI2 (HIGH/LOW RATE, P	'F)	Deposit:	KShs. 0.00		Sup	ply Location:	0/03/2015	
	CON	SUMPTI	ON DATA			PL1/209 / 8176 ADDIS	ABABA RD	
Consumption Type	Meter Number	Previous Reading	Current Reading	Conversion Factor	Consumption	BILLING CONCEPT	AMOUNT IN SHILLINGS	
HIGH RATE (C2) OW RATE (C2) HEMAND KVA (C2) HEMAND KW (C2) Ah/KWh : C4 30	8083213 8083213 8083213 8083213 8083213 0nsumption	2921610 2704700 Poriod : 015 (Act)	2968360 2748650 350 304 Powe 0.87	1 1 1 2 2 7 7 Factor :	46750 43950 350 304	BALANCE BROUGHT FORWARD FIXED CHARGE HIGH RATE CONSUMPTION LOW RATE CONSUMPTION UW RATE CONSUMPTION FUEL COST CHARGE 251.0 cents/kwh FOREX ADJ. 41.0 cents/kwh INFLATION ADJ. 23.0 WARMA LEVY 5.0 ERC Levy 3.0 cents/kwh REP Levy 5.00 % MAXIMUM DEMAND KVA POWER FACTOR SURCHARGE 0.03 (0kwh) VAT 18.00 %	1,778,284.60 4,500.00 385,687.50 362,587.50 227,657.00 37,187.00 20,861.09 4,535.00 2,721.00 37,413.75 182,000.00 55.816.50 204,207.44 41,778,284.10	
EMAILLP.20150301_04.52.47 selectricity bill is payable to ce is hereby given that is from 08/03/2015, i.e o isconnection without any found uid the supply be disconnec- tanding amount, you onnection (RC) fee follows: Sh580 for ct 3,920 for service line RC.Tf n 16% VAT charge. In addit up your deposit to 2 times to	The monthly 125 0 before 08/03/20 It if this bill n 22/03/2015 urther notice to ected, in additio will be requi- before reco nt-out RC or ne said RC fees- ion, you will all your average m	bill is KShs. 178 15. is not pair your supply you, on to settling to dired to pay onnection.The Sh3.828 f are inclusive to be required isonthly bill	1,525,17 20 d within fo ly shall be the y the app RC feet or pole F	3.70 Nurteen liable licable s are IC or		Add Wino's Slavo's Round Adjustment Total Amount:	0.01	
All enquiries to ail:	Customer Se	ervice Eng.	NAIROBI	SOUTH P.O	BOX 30177.	NAIROBI TEL. 020-3211547		
o be posted with chequ	bi@kplc.co.k le payments	e • ALI	L CHEQUE	S PAYARI	E TO KENYA	POWER & LIGHTING COL		
stomer's Name:	EAST AFRIC	CAN CABLES	s i	Postal A	ddress:	DO DOVING COM	MPANY LIMITED	
e Due:	Bill Number	r:		Amount		Form Series	ial Number:	

227341DEAF554FCC903448B723F7EE1D1C6D10 0996 03536483 1503011101 ALP06000725

Contract No. / Account No: 2344023-01 MAMUM enya Power EAST AFRICAN CABLES Po BOX 18243 NAIROBI Curr Source Put 7 Kamining Statustics Maximum Authorised Load (KV): 1.815 Date of Issue: 291032015 Oate Of Issue: 291032015 Oate Of Issue: 291032015 Date Of Issue: 291032015 <th>N.</th> <th></th> <th>A State of the second</th> <th>unite and and</th> <th></th> <th>Tank be</th> <th></th> <th>1.1000</th>	N.		A State of the second	unite and and		Tank be		1.1000
Encya Power EAST AFRICAN CABLES PO BOX 18243 NAIROBI CTV SOUARCELV Winning Strenshies.com Number: 234402301547/03/201541 Maximum Authorised Lead (KW): 1.815 Date of issue: Date of issue: 2340023015 Date Due: % Date of issue: 2050023015 Date Due: % Date Of issue: 2050024015 Date Due: % Date Due: % Da			Con	tract No.	MARCH			
Consumption State biles.com Number: 25402231014270322015-1 Maximum Authorised Load (KW): 1.815 Date of Issue: 2540231014270322015 Date Due: 254023015 Maximum Authorised Load (KW): 254023114270322015-1 Date of Issue: 2540230114270322015 Date Due: 254023015 Date Due: 2540230	enva Powe	r imi	INTE DIN DER HAT HE	IN DAMA OF THE	EASTA	FRICAN	ABLES	RO
Mainting: Date of Issue: Date of Issue: Date Of Issue: Date Due: Subject 2003/2015 254.022.03.01.42703/2015-1 1.815 Date of Issue: 2003/2015 Date Due: Supply Location: 291.01/2017 Deposit: KSBs. 0.00 Supply Location: PLT / 2009 / 5176 ADDIS ABABA_RD Consumption Type Meter Previous Consumption BILLING CONCEPT MOUNT IS SHALMES Consumption Type Meter Previous Consumption BILLING CONCEPT MOUNT IS SHALMES Consumption Type Meter Previous Consumption BILLING CONCEPT MOUNT IS SHALMES Consumption Type Meter Previous Consumption BILLING CONCEPT MOUNT IS SHALMES Consumption Type Meter Previous Consumption BILLING CONCEPT MOUNT IS SHALMES Consumption Type Meter Previous Consumption 1.525.174.20 Previous 1.525.174.20 Consumption Period: Previous 278859 278829 1.4759 Low RATE CONSUMPTION 329.573.70 Standord State <th>cinja : one</th> <th></th> <th>2 5 4 4 0</th> <th>53*</th> <th>PO BO</th> <th>X 18243 Bl</th> <th>cm</th> <th>Y SQUARE BLY 7</th>	cinja : one		2 5 4 4 0	53*	PO BO	X 18243 Bl	cm	Y SQUARE BLY 7
Builded of Charge No.: 12 (HIGHLOW RATE, PF) Deposit: KSIss. 0.00 Supposit: KSIss. 0.00 Consumption Type Refer Previous Consumption Billing Dettails: Consumption Type Refer Previous Consumption Consumption Billing Dettails: Consumption Type Refer Previous Consumption Consumption Billing Dettails: Consumption Type Refer Previous Consumption Billing Dettails: Association Consumption Type Refer Previous Consumption Billing Dettails: Association Consumption Type Refer Previous Consumption Previous Consumption Min Art (C2) BEB3213 2748559 2798209 1 47590 Min Art BED3213 274859 2798209 1 47590 Previot Association 268373 Consumption Type BEB3213 27477 1 377 4 377 4 377 BARMON DELAND RVA 4685.60 ERAND KWA (C2) BEB3213 2777 1 377 4 377 4	Kaminjugencables.co Number : 2544023-01-27/03	om /2015-1	Maximun 1,815	n Authorise	d Load (KW) :	Date of 29/0	of Issue: Da 3/2015 05	te Due: 🖤 104/2015
CONSUMPTION DATA BILLING DETAILS Consumption Type Meter Number Previous Previous Supervised Consumption Reading Consumption Reading Bulling Consumption BILLING DETAILS Consumption Type Meter Number Previous Supervised Consumption BILLING CONCEPT AVOUNT IN SHILLING ASDA chi same (c)2 8083213 2988360 3010600 1 42240 High Rate Consumption 348,480.00 wire are consumption 8083213 2748650 2795200 1 47550 UW Rate Consumption 392,257.50 wire are consumption 8083213 2748650 2795200 1 47550 UW Rate Consumption 392,257.50 cmass wire (c) 8083213 377 1 372 900000 Billin Devine 2,683.70 emass wire (c) 8083213 300 1 308 277 900000 Billin Devine 2,683.70 emass wire (c) 8083213 300 1 308 277 308 1,326.81.90 emass wire (c) 8083213 300 1 3	thod of Charge No.:	PE)	Deposit:	KShs. 0.00		Supp	ly Location: PLT / 209 / 8176 ADDIS	ABABA RD
Consumption Type Meter Number Previous Reading Consumption Factor Consumption BILLING CONCEPT AUOUNT N SHALLING Set NATE EH NATE 6021 50632/13 2968360 3010600 1 42240 High RATE CONSUMPTION 348,480,00 WH RATE 6021 50632/13 278650 2785200 1 47560 LOW RATE CONSUMPTION 348,480,00 WH RATE 6021 50832/13 2785200 1 47560 LOW RATE CONSUMPTION 392,287.50 PUEL COST CHARGE SHALL 20537.30 206,51.70 WARMALEY 5.00 4,463.50 BRAND KVA 600 1 377 1 377 MARMALEY 5.00 4,463.50 BRAND KVA 600 1 900 1 377 MARMALEY 5.00 4,463.50 BRAND KVA 607 8033213 377 1 377 MARMALEY 5.00 4,463.50 BRAND KVA 601 0.32 9199326 PATIMENT 1,925.114.20 195.93 BRAND KVA 607 8032215 90		CON	SUMPTIC	ON DATA			BILLIN	G DETAILS
Enk ANCE (C2) B083213 2968369 3010600 1 42240 High ARTE CONSUMPTION 348,480.09 WI RATE (C2) B083213 2748650 2796200 1 47550 LOW RATE CONSUMPTION 348,480.09 WI RATE (C2) B083213 2748650 2796200 1 47550 LOW RATE CONSUMPTION 392,287.50 FUEL COST CHARGE 201.0 B083213 274650 2796200 1 47550 LOW RATE CONSUMPTION 392,287.50 FUEL COST CHARGE 201.0 B083213 2776210 200,201 200,851.70 200,851.70 BERND KVA (C2) B083213 377 1 377 <td< th=""><th>Consumption Type</th><th>Meter</th><th>Previous Reading</th><th>Current Reading</th><th>Conversion Factor</th><th>Consumption</th><th>BILLING CONCEPT</th><th>AMOUNT IN SHILLINGS</th></td<>	Consumption Type	Meter	Previous Reading	Current Reading	Conversion Factor	Consumption	BILLING CONCEPT	AMOUNT IN SHILLINGS
En KATE (C2) 8053213 3968359 5010600 1 42240 Hich RATE CONSUMPTION 348,480.06 WI KATE (C2) 8053213 2746550 2755200 1 47555 LOW RATE CONSUMPTION 392,287.59 WI KATE (C2) 8053213 2745550 1 47555 LOW RATE CONSUMPTION 392,287.59 WI KATE (C2) 8053213 277 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 378 1 398 1 398 1 398 1 398 1 398 1 1 1,55,17.9 1,55,17.9 1,55,17.9 1,378 1,56,040.00 0 0 1,55,26,35 1 1,55,64,040.00 1,55,25,17.9 <	Part Part	Filmiter .				and a second	BALANCE BROUGHT FORWARD	1,525,174.20
chi KATE (G2) 8053213 2956360 3010600 1 42240 High RATE ConsumPtion 348,480.08 WI RATE (G2) 8053213 2746560 2796200 1 47550 LOW RATE CONSUMPTION 392,287.50 WI RATE (G2) 8053213 2746560 2796200 1 47550 LOW RATE CONSUMPTION 392,287.50 WI RATE (G2) 8053213 2746560 2796200 1 47550 LOW RATE CONSUMPTION 392,287.50 IMAMD KVA (C2) 8053213 307 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 376 1 368 196,040.00 196,040.00 196,040.00 196,040.00 196,040.00 196,040.00 196,040.00 197,038.37 396.37 396.37 396.37 396.37 396.32 197,038.37 396.32 197,038.37 396.32 197,038.37 396.32 197,038.37 396.32 197,038.37 3							FIXED CHARGE	4,500.00
W RATE (C2) 8083213 2748650 2796200 1 47950 LOW RATE CONSUMPTION 392,287.50 PUL (C2) 8083213 2748650 2796200 1 47950 PUL (C2) 226,372.90 IMAND XVA (C2) 8083213 377 1 377 1 377 IMAND XVA (C2) 8083213 377 1 377 1 377 IMAND XVA (C2) 8083213 377 1 377 1 377 IMAND XVA (C2) 8083213 377 1 377 1 377 IMAND XVA (C2) 8083213 377 1 377 1 377 IMAND XVA (C2) 8083213 308 1 308 1 308 IMAND XVA (C2) 8083213 301 302 308 1 308 IMAND XVA (C2) 8083213 302 303 1 308 1 308 1 308 1 308 1 308 1 39326	GH RATE (C2)	8083213	2968360	3010600	1	42240	HIGH RATE CONSUMPTION	348,480.00
EMAND KVA (C2) 8083213 377 1 378 1 98 1 98 1 98 1 98 1 98 1 98 1 398 1 398 1 398 1 398 2193,395,40 2193,395,44 2193,395,46 2193,395,46 2193,395,46 2193,395,46 2193,395,46 2193,395,46 2193,395,46 2193,395,45 2193,395,45 2193,295,45	WRATE (C2)	8083213	2748650	2796200	· 1	47550	LOW RATE CONSUMPTION	392,287.50
IMAND XVA (C2) B083213 377 1 372 MARK LEVY 5.0 4,489.50 IMAND XVA (C2) B083213 377 1 372 MARKMULEVY 5.0 4,489.50 IMAND XVA (C2) B083213 377 1 372 MARKMUN DEMAND KVA 196,600.00 IMAND XVA (C2) B083213 306 1 398 POWER FACTOR SURCHARGE 195,625.35 IMAND XVA (C2) B083213 306 1 398 POWER FACTOR SURCHARGE 195,625.35 IMAND XVA (C2) B083213 308 1 398 POWER FACTOR SURCHARGE 195,625.35 IMAND XVA (C2) ECOnsumption Period : Power Factor : 219,395.48 219,395.48 All/KWh : Consumption Period : Power Factor : 0.82 219,395.48 The monthly bill is KShs. 1,634,838.80 Exoticity bill is payable before 05/04/2015. 0.82 2019325-PAYMENT 1,524,838.80 Exoduct House the induction to your supply the induction to settling the							FUEL COST CHARGE 251.0	225,372.90
IMAND KVA (C7) B085213 377 1 377 MARKA LEVY 5.0 4,493.50 IMAND KW (C2) B085213 377 1 377 MARMUM DEMAND KVA 196,640.00 IMAND KW (C2) B085213 308 1 308 POWER FACTOR SURCHARGE 175,525.35 IMAND KW (C2) B085213 308 1 308 POWER FACTOR SURCHARGE 175,525.35 IMAND KW (C2) B085213 308 1 308 POWER FACTOR SURCHARGE 175,525.35 IMAND KW (C2) B085213 308 1 308 POWER FACTOR SURCHARGE 175,525.35 IMAND KW (C2) B085215-27/03/2015 (hct) 0.82 2019325-PAVMENT 1,525,174.20 It co is breavy on thit if this bill is not paid within fourteen sys from 05/04/2015, i.e on 10/04/2015, your supply shall be liable disconnection without any further notics to you. Round Asjustment 0.00 It co is breave filme RC. The said RC fees size are inclusive connection. RC fees size size for baske are inclusive connection. RC fees size for one size are inclusive cone to up your deposit to 2 times your average monthly bill 1,634,838.80 All endulties to Clustomer Service Eng. MAIROBI SOUTH P.O. 80X 30177. NAIROBI TEL. 929-3211547 1.634,838.80						1.4	FOREX ADJ. 17.9 cents/swh	15,264.30
MAND KVA (C2) B083213 377 1 377 MAXBUM DEMAND KVA 2,633.70 BIAND KW (C2) B083213 377 1 377 MAXBUM DEMAND KVA 195,640.00 BIAND KW (C2) B083213 308 1 268 POWRE RACTOR SUBCHARGE 195,640.00 BIAND KW (C2) B083213 308 1 268 POWRE RACTOR SUBCHARGE 195,640.00 ANKWH: Consumption Period : Power Factor : 0.431 Bawh 1 219,335.48 219,335.48 ANKWH: Consumption Period : Power Factor : 0.82 219,335.48,291 4,69.40 Is electricity bill is payable before 05/64/2015. 0.82 20 20 20 20 is electricity bill is payable before 05/64/2015. 0.82 80.00 80.00 80.00 1,525,134.20 MAILP.20159229 0.3.5 54 201 0176 20 2				- All All All All All All All All All Al			INFLATION ADJ, 23.0	20,651.70
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EMAND XVA (C2) 2083213 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 377 1 378 1 96.040.00 196.0		a Allan		- 10			ERC Levy 3.0 cents/kwh	2,693.70
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AUXINI: 27/02/2015 - 27/03/2015 (Act) 0.82 The monthly bill is KShs. 1,634,838.80 I EMAILLP.20150:239_03.35.54_201 9176 is electricity bill is payable before 05/04/2015. 20 is electricity bill is payable before 05/04/2015. 20 is olectricity bill is payable before 05/04/2015. 20 is olectricity bill is payable before 05/04/2015. 90 is olectricity bill is solution without any further notice to you. 80 is olectricity bill is payable before reconnection. The RC fores are regulated to pay tifle - applicable 80 iconnection (RC) fee before fees are inclusive 80 an 16% VAT charge. In addition, you will also be required to 90 90 pu your deposit to 2 times your average monthly bill 90 90 All enquiries to Customer Service Eng NAIROBI SOUTH P.O. BOX 30177. NAIROBI TEL, 020-3211547 mail: customercarenairobi@kplc.co.ke 90 To be posted with cheque pa	AL-REAL A	Consumption	Period	Pou	er Factor	a haran ara ara ara ara ara ara ara ara ara	20150325-PAYMENT	-1,525,174.20
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an 16% VAT charge. In addition, you will also be required to p up your deposit to 2 times your average monthly bill All enquiries to Customer Service Eng. NAIROBI SOUTH P.O. BOX 30177. NAIROBI TEL. 020-3211547 Mebsite: www.kpic.co.ke To be posted with cheque payments. EAST AFRICAN CABLES Postal Address: PO BOX 18243 NAIROBI	13,920 for service line R	C.The said RC fe	es are inclusi	ive Ive	NU OI		Total Amount:	1,634,838.80
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Website: Website: www.kplc.co.ke To be posted with cheque payments. ALL CHEQUES PAYABLE TO KENYA POWER & LIGHTING COMPANY LIMITED ustomer's Name: EAST AFRICAN CABLES Postal Address: PO BOX 18243 NAIROBI	All enquirie	s to Customer	Service En	NAIRO	BI SOUTH P.	0, BOX 3017	7. NAIROBI TEL. 020-321154	7
To be posted with cheque payments. ALL CHEQUES PAYABLE TO KENYA POWER & LIGHTING COMPANY LIMITED ustomer's Name: EAST AFRICAN CABLES Postal Address: PO BOX 18243 NAIROBI	nail: customercaren	airobi@kolc.co	o.ke		Website: v	www.kplc.co	.ko	
ustomer's Name: EAST AFRICAN CABLES Postal Address: PO BOX 18243 NAIROBI	To be posted with ch	neque paymer	its.	ALL CHEQ	UES PAYAB	LE TO KEN	YA POWER & LIGHTING CO	OMPANY LIMITED
	ustomer's Name:	EAST AF	RICAN CAB	LES	Postal	Address:	PO BOX 18243	NAIROBI

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BROTHERS SEYAN P O BOX 60070-002 NAIROBI	4I •	NAIROBI CEN	TRAL, 209/8176 ADIS A ATHI-ADDIS ABABA R	BABA, , 0, 16-16-1B OAD	JA	N 2014 NT NO.:	
INDUSTRIA	L	Old Account	No.:		8 Book-Itinerary	525 / No	
05/02/2014		Bat No.	198657903		Property Sequence.		
Bin Herns Bal. B/fwd	Meler Number	Principais Reading	Present Reading	Consumption	Rate	CHARGE (KES.)	
TOTAL CONSUMPTION WATER SEWER METER RENT PAYMENTS Rov'd ADJUSTMENTS 0.00	5155047 15213754 15213754 0.00 DEBT	50601 ANALYSIS	0.00	9.67 19.33 29 475 9.67 9.67 9.67 9.67	18.71 28.07 42.89 53.80 14.03 . 14.03 . 14.03 . 14.03 .	180.93 28.07. 1243.81. 25555.00. 135.67. 135.67. 135.67. 135.67. 435.00 -65878.00 -65878.00 0.00 48599.08	
Debt above 60 days: 06/	01/2014 to 04/02/2014 Debt within 60 da	ys:	A Debt within 30 da	CTUAL ys:	Current:	05/02/2014 TOTAL DUE	
05/02		Estimated/Actu	12/02/2014 al Bill:		Payment inclu	usive upto	
lling Date:	PAY YOUR OUTS	ΓANDING BIL Due Date:	L PROMPTLY TO	AVOID DISCON	NECTION Contract Depo	usits:	
EQUES SHOULD BE MADE PA	YABLE TO NAIROBI WA	TER COMPANY	LTD.		THE RECEIPT N RETAINED BY C	MUST BE MACHINE PRINTED CUSTOMER	
			19/02/2014				

P O BOX 60070-002	NCWSC	VAT Number: 0161		IN Number: P051159	4940	-B 2014
KENYA		, 0, 16-	16-18 ATHI-	ADDIS	. -	1619208
INDUSTRIAL			0		ACCOUNT	NO.: 8525
Category:	· · · · · · · · · · · · · · · · · · ·	Old Account	No.:		Book-Itinerary No	: •
Meter Reading Date:	/03/2014	Bill No.:	200319414		Property Sequence	3 :e:
Bill Items	Meter Number	Previous Reading	Present Reading	Consumption	Rate	CHARGE (KES.)
SEWER	5155047	51134	\$1591	9 18 27 403	18.71 28.07 42.89 53.80	48599.08 168.39 505.26 1158.03 21 681.40
METER RENT				9 18 27 403	14.03 21.05 32.17 40.35	126.27 378.90 868.59 16261.05 405.00
ADJUSTMENTS						-48600.00 0.00
tinti attendi tata in an ana ana ana ana ana ana ana ana	D	EBT ANALYSIS				TOTAL DUE
Debt above 60 days: 0.00	Debt within 60) days:).00	Debt within 30 da	00 41	Current: L552.89	41552.89
To 03 Consumption Period:	3/03/2014	Estimated/Actu	ACTUAL al Bill:		Payment inclusive	04/03/2014 e upto
04/03/2014 Billing Date:		Due Date:	11/	03/2014	Contract Deposits:	
CHEQUES SHOULD BE MADE	PAYABLE TO NAIROBI	WATER COMPANY	LTD.		THE RECEIPT MUST RETAINED BY CUST	BE MACHINE PRINTED AND OMER

NOTICE IS HEREBY GIVEN THAT IF THIS BILL IS NOT PAID BY YOUR SUPPLY WILL BE DISCONNECTED WITHOUT FURTHER NOTICE.

Maikobi War	HEAD OFFICE TELEPHONE EMAIL: IN	OBIN E, KAMPALA ROAD : 020-3988598/000, 5 ifo@nairobiwater.co	ATE P.O. BOX 30656, G.F 013598/000, FA .ke WEBSITE:	R CO 0.00100 NAIROBI, ax: 020-552126 / 020 www.nairobiwater.c	KENYA. 0-552133 10.ke	
SEVAN THERS	NCWSC	VAT Number: 01611	58Q NCWSC PI	Number: P0511594	494Q	OCH OOL
NAIROBI KENYA		209/81/6	ADIS ABABA		NASI	M auto
		, 0, 10-	TO-TR AIHT-	ADD15	ACCOUNT	1619208
INDUSTRIAL		L	0		мтнс	8525
Category:		Old Account	No.:		Book-Itinerary No.:	*
02, Meter Reading Date:	/04/2014	Bill No.:	201866381		Property Sequence:	3
Bill Items BAL B/Fim	Meter Number	Previous Reading	Present Reading	Consumption	Rate	CHARGE (KES.)
WATER	5155047	51591	51950	10 20 30	18.71 28.07 42.89	41552.89 187.10 561.40 1286.70
SEWER				299	53.80	16 086.20
				10 20 30	14.03 21.05 32.17	140.30 421.00 965.10
METER RENT				299	40.35	12064.65
PAYMENTS= 1556657 Adjustme nts	20140315		IN	ITIAL		-41553.00 0.00
			DICE TIFIED DICE CKED	Op	PATM: Dictional	
	D	EBT ANALYSIS	2010-00-00-00-00-00-00-00-00-00-00-00-00-	LUE MAR HARDWICK AN IN THE MEMORY AND A CARDON OF AND		TOTAL DUE
Debt above @ days: 0.00	Debt within 60) days: 0 . 00	Debt within 30 da 0 .	ys: 00 3	Current: 2162.45	32162.45
03/03 To 02 Consumption Period:	/2014 /04/2014	Estimated/Actua	ACTUAL		Payment inclusive	04/04/2014 upto
03/04/2014 Billing Date:		Due Date:	11/	04/2014	Contract Deposits:	
CHEQUES SHOULD BE MADE	PAYABLE TO NAIROBI	WATER COMPANY	LTD.		THE RECEIPT MUST E RETAINED BY CUSTO	E MACHINE PRINTED AND MER
You can payyour Bills at a	ue w.e.f 31st	ntres:	≺U Plaza(^e	ormer Comora	aft House) to Ca	ameo Building
NAIROBI DAM CHARAN CE K-REP BANK, POSTAL OFFICI	NTRE, MSA RD. CO ES IN NAIROBI, EQUITY	MCRAFT HOUSE BANK, CO-OPERATI	KAMPALA ROAD	PANGANI OFFICE BANK.	KAREN SHOPPING CENT	RE THE MALL, WESTLANDS

L

NAROBI WATER	HEAD OFFIC TELEPHONE EMAIL: IN NCWSC	OBIV E, KAMPALA ROAD : 020-3988598/000, fo@nairobiwater.c : VAT Number: 016	VATE: 0.0.80X 30656, G.F. 5013598/000, F/ 0.ke WEBSITE: 1158Q NCWSC PIL	CONNAIROBI, Ax: 020-552126 / 020- www.nairobiwater.co N Number: P0511594	APANYA 552133 0.ke 194Q	1 6 1 9 2 0 8 ×
P O BOX 60070-0020 NAIROBI	0	NAIROBI 209/8176	ADER REAL	ATT AND A AN	APRIL	2017
KENYA		, 0, 16-	16-18 ATHI-A	DDIS		1619208
INDUSTRIAL	g ar ga chin ch chaile church the s-sh file		0	antara finis memorphy in pro deservation and a defendants	мтнс	8525
Category		Old Accour	nt No.:	집에서 아파니	Book-Itinerary No.:	
05/05/2014			202932981	anten munde er udelar fin der fan intenden er sich ei mellen fin der sich die soften.		₽ 3
Meter Reading Date:		Bill No.:	annan a sua a sua sua sua sua sua ana ana ana ana ana ana ana ana ana a	an carrier o construction de la const	Property Sequence	
	Meter Number	Previous Reading	Present Reading	Consumption	Rate	CHARGE (KES.) 32162-45
WATER	5155047	51950	\$2307	11 22 33 291	18.71 28.07 42.89 53.80	205.81 617.54 1415.37 15655.80
SEWER				11 22 33 291	14.03 21.05 32.17 40.35	154.33 463.10 1061.61 11741.85 495.00
PAYMENTS= 1572417 ADJUSTMENTS	20140416					-32162.00 0.00
		•				
	anara ang ang ang ang ang ang ang ang ang an	DEBT ANALYSIS		2012/03/2012/12/2012/2012/2012/2012/2012		TOTAL DUE
Debt above 60 days: 0.00	Debt within	60 days: 0.00	Debt within 30 o 318	days: 10.86	Current: 0.00	31810.86
02/04 To 09 Consumption Period:	1/2014 5/05/2014	Estimated/A	ACTUA ctual Bill:	L	Payment inclusive	05/05/2014 e upto
05/05/2014 Billing Date:		Due Date:	12	/05/2014	Contract Deposits:	
CHEQUES SHOULD BE MADE	PAYABLE TO NAIRC	DBI WATER COMPA	NY LTD.		THE RECEIPT MUS RETAINED BY CUST	T BE MACHINE PRINTED A

NCWSC will be relocating offices from KU Plaza(former Comcraft House) to Cameo Building Kenyatta Ave

You can pay your Bills at any of the following Centres: NAIROBI DAM CHARAN CENTRE, MSA RD. COMCRAFT HOUSE KAMPALA ROAD PANGANI OFFICE KAREN SHOPPING CENTRE THE MALL, WESTLANI K-REP BANK POSTAL OFFICES IN NAIROBI EQUITY BANK, CO-OPERATIVELIS/10.5//2014/F BANK NOTICE IS HEREBY GIVEN THAT IF THIS BILL IS NOT PAID BY______YOUR SUPPLY WILL BE DISCONDECTED WITHOUT FURTHER NOTICE

NAIROBI WATER SEXAN THERS P O BOX 60070-002 NAIROBI KENYA	EMAIL: I NCWS(Info@nairobiwater C VAT Number: 01 NAIROBI 209/817 , 0, 16	co.ke WEBSITE 61158Q NCWSC P CENTRAL ADIS BBBBB ADIS BBBBB -16-18 ATHI-A	: www.nairobiwater.co IN Number: P0511594	ske 94Q MAA	1619208 * 2012 1619208
INDUSTRIAL		Old Accou	0 unt No.:		ACCOUNT MTHC Book-Itinerary No	NO.: 8525
04, Meter Reading Date:	/06/2014	Bill No.:	204357208		Property Sequence	3 Se:
Bill Items BAL. B/FWD	Meter Number	Previous Reading	Present Reading	Consumption	Rate	CHARGE (KES.)
WATER METER RENT PAYMENTS= 1592783 ADJUSTMENTS	5155047 20140522	52307	52897	10 20 30 530 10 20 30 530	18.71 28.07 42.89 53.80 14.03 21.05 32.17 40.35	187.10 561.40 1286.70 28514.00 140.30 421.00 965.10 21385.50 450.00 -31810.00 0.00
		DEBT ANALYSIS	• Di Konstanovanjanjevi vinjeva je posovanj			TOTAL DUE
Debt above 60 days: 0.00	Debt within 6	0 days: 0.86	Debt within 30 da O	ays: 00 539	Current: 011.10	53911.96
To 04 Consumption Period:	/06/2014	Estimated/Ac	ACTUAL stual Bill:	ene normen fange ekknolog op de Stande en op de Henrik ekknole og de Stande	Payment inclusive	09/06/2014 e upto
06/06/2014 Billing Date:		Due Date:	16/0	06/2014	Contract Deposits:	

RETAINED BY CUSTOMER

NCWSC will be relocating offices from KU Plaza(former Comcraft House) to Cameo Building Kenyatta Ave

You can pay your Bills at any of the following Centres:

NAIROBI DAM CHARAN CENTRE, MSA RD. COMCRAFT HOUSE KAMPALA ROAD PANGANI OFFICE KAREN SHOPPING CENTRE THE MALL, WESTLAND K-REP BANK, POSTAL OFFICES IN NAIROBI, EQUITY BANK, CO-OPERATIVE 3/06/2014/S BANK.

YOUR SUPPLY WILL BE DISCONNECTED WITHOUT FURTHER NOTICE NOTICE IS HEREBY GIVEN THAT IF THIS BILL IS NOT PAID BY

A RECONNECTION FEE OF KSH 500.00 WILL BE CHARGED ON ISSUANCE OF DISCONNECTION SERVICE ORDER

ALL ENQUIRIES TO NWC OFFICES.

MAIROBI WATER	HEAD OFFICE TELEPHONE: EMAIL: IN	OBI E, KAMPALA RC 020-3988598/00 fo@nairobiwate	AD P.O. BOX 30656, G. 00, 5013598/000, F r.co.ke WEBSITE:	R C P.O. 00100 AX: 020-55 www.nair	NAIROBI, H 52126 / 020- obiwater.co	KENYA. 552133 .ke	1 6 1 9 2 0 8 *
SEYANI BROTHERS P O BOX 60070-0020 NAIROBI KENYA	0	NAIROB 209/81 , 0, 1	APPER BIL 76 ADIS ABABA 6-16-18 ATHI-/	L ADDIS			E 2014 1619208 NO.:
INDUSTRIAL Category:		Old Acco	0 ount No.:			MTHC Book-Itinerary No.:	0121
02/ Meter Reading Date:	07/2014	Bill No.:	205675934			Property Sequence	ॐ 3
Bill Items	Meter Number	Previous Reading	Present Reading	Cons	umption	Rate	CHARGE (KES.)
BAL B/FWD WATER SEWER	5155047	52897	53154	9.33 18.67 28 201		18.71 28.07 42.89 53.80	53911.96 174.56 524.07 1200.92 10813.80
METER RENT				9.33 18.67 28 201		14.03 21.05 32.17 40.35	130.90 393.00 900.76 8110.35 420.00
PAYMENTS= 1613218 Adjustments	20140625						-53912.00 0.00
		0-12- -paption -091 °	57 2014				
L	DE	BT ANALYSIS					TOTAL DUE
Debt above 60 days: 0.00	Debt within 60 0	days: •00	Debt within 30 da 0 .	ys: 00	22	Current:	22668.32
04/06/ To 02/ Consumption Period:	2014 07/2014	Estimated/A	ctual Bill: ACTUAL			Payment inclusive	04/07/2014
04/07/2014 Billing Date:		Due Date:	11/	07/201	4	Contract Deposits:	
CHEQUES SHOULD BE MADE P	AYABLE TO NAIROBI	WATER COMPA	NY LTD.			THE RECEIPT MUST E RETAINED BY CUSTO	BE MACHINE PRINTED AND MER
NCWSC will be Kenyatta Avenu You can pay your Bills at any NAIROBI DAM CHARAN CENT K-REP BANK, POSTAL OFFICES NOTICE IS HEREBY GIVEN T	relocating or e w.e.f 31st of the following Cen TRE, MSA RD. COL S IN NAIROBI, EQUITY I HAT IF THIS BILL IS N	ffices fro March 20 tres: MCRAFT HOUSE BANK, CO-OPER OT PAID BY	OM KU Plaza(fo 14 KAMPALA ROAD KATIVE BANK PAPOLAYS	PANGANI BANK. YOUR SUP	Comcraf OFFICE PLY WILL B	T HOUSE) TO Ca KAREN SHOPPING CENT E DISCONNECTED WITH	RE THE MALL, WESTLANDS

SEYANI BROTHERS P O BOX 60070-00200 NAIROBI KENYA	NCWSC	AT Number: 0161 NAIROB 209/8176 , 0, 16-	ATER BILL ADIS ABABA 16-18 ATHI-AD	Number: P0511594		1619208 1619208
INDUSTRIAL Category:		Old Accoun	0 t No.:		MTHC Book-Itinerary N	0. :
04/0 Meter Reading Date:	8/2014	Bill No.:	206822851		Property Sequer	3 nce:
Bill Items	Meter Number	Previous Reading	Present Reading	Consumption	Rate	CHARGE (KES.)
WATER	5155047	53154	53191	11 22 4	18.71 28.07 42.89	22668.32 205.81 617.54 171.56
SEWER METER RENT			Paga - 12 2 - 12 2 - 12	11 22 4	14.03 21.05 32.17	154.33 463.10 128.68 495.00
PAYMENTS= 1630878 Adjustments	20140723					-22668.00 0.00
		·				
Dabé shous 60 daya	Debt within 60	BT ANALYSIS	Dobt within 20 dow		Current	TOTAL DUE
0.00	Debt within 60	.00	0.3	2 22	36.02	2236.34
02/0// Consumption Period: To 04/	2014 08/2014	Estimated/Act	ual Bill: ACTUAL		Payment inclusi	05/08/2014 ve upto
05/08/2014 Billing Date:		Due Date:	12/0	8/2014	Contract Deposits	5:
CHEQUES SHOULD BE MADE PA					THE RECEIPT MUS	T BE MACHINE PRINTED

NCWSC will be relocating offices from KU Plaza(former Comcraft House) to Cameo Building Kenyatta Ave

You can pay your Bills at any of the following Centres:

NAIROBI DAM CHARAN CENTRE, MSA RD. COMCRAFT HOUSE KAMPALA ROAD PANGANI OFFICE KAREN SHOPPING CENTRE THE MALL, WESTLANDS K-REP BANK, POSTAL OFFICES IN NAIROBI, EQUITY BANK, CO-OPERATIVE BANK, BARCI AYS BANK. 19/08/2014

NOTICE IS HEREBY GIVEN THAT IF THIS BILL IS NOT PAID BY _____YOUR SUPPLY WILL BE DISCONNECTED WITHOUT FURTHER NOTICE.

NAIROBIWATER MAIROBIWATER EYANI DROTHERS		HEAD OFFICE	KAMPALA ROAD INDU TELEPHONE: +254 203 EMAIL: Info@nairobiw VEBSITE: www.nairobiw r: 0161158Q NCWS0	SEWERA STRIAL AREA, NAIF 3 988 000 ater.co.ke vater.co.ke C PIN Number: P05	II159494Q	
O BOX 60070-002 AIROBI ENYA	00	NAIROB: 209/81 , 0, 10	ADIS ABABA 5-16-18 ATHI-4		AU	G 2014 1619208
Category:		Old Accour	0 nt No.:		ACCOUNT MTHC Book-Itinerary No.	NO.: 8525
02, Meter Reading Date:	/09/2014	Bill No.:	208186964		Property Sequence	3 e:
Bill Items	Meter Number	Previous Reading	Present Reading	Consumption	Rate	CHARGE (KES.)
WER TER RENT YMENTS= 1646817 JUSTMENTS	5155047 20140816	53191 DEBT ANALYSIS	53278 AMM : 8/9/2	9.67 19.33 29 29 9.67 19.33 29 29 29 29 29 29 29 29 29 29	18.71 28.07 42.89 53.80 14.03 21.05 32.17 40.35 IVED INITIAL OS IVED INITIAL OS IFIED INITIAL	2236.34 180.93 542.59 1243.81 1560.20 135.67 406.90 932.93 1170.15 435.00 -2237.00 0.00 TOTAL DUE
Debt above 60 days:	Debt within 0	60 days: • 00	Debt within 30 d. 0 . 0	^{ays:} 0 66	Current: 08.18	6608.18
04/08, To 02, onsumption Period:	/2014 /09/2014	Estimated/A	ACTUAL		Payment inclusive up	04/09/2014
U4/U9/2014		Due Date:	11/0	9/2014	Contract Deposits:	
CHEQUES SHOULD BE MAR YOU CA Legional Offices & Busine ower Ground Floor, Westla louse, Spine Road Kayole couthern Region: Woodley	DE PAYABLE TO NAIRO AN PAY YOUR WATE ess Centres: Cameo ands Western Regio a North Eastern Regio o, Off Joseph Kangeti	BICITY WATERA R BILLS AT ANY Building 1st Floo on: Parklands Pl gion: Eastleigh S he Road Cer	ND SEWERAGE COMPA OF THE FOLLOWIN or, Kenyatta Avenue, C aza, Chiromo Lane; - I section III, 18th Street tral Region: Enternris	G AUTHORIZED P BD Head Office, Northern Region: S Kasarani: Kasar Be Plaza Enterpris	THE RECEIPT MUST B RETAINED BY CUSTOM AY POINTS: Kampala Road, Industria howbe Plaza; Pangani rani/ Mwiki Rd, Opposite e Road, Industrial Area	E MACHINE PRINTED AND MER I Area Nairobi The Mall, Eastern Region: Pinnacle Kasarani Police station Karen Shopping Control

NCWSC will be relocating offices from KU Plaza(former Comcraft House) to Cameo Building Kenyatta Avenue w.e.f 31st March 2014

gents: The Co-operative Bank of Kenya - K-Rep Bank - Citi- Bank - Barclays Bank of Kenya Ltd - Equity Bank Ltd - Housing Finance of Kenya - Postal orporation of Kenya: Service Providers: Nakumatt Supermarket outlet 0972014 usiness No. 444400 - Airtel Money - Jambo Pay - Pay- Net.

O BOX 60070-00200 AIROBI ENYA)	NAIROBI 209/817 , 0, 16	ADIS ABABA 6 ADIS ABABA -16-18 ATHI-	ADDIS	SZ	1619208 10: 0525
INDUSTRIAL	an a	1	0	an a	мтнс	8525
03/10/2014 Meter Reading Date:		Old Account	No		Book-Itinerary No.	2
		209641443 Bill No :			3 Property Sequence	
Bill items	Mater Number	Previous Reading	Present Reading	Consumption	Rate	CHARGE (KES.)
AL. B/HWU ATER	5155047	53278	53303	10.3 14.67	18.71 28.07	193.27 411.79
EWER				10.33 14.67	14.03 21.05	144.93 308.80 465.00
AYMENTS= 1668669 DJUSTMENTS	20140919					-6608.00 0.00
anarana marina 21 Augusta marang maring na maring marina kang marina sa marina sa marina sa marina sa marina sa		une und und er Weinstein auf Bergen Berliner Lauf Marke 190	-		A CONTRACTOR OF A CONTRACTOR O	TOTAL DUE
		DEBTANALYSI	5			r (
Debt abov 6000 ys:	Debt withi	0⁶⁰da ys:	Debt within 3	0 days: 0.18 15	Current: 23.79	152 3.9 7
02/09 To 03	/2014 /10/2014	enter eta un arten en derenter te personatus de	ACTU	AL		06/10/2014
Consumption Period:		Estimated/	Actual Bill:		Payment inclusive u	ipto
06/10/2014	azan ya ma ang mana ang mana na na na ang manang ang bang ang manananan na ma	. La constatut constatut services	1	3/10/2014		
Billing Date:		Due Date:			Contract Deposits	

Regional Offices & Business Centres; Cameo Building 1st Floor, Kenyatta Avenue, CBD, - Head Office, Kampala Road, Industrial Area Nairobi, - The Ma Lower Ground Floor, Westlands, - Mestern Region, - Parkiands Plaza, Chirokio Lane, - Northern Region, Showbe Plaza, Pangani, - Eastern Region, Pinnac House, Spine Road Kayole, - Worth Eastern Region, Eastleign Section, III, 18th Street, - Kasarani, Kasarani, Mwiki Rd, Opposite Kasarani Police station Southern Region, Off Joseph, Kangethe Plaza, - Central Region, Enterprise, Plaza, Enterprise, Road, Industrial Area, Karen, Shopping, Centr Southern, Region, Woodley, Off Joseph, Kangethe, Plaza, - Central Region, Enterprise, Plaza, Enterprise, Road, Industrial Area, Karen, Shopping, Centr

Opponewscenwont Spectrelocating offices from KU Plaza(former Comcraft House) to Cameo Building Kenyatta Ave

Agents: The Co-operative Dash of Kenyo - K Rep Bank - Oth-Bank - Bendays Bank of Kenya Ltd - Equity Bank Ltd - Housing Finance of Kenya - Pos Corporation of Kenyu - Service Providers: Mokamart Supermarker in 20/10/2014 indiass No. 444430 - Ainel Money - Jambo Pay - Pay- Net

O BOX 50070-0020 AIROBI	0	NAIROBI 209/817 , 0, 16	ADIS ABABA 6 ADIS ABABA -16-18 ATHI-A		00	T 2014 1619208
INDUSTRIAL			0		ACCOUN	T NO.: 8525
Category:		Old Accoun	t No.:		Book-Itinerary	No
04/ Meter Reading Date:	11/2014	Bill No.	210879408		Property Seque	3 ence
	Meter Number	Previous Reading	Present Reading	Consump	tion Rate	CHARGE (KES.)
rER	5155047	53303	53437	10.6 21.33 32 70	18.71 28.07 42.89 53.80	1523.97 199.64 598.73 1372.48 3766.00
VER				10.67 21.33 32 70	14.03 21.05 32.17 40.35	149.70 449.00 1029.44 2824.50
MENTS= 1688999 DUSTMENTS	20141023					480.00 -1524.00 0.00
an a	2112 ⁸ 4231-4210-4210-4210-4210-4210-4210-4210-421	DEBTANALYSI	terendrovendersenenenenenenenenenenenenenenenenen S	460/03802800705-07403-07403-07403		TOTAL DU
Debt abc 0 e 000 Jays: 03/10	Debt with	n.@Olays:	Debt within 30	00 ^{9ys:}	10869.46	. 10869.46
10 04	/11/2014		ACTUAL		1	09/11/2014
onsumption Period: 05/11/2014		Estimated/	Actual Bill: 17/	11/2014	Payment inclusiv	ve upto
Billing Date: Due					Contract Depos	its:
CHEQUES SHOULD BE MA	ADE PAYABLE TO NAI		AND SEWERAGE COM	PANY LTD ONL	THE RECEIPT MU Y. RETAINED BY CU	IST BE MACHINE PRINTER
CHEQUES SHOULD BE MA	ADE PAYABLE TO NAIR	ROBI CITY WATER	AND SEWERAGE CON	IPANY LTD ONL	THE RECEIPT MU Y. RETAINED BY CU IZED PAY POINTS: Office, Kampala Road, Indi	IST BE MACHINE PRINTE ISTOMER ustrial Area Nairobí TI

Agents: The Competative Bank of Manya of Pep Bank of the Bank Barcis of Bank of the statution of Legule Bank Ltd - Housing Finance of Kenya - Posta Corputation of Kenya - Service Providers to the Amattan Barcis of Bank of the statution of Kenya - Bank Ltd - Housing Finance of Kenya - Posta Corputation of Kenya - Service Providers to the Amattan Barcis of Bank of the statution of the United Money - Bank Ltd - Housing Finance of Kenya - Posta

P Ó BOX 60070-002 NAIROBI KENYA	00	/SC VAT Number: NAIROBI 209/817 , 0, 16	0161158Q NCWS 0161158Q NCWS 0 ADIS ABABA -16-18 ATHI-	SC PIN Number: P0511	IS9494Q	/ 2014 1619208	
		L	0			0.: 8525	
O2/12/2014 Meter Reading Date:		Old Account No.: 211896111 Bill No.:			Book-Itinerary No. 3 Property Sequence		
							BAL. B/#Woms
¥A [™] ER	5155047	53437	53512	9.33 18.67 28 19	18.71 28.07 42.89 53.80	174.56 524.07 1200.92 1022.20	
IETER RENT				9.33 18.67 28 19	14.03 21.05 32.17 40.35	130.90 393.00 900.76 766.65 420.00	
AYMENTS= 1708495 DJUSTMENTS	20141124					-10869.00 0.00	
		•					
NA BAR BUTTERSTONSTRATING CONTINUES AND THE ADDRESS AND THE ADDRESS AND THE ADDRESS AND THE ADDRESS AND THE ADD		TOTAL DUE					
					r a suada		
Debt above 60 days: Debt within 0000		30 99 ys.	9gys: Debt within 0 0 d46 s: 5533		3.006 rent. 5533.52		
and the second se	/12//2014	naan maana maana maana maana maana dha 1	ACTUAL	en ander an seiner versache aussen verste die Later en statemen verste seiner -	มาก สุขาร์การแขน และ	05/12/2014	
	Consumption Period: Estimated		/Actual Bill: 12/12/2014		Payment inclusive upto		
Consumption Period: 04/12/2014	Billing Date:		Due Date:			Contract Deposits	
Consumption Period: 04/12/2014 Billing Date:		Due Date:			Contract Deposits:		

House, Spine Road Kayole. - North Eastern Region: Eastleigh Section III, 18th Street. - Kasarani: Kasarani: Mwiki Rd, Opposite Kasarani Police station. -Southern Region: Moorley, Off Joseph Kangethe Road. - Central Region: Enterprise Plaza, Enterprise Road, industrial Area, Karen Shopping Centra Opposite Karen Police Station - Cameo Building Kenyatta Ave

Agents: The Co-operative Bank of Kenya - K-Rep Bank - Citi- Bank - Bank - Bank - Bank of Kenya Ltd - Equity Bank Ltd - Housing Finance of Kenya - Postal Corporation of Kenya - Service Providers: Nakumatt Supermarkel outliers - MPESA Business No. 444000 - Anter Money - Jambo Pay - Pay - Met

roving Reliability	NCWS	C VAT Number: 010	ATER BI	PIN Number: P0511	59494Q	*1619208* DEC
BROTHERS SEYANI P O BOX 60070-00200 NAIROBI ategory: INDUSTRIAL 08/01/2015		NAIROBI CENT A	RAL, 209/8176 ADIS A THI-ADDIS ABABA R	BABA, , 0, 16-16-1B DAD	ACCOUN	20/ NT NO:208
		Old Account No.: 213175300 Bill No.:			Book-Itinerary	525.: *
					3 Property Sequence:	
Bill Items	Meter Number	Previous Reading	Present Reading	Consumption	Rate	CHARGE (KES.)
BAL B/IWD TOTAL CONSUMPTION WATER SEWER METER RENT PA YMENTS Rev'd ADJUSTMENTS	5155047 0 0	53512	53695	12.33 24.67 37 109 12.33 12.33 12.33 12.33	18.71 28.07 42.89 53.80 14.03 . 14.03 . 14.03 . 14.03 .	5533.52 230.69 28.07. 1586.93. 5864.20. 172.99. 172.99. 172.99. 172.99. 555.00 0.00 0.00 0.00
0.00 Debt above 60 days: 0 09/f	0.46 2/12/2014 to 08/01/2015 01/2015	50 days: Estimated/Actu	5533.06 Debt within 30 ⁴ 5 16/01/2015 al Bill:	TUAL ays:	Current:	20743.56 09/01/2015 15 210
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