

26	AMOONGA	N	83080410610	812858957	29/07/2015
27	MATEUS	N	83080410521	813426802	21/06/2016
28	KAUTHE	HNN	76120500197	812607940	20/07/2016
29	MBUMBO	BM			05/09/2016
30	SMITH	AH		816437461	09/09/2016
31	MAPANI	W		814649708	08/09/2016
32	MARINDA	BT		0813904287/ 0814019494	22/06/2017
33	NKOSHI	HI	88031600066	814102089	19/07/2017
34	MWTLJMA	IS		0812847445/ 0813754166	03/11/2017
35	TJVINDE	B		814524955	08/03/2018
36	MASULE	SH	77060410497	814719278	27/07/2018
37	MBONGO	PM	82120410437	814258230	26/06/2019
38	KEKUEMANG	R		815622231	18/10/2019
39	KAVANGA	K		812353536	18/10/2019
40	SHIKUSHO	M		813534568	18/10/2019
41	ARAEB	B	6602020382	816048822	07/12/2019
42	TJMBUNDU	D		812606526	3/3/2021
43	HUKUNUNA	T		812447483	25/01/2022
44	ROOY	M	9212280027	818457142	16/06/2022

7

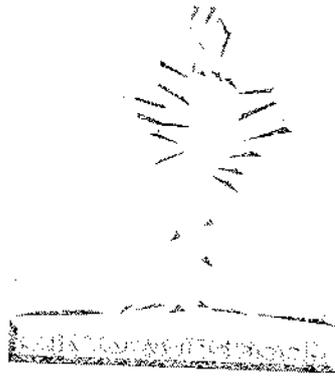
**[ELE] - RESUBMISSION: DEMAND SIDE MANAGEMENT (DSM)
AND ENERGY EFFICIENCY PLAN 2018 TO 2023 FOR THE CoW**

- 1 That the resubmission of the Demand Side Management (DSM) and Energy Efficiency Plan 2018 to 2023 for the CoW, by the SE: ELE, be noted.
- 2 That the Demand Side Management (DSM) and Efficiency Plan, be approved.

8

[INF] - INFRASTRUCTURE DEFECTS OF THE NEW BUILDING

- 1 That the observation by the SE: ICT of interlocks separating in the parking area on the top parking level of the new building be noted, with concern.
- 2 That it further be noted that elevators are constantly out of order and some door handles are not working.



The Gateway to Endless Opportunities

**DEMAND SIDE MANAGEMENT (DSM) AND ENERGY
EFFICIENCY PLAN 2018-2023
FOR CITY OF WINDHOEK**

Authorized by:

Strategic Executive: Electricity

Approved by the Chief Executive Officer.....

Date:/...../2018

1 INTRODUCTION

The City of Windhoek launched its five year Strategic Business Plan in July 2017. One of the Cities key strategic initiatives in support of the Cities Strategic Plan is the reduction on reliance to NamPower for bulk electricity supply. As part of the City's quest to reduce its reliance on NamPower for bulk electricity supply, the following options are proposed:

- i. Reduce the City's internal energy foot prints by implementing energy efficiency strategies
- ii. Implement Demand Side Management (DSM) strategies

The City currently utilizes 31GWh per annum for its own use (water pumping, buildings, street lighting and municipal parks etc.) at a cost of N\$ 56 million a year. The City proposes to utilize Energy Efficient technologies to minimize the Cities internal energy foot print. This will result in the City using less electrical energy and buying less energy from NamPower in turn reducing the City's reliance on NamPower, saving the city money in the long run.

Furthermore electricity consumption during peak hours is costly, that is why load management systems are required by a utility in order to manage the electricity consumption by reducing energy utilization especially during peak hours since energy cost and rates are usually higher during peak hours. Such measures are particularly useful to alleviate supply and/or network constraints and are primarily motivated by the network operator's and/or distributors' desire to optimize the utilization of the electricity network infrastructure. This approach to the use of load management systems is known as DSM.

The City of Windhoek currently has a Notified maximum Demand (NMD) of 190MVA from NamPower. A ripple control system is presently being operated by the City of Windhoek to reduce the energy consumption as well as to shift load from peak time to off peak time or standard time by remotely switching off electrical geysers at households and business at specific times.

The DSM and Energy Efficiency plan will therefore look at the existing load management system and other avenues in an effort to reduce energy, improve

efficiency, reduce cost and reduce reliance on NamPower as the bulk electricity supplier.

2 ENERGY EFFICIENCY STRATEGIES

Below are the initiatives that are identified for the energy efficiency strategy:

1. Implementation of Solar Streetlights
2. Implementation of Light Emitting Diode (LED) Streetlights and Traffic Lights
3. Installation of Solar systems, LED lighting and motion detection systems in council buildings

2.1 Solar streetlights

The process of installing solar street lights in newly developed areas and converting existing grid fed streetlight installations to solar fed installations will have to be investigated. It is proposed that the City launches its own solar fed streetlight pilot project in order to determine the most suitable solar streetlight option for the City.

The pilot project will consist of a number of LED fitted streetlights fed from a centrally located solar installation. This initiative is pictorial represented below;

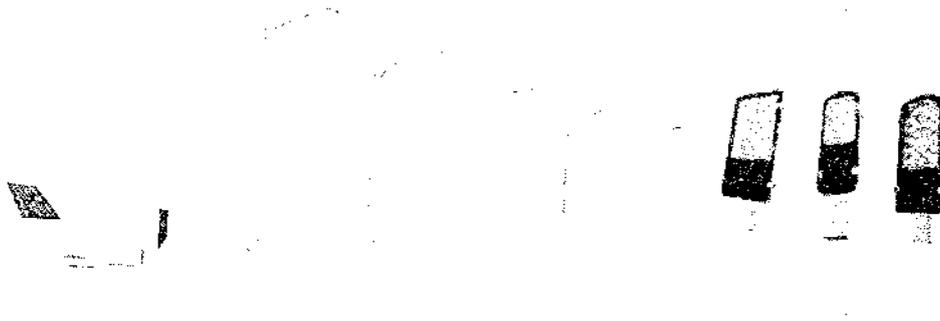


Figure 5: Solar Powered and LED Streetlight

2.2 LED streetlights and Traffic Lights

All City of Windhoek's current streetlight installations and traffic light installations will be refitted with LED lighting technologies. The city will prioritize locally developed solutions to encourage locally developed and produced goods. This initiative is graphically depicted in the figure below;

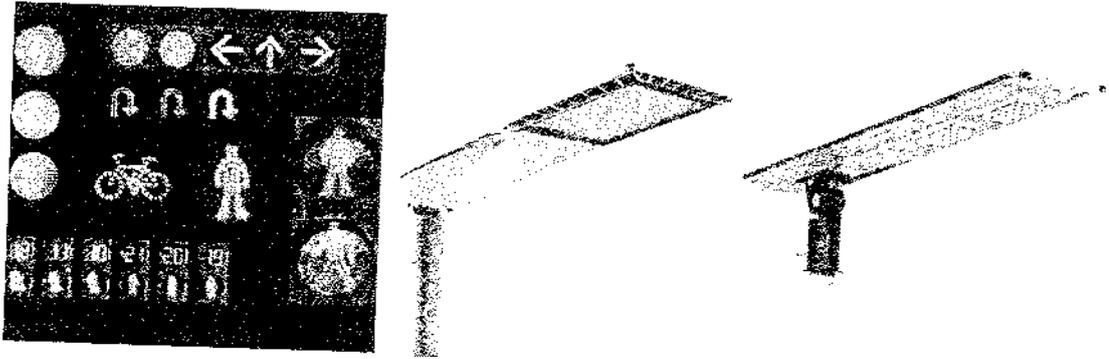


Figure 2. LED Street and Traffic lights

The aim is to reduce the current grid connected energy consumption for each streetlight and traffic light by up to 30%. On top of the energy reduction, maintenance cost reduction of up to 20% is also expected from the LED lights.

2.3 Solar systems, LED lighting and motion detection systems for council buildings

Solar installations for council building and LED lighting with motion detection for municipal buildings and property will be combined. The aim is to reduce the grid connected energy consumption for each building / property by up to 30%. These initiatives are graphically depicted in the figure below;

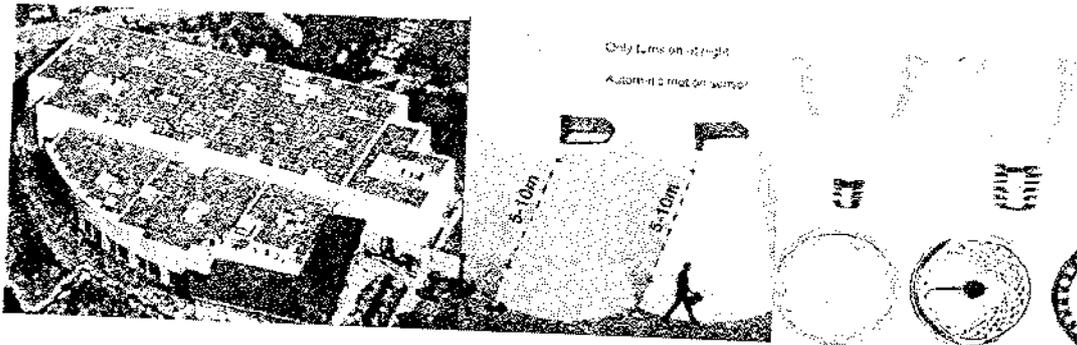


Figure 3 Solar Powered and Energy Efficiency Building Initiatives

The Electricity department is earmarked as the pilot site for the solar installation as well as LED lighting with motion detection. Once completed, the same will be rolled out to different Council buildings over a five year period.

3 DEMAND SIDE MANAGEMENT (DSM) STRATEGIES

Below are the initiatives that are identified for the DSM strategy:

1. Increasing Footprints of Ripple Control
2. Optimise the use of the City's water pumping schemes
3. Promote the use of Solar Water Geysers

3.1 Ripple control

The ripple control system has a huge impact in reducing energy and demand for the City of Windhoek since it can reduce the demand during peak hours by up to 50MVA provided that all the ripple control receivers are in a functional state. It is therefore significant to increasing the ripple control footprints and this will be done in three stages as follows:

- Mandatory Ripple Control receiver for all household with Council carrying 50% of the Cost
- Ripple control receiver audit and rectify all the non-functioning ripple control receivers.
- Install ripple control receivers at premises where there are none installed

3.2 Optimize City's water pumping scheme

The City of Windhoek department of Infrastructure, Water and Technical Service is the biggest consumer of the 31GWh of electricity consumed by the City internally. This initiative thus aims to ensure that the City of Windhoek only pumps water during Off-Peak periods when electricity is cheaper, thus pumping of water during Peak and Standard period shall only be done during emergencies i.e. during drought seasons or loss of supply from NamWater.

In addition and depending on the availability of funds; consideration can be made to have most of the City pumping supplied from the Solar system, optimized and automated.

3.3 Solar water geysers (SWGs)

Solar Water Geysers are traditionally a national DSM initiative of the electricity generating companies to defer investment in new power generation. A typical example of this is a similar project by the South Africa government in 2009 where they committed to install one million Geysers nationally with government funding. Due to limited funding, electricity distributors and municipalities are not in the

position to fund this type of project as technically speaking they will reduce their electricity sales and thus a threat to their electricity business mainly driven by volume of electricity sales.

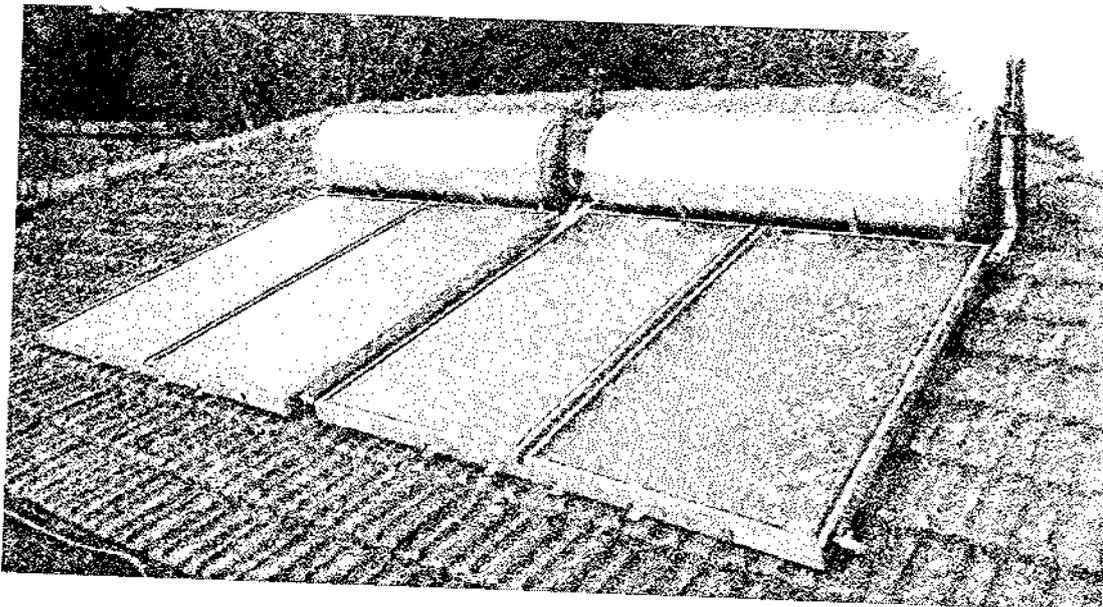


Figure 4: Solar Water Geyser mounted on residential premises

It's also difficult for each individual customer to bear the cost of the SWGs due to its high upfront-capital cost of systems. It thus be difficult for the City of Windhoek to make SWGs a standard Geyser installation for Windhoek without any incentives, rebates and regulations. It is thus recommended that the City of Windhoek standardize on SWGs for all new houses and this must be supported by the City of Windhoek building regulations. However due to the benefit associated with reduction in customer electricity bill by up to 30%, the City of Windhoek under this initiative will also promote the use of SWG on existing households by raising awareness about the benefit of having such installations. The City of Windhoek can also collaborate with NamPower DSM such as their 20 000 SWGs projects to make sure existing households in Windhoek can benefits from such a project.

4 FIVE YEAR IMPLEMENTATION PLAN

The strategies will be mostly implemented in house by the City of Windhoek through competitive bidding to acquire goods and services. However were applicable, the Public Private Partnership (PPP) options can be considered. Each of the strategies will be implemented over a period of five years and an annual budget will be allocated to the strategies. It is however projected that the City requires at least ten

(10) years to fully implement the DSM strategies due to limited budget hence an indicative budget from 2023 to 2028 is also provided.

The budget in Table 1 below shows the annual provision made for capital required to implement the Energy Efficiency and DSM strategies in house over a five year period and total budget for the other five years.

Energy Efficiency & DSM Strategies	Budget Allocation per Financial year (N\$)					
	2018/19	2019/2020	2020/2021	2021/2022	2022/2023	2023-2028
Solar Streetlights	2 000 000	2 000 000	3 000 000	4 000 000	5 000 000	90 000 000
LED Streetlights and Traffic Lights	500 000	1 000 000	1 000 000	1 000 000	1 000 000	20 000 000
Solar systems, LED lighting and motion detection systems in council buildings	3 000 000	3 000 000	3 000 000	3 000 000	3 000 000	6 000 000
Ripple control	500 000	1 000 000	1 000 000	1 000 000	1 000 000	20 000 000
Optimize City's water pumping scheme	N/A	N/A	N/A	N/A	N/A	N/A
Solar water geysers (SWGs)	N/A	N/A	N/A	N/A	N/A	N/A
Total	6 000 000	7 000 000	8 000 000	9 000 000	10 000 000	136 000 000

Table 1 : Five year Capital Budget allocation for Energy Efficiency and DSM strategies

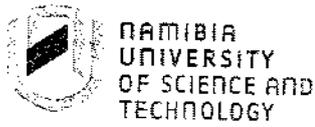
5 DSM STRATEGIES COST BENEFIT ANALYSIS TO CITY OF WINDHOEK

Table 2 below summarises the cost benefit analysis of the various DSM strategies of City of Windhoek with the following assumptions;

- Grid power increase with 5% annually
- LED lights reduce consumption by 30%
- Solar Power fixed rate of N\$ 1.20/kWh
- N\$ 1000 per LED Streetlight Fittings
- 150W Streetlight size
- N\$ 2000 per Ripple Installations

Energy Efficiency & DSM Strategies	Cost Benefit Analysis	10 year Planning Horizon per Financial year						
		2018/19	2019/2020	2020/2021	2021/2022	2022/2023	2023 - 2028	
Solar Streetlights	Number of Streetlights	40	40	50	70	100	19700	
	Current Cost							
	New Cost	42,508.80	44,634.24	58,582.44	86,116.19	129,174.28	26,719,699.86	
	Savings	31,104.00	31,104.00	38,880.00	54,432.00	77,760.00	15,318,720.00	
LED Streetlights and Traffic Lights	Number of Streetlights	11,404.80	13,530.24	19,702.44	31,684.19	51,414.28	11,400,979.86	
	Current Cost	500	1000	1000	1000	1000	16500	
	New Cost	531,360.00	1,115,856.00	1,171,648.80	1,230,231.24	1,291,742.80	22,379,444.04	
	Savings	371,952.00	781,099.20	820,154.16	861,161.87	904,219.96	15,665,610.83	
Solar systems, LED lighting and motion detection systems in council buildings	Number of Buildings	1	0	1	2	2	6,713,833.21	
	Current Cost	520,836.71		574,222.47	1,205,867.19	1,266,160.55	2,658,937.16	
	Savings	381,100.03		381,100.03	762,200.06	762,200.06	1,524,400.13	
Ripple control	Number of Ripples	250	500	193,122.44	443,667.13	503,960.49	1,134,537.03	
	Current Cost	22,140.00	46,494.00	48,818.70	51,259.64	53,822.62	1,130,274.95	
	New Cost	0	0	0	0	0	0	
	Savings	22,140.00	46,494.00	48,818.70	51,259.64	53,822.62	1,130,274.95	
Total Savings		332,689.48	394,781.04	613,138.22	895,680.32	996,720.23	20,379,625.05	

TABLE 2: DSM COST KAPOTTA ANALYSIS



Energy Audit for the City of Windhoek - Electricity Department and Head Office

Final Report

Prepared by:

Penti Paulus - DECE, NUST

Gideon Gope - DECE, NUST

Helvi Iileka - NEI, NUST

September 2021

Executive Summary

A walkthrough energy audit was conducted between October 2020 and January 2021 for the City of Windhoek's Head Office and Electricity Department. Actual energy consumption logging was also conducted between June and July 2021. The main purpose of this undertaking was to:

- Identify the electrical energy consumption patterns by analysing Historical consumption data.
- Survey the electrical energy consuming equipment used and
- Identify the scope of energy saving opportunities, if any and to propose remedial measures aimed at reducing energy consumption.

The walkthrough audit essentially involved a visual inspection of various electrical equipment and installations, recording their power ratings, approximate durations of operation, etc. to identify Energy Management Opportunities (EMO).

The main findings of the energy audit were:

- There is a high Off-Peak energy consumption at the City of Windhoek (CoW) Head Office and the Electricity Department despite the fact the Off-peak period corresponds with the period in which the two facilities (buildings) are mostly closed or at least operating at minimum capacity.
- The two CoW facilities have a relatively high baseload, as significant load was observed during the nights and weekends. In terms of the baseload at the CoW Head Office, there seem to be no difference between a weekday and non-weekdays (weekends). A reduction of the baseload represents a potential energy saving opportunity.
- The City of Windhoek Head Office (HO) does not have power factor control equipment (power factor correction) despite the facility being billed on both Demand charge and Energy Charge. Demand Control represents a potential for Demand management and reduction of the demand charge and the associated electricity bill.
- Low level of awareness on good housekeeping measures for energy saving and energy efficiency improvement at the City of Windhoek facilities. Some of the observations at the CoW facilities which indicate an inadequate awareness of good housekeeping measures include the following:
 - ✓ Heating Ventilation and Air Conditioning (HVAC) units were also observed to be kept running (or in operation) in some unoccupied offices.
 - ✓ The use of old HVAC units and relatively newer HVAC units with poor energy star and SEER/EER ratings.

- ✓ Rooms that have sufficient natural lighting (350-650 lumens), yet the lights were switched on, nevertheless.
 - ✓ Lights are left on in unoccupied toilets
 - ✓ Most lighting systems are manually operated, hence, corridors, stairways, and office lights remain on the whole day and night.
 - ✓ Refrigerators appear to be running 24/7 even those that were found empty.
 - ✓ External security lighting systems (floodlights) were observed to be on during the day.
- There is an extensive use of traditional lighting systems which are not the most energy efficient lighting systems available in the market. A retrofit project for interior lighting system represents an opportunity for energy saving and for improving the energy efficiency of the two facilities which were audited at City of Windhoek (CoW).
 - The use of old refrigerators and relatively newer ones of energy rating class B or C. The old refrigerators and the class B or C refrigerators are not the most energy efficient devices in the market.

The Energy Management Opportunities (EMOs) which were identified for the CoW facilities include:

- No Capital Cost Options
The no capital cost option requires an intervention to raise energy management awareness across the board within the City of Windhoek facilities which were audited during this exercise.
- Retrofit Options
The retrofit projects are capital projects which are based on the identified ESOs (Energy Saving Opportunities) for each of the CoW facilities which were audited. Four (4) Energy Management Opportunities (EMOs) were identified as follows:
 - EMO 1: Replacement of Fluorescent lighting systems (FL & CFL) with Light Emitting Diode (LED) Lighting systems
 - EMO 2: HVAC Replacement with CoW Financing alone
 - EMO 3: HVAC Replacement with CoW + EELA Co-Financing Option 1
 - EMO 4: HVAC Replacement with CoW + EELA Co-Financing Option 2

The consultant recommends that the identified no-capital cost option and the retrofit project on the replacement of Fluorescent lighting systems (FL & CFL) with Light Emitting Diode (LED) lighting systems be implemented. Substantial energy savings are expected to accrue to the City of Windhoek with the consequent reduction in operational (running) costs. The Energy Audit project provides a background and a basis for establishing an Energy Management System (EMS) within the facility management section at City of Windhoek (CoW).

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Glossary

AC – Air Conditioner/ Air Conditioning

BTU – British Thermal Unit

CFL – Compact Fluorescent Light

CoW – City of Windhoek

DECE – Department of Electrical & Computer Engineering

ED – Electricity Department

EE – Energy Efficiency

EELA – Energy Efficient Lighting and Appliances

EMO – Energy Management Opportunities

EMS – Energy Management Systems

ESOs – Energy Saving Opportunities

FTL – Fluorescent Tube Light

HO/TH – Head Office/Town House

HVAC – Heating Ventilation and Air Conditioning

kW – kiloWatts

kWh – kilowatt-hour

LED – Light Emitting Diode

NEI – Namibia Energy Institute

NPV – Net Present Value

NUST – Namibia University of Science & Technology

PI – Profitability Index

PIR – Passive Infrared

ROI – Return on Investment

TOU – Time of Use

W – Watts (SI unit for real power)

Disclaimer

The consultants have made every effort to ensure the highest possible level of accuracy in the results obtained in this report. However, the accuracy of calculations is dependent on:

- a) Information provided by the CoW
- b) Information gathered from sites
- c) Numerous assumptions made, some of which are estimates.

As far as possible, where assumptions are made for calculations, they have been documented.

Project Capital Investment Costs are based on estimates based upon suppliers' information, but the consultants have no control over pricing by external suppliers. Capital Costs are presumed correct at the time of writing; however, actual costs will by necessity first be determined by competitive quotations prior to implementation of recommended energy efficiency (EE) measures.

Although internal quality control efforts and cross checking of results was rigorously applied, we accept that the results are exposed to human error.

Acknowledgements

We express our gratitude to all CoW personnel for their friendly welcome, availing their offices for the walkthrough energy audit exercise and for providing the necessary information and making time available.

We recognise the significant contribution of all the DECE Power Lab interns who assisted with data collection during the walkthrough and logging exercises.

Finally, special appreciation to Mr Joseph Mundilo, the lead person at City of Windhoek for this project for his support throughout the audit process.

1 Introduction

Energy Auditing is the key to a systematic approach for decision-making in the area of energy management. It attempts to balance the total energy inputs with their use and serves to identify all the energy streams in a facility. Energy audit is an effective tool in defining and pursuing a comprehensive energy management program within a business

A walkthrough energy assessment was conducted between October 2020 and January 2021 at the City of Windhoek's Electricity Department and Head Office. An energy audit is a study of a plant or facility to determine how and where energy is used and to identify possible opportunities for energy efficiency and methods for energy savings. There is now a universal recognition of the fact that new technologies and optimum use of some that already exist provide the most hopeful prospects for the future.

The opportunities lie in efforts towards energy efficiency and the use of new technologies for energy conservation. Therefore, an energy audit is a preliminary activity towards instituting an energy management program in an organisation. It consists of activities that seek to identify conservation opportunities preliminary to the development of an energy savings program. Identifying where energy is used is useful because it identifies which areas the audit should focus on and raise awareness of energy use and cost. The results of the analysis can be used in the review or implementation of management structures and procedures for controlling energy use.

The purpose of this report is to communicate to the client the findings and observations noted during the audit exercise of the two facilities. This report will provide an insight into the observations of the audit team during the walkthrough exercise and provide EE recommendations, provide an in-depth analysis and recommended EE strategies (i.e. energy efficiency opportunities), inventory audit, economic analysis (for all proposed EE strategies) and historical energy consumption data analysis.

1.1 Audit Objective

The main objective of this undertaking was to identify the electrical energy consuming equipment, their power ratings, period of use and energy saving potential that exist in each facility. Subsequent objectives were:

1. To gain a better understanding of trends and drivers of electricity consumption in CoW buildings;
2. To identify ways of reducing electricity consumption that do not require any investments (primarily behavioural measures);

3. To identify ways of reducing electricity consumption at different investment cost levels; and
4. To advise on a way forward to ensure the identified energy efficiency measures can be implemented within a reasonable timescale.

1.2 Audit Methodology

1.2.1 Historical Data

The consultants collected and analysed the historical energy consumption data and billing information for the two facilities.

1.2.2 On-site assessments

The on-site assessment included:

- 1) A walk-through audit aimed detailed site data gathering of all appliances to obtain a load inventory.
- 2) Gathering of any information related to other energy sources.
- 3) Additionally, late-night surveys outside of normal business hours or on weekends were also be performed to confirm building system and occupancy schedules.
- 4) Energy logging - logging of main supply, various buildings and floors within the two facilities.

2 Metering and Applicable Tariff Structure

The two facilities are each equipped with a four quadrant, three phase Elster A1140 TOU meter with maximum demand, figure 1, which records energy consumption at an interval of



Figure 1 Energy Metering in use

30 minutes. This interval is in synchronism with the respective facility server which in turn is synchronised to the international time. These meters have the capability to store data for 18 months, but it is also integrated to the E-Venus ERP (enterprise resource planning) software, from which consumption data for the previous 24 months can be extracted. Data can also be directly downloaded from the meter via a PC optical cable connection.

The two facilities fall under Departmental consumers with conventional meters with TOU meters with maximum demand. The Head Office is equipped with TOU meter TOU 321 whereas the Electricity Department is equipped with TOU meter 1499D. The Traffic Lights section within the ED falls under Departmental consumers with conventional meters with TOU meters and is equipped with TOU meter CP45481.

For the 2019/2020 financial year going backwards, the time-of-use (TOU) electricity tariff for the two facilities that was applicable consisted of three main components:

- 1) A maximum demand charge based on the maximum kVA recorded each month.
- 2) A network access charge, which is applied each month, based on the maximum kVA recorded in the previous year.
- 3) An energy charge divided into three tariffs, Peak (P), Standard (S) and Off-peak (O) for different times of day and week. The energy charge tariffs are further divided into two seasons: (High Season: 1 June to 31 August, Low Season is all other days), as shown in figure 2.

TOU TIME SLOTS (P=Peak, S=Standard, O=Off-Peak)

Hour	Low Season 274 Summer time			Low Season Winter Time			High Season 91		
	Week Day	Sat	Sun	Week Day	Sat	Sun	Week Day	Sat	Sun
0	O	O	O	O	O	O	O	O	O
1	O	O	O	O	O	O	O	O	O
2	O	O	O	O	O	O	O	O	O
3	O	O	O	O	O	O	O	O	O
4	O	O	O	O	O	O	O	O	O
5	O	O	O	O	O	O	O	O	O
6	S	O	O	S	O	O	S	O	O
7	S	S	O	S	S	O	S	S	O
8	P	S	O	P	S	O	P	S	O
9	P	S	O	P	S	O	P	S	O
10	P	S	O	P	S	O	P	S	O
11	P	S	O	P	S	O	P	S	O
12	P	O	O	S	O	O	S	O	O
13	S	O	O	S	O	O	S	O	O
14	S	O	O	S	O	O	S	O	O
15	S	O	O	S	O	O	S	O	O
16	S	O	O	S	O	O	S	O	O
17	S	O	O	S	O	O	S	O	O
18	P	S	O	P	S	O	P	S	O
19	P	S	O	P	S	O	P	S	O
20	P	O	O	S	O	O	S	O	O
21	S	O	O	O	O	O	O	O	O
22	O	O	O	O	O	O	O	O	O
23	O	O	O	O	O	O	O	O	O

Figure 2 Old TOU time slots

The applicable tariff structure when these TOU time slots were in place is shown in figure 3.

Departmental Consumers - Conventional meters - With TOU meters		Energy Charge - Peak N\$/kWh	Energy Charge - Standard N\$/kWh	Energy Charge - Off-Peak N\$/kWh	Capacity Charge N\$/Amp
ELB2	High Season	2.43	1.34	1.07	18.10
	Low Season	1.22	1.22	0.84	18.10
	ECB Levy	0.02120	0.02120	0.02120	
	NEF Levy	0.01600	0.01600	0.01600	

Departmental Consumers - Conventional meters - With TOU meters - With Maximum Demand	Energy Charge - Peak N\$/kWh	Energy Charge - Standard N\$/kWh	Energy Charge - Off-Peak N\$/kWh	Demand Charge N\$/kVA	Network Access Charge N\$/kVA	Penalty Charge N\$/kVA
ELB2 High Season	2.43	1.34	1.07	121.00	49.00	170.00
Low Season	1.22	1.22	0.84	121.00	49.00	
ECB Levy	0.02120	0.02120	0.02120			
NEF Levy	0.01600	0.01600	0.01600			

Minimum Charge: 55kVA N\$ 6,338.20

Figure 3 Old tariff structure

However, due to the current economic situation brought about by the Corona virus pandemic and the impact it has on the lives of the residents, the City of Windhoek has implemented a single-season Time of Use (TOU) tariff for large power users or maximum demand clients with time-of-use (TOU) metering as of 1 July 2020. The Tariff structure applicable at the time of writing this report is therefore the one shown in figure 4 and the TOU time slots are shown in figure 5.

Departmental Consumers - Conventional meters - With TOU meters		Energy Charge - Peak N\$/kWh	Energy Charge - Standard N\$/kWh	Energy Charge - Off-Peak N\$/kWh	Capacity Charge N\$/Amp
ELB2	All Seasons	1.91	1.39	0.96	18.10
	ECB Levy	0.02120	0.02120	0.02120	
	NEF Levy	0.01600	0.01600	0.01600	

Departmental Consumers - Conventional meters - With TOU meters - With Maximum Demand	Energy Charge - Peak N\$/kWh	Energy Charge - Standard N\$/kWh	Energy Charge - Off-Peak N\$/kWh	Demand Charge N\$/kVA	Network Access Charge N\$/kVA	Penalty Charge N\$/kVA
ELB2 All Seasons	1.91	1.39	0.96	121.00	49.00	170.00
ECB Levy	0.02120	0.02120	0.02120			
NEF Levy	0.01600	0.01600	0.01600			

Minimum Charge: 55kVA N\$ 6,338.20

Figure 4 New tariff structure

In addition to the electricity related tariffs, there are also two costs reflected on the billing information; the electricity control board levy and a contribution to the National Energy Fund. These two components of the overall cost will not be further discussed since they do not have any impact on the energy consumption in the facilities being audited.

TOU TIME SLOTS (P=Peak, S=Standard, D=Off-Peak)			
Hour	Non-Seasonal Time of Use		
	Week Day	Sat	Sun
0	O	O	O
1	O	O	O
2	O	O	O
3	O	O	O
4	O	O	O
5	O	O	O
6	S	O	O
7	P	P	O
8	P	S	O
9	P	S	O
10	S	S	O
11	S	S	O
12	S	O	O
13	S	O	O
14	S	O	O
15	S	O	O
16	S	O	O
17	P	O	O
18	P	S	O
19	P	S	O
20	P	O	O
21	S	O	O
22	O	O	O
23	O	O	O

Figure 5 New TOU time slots

SECTION A: Electricity Department (ED)

1 Building Characteristics

The Electricity Department is a single storey municipal building situated next to the Old Power Station and it houses seven subdivisions including Streetlights, Traffic Lights and Protection. A layout is shown in figure 6. Except for the personnel of sections such as Streetlights, Traffic Lights and Operations, who are mostly in the field during the day, the rest of the offices are occupied from 07h30 -16h30, Monday to Friday. In addition to regular office hours, sections such as Protection and Streetlights sometimes opens after hours and even during weekends when attending to emergencies.

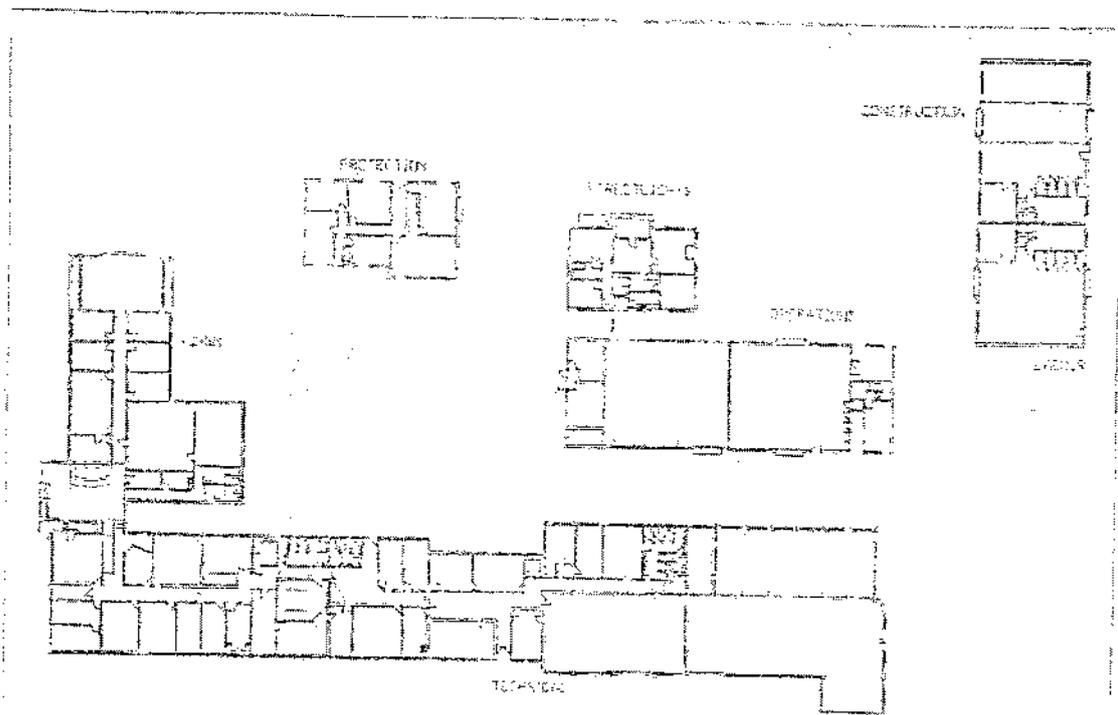


Figure 6 Electricity Department Layout Schematic

2 Building envelope

The Electricity Department is a single-storey structure with a brick exterior, cardboard ceilings, corrugated iron roofing and single glazed windows. The main entrance to the building consists of one single glazed double swing door and there are two other exits or entrances, one facing the Protection section and the other facing the Gym adjacent to the technical section.

3 Historical Consumption

In energy audit studies, historical energy consumption is performed to form a baseline, to determine the types of energy sources used in the facility and to give a picture of how energy has been consumed. This can be useful for energy forecasting and management plans. The historical energy consumption data collected in this undertaking was for three years, 2018-2020. Billing data was also obtained and compared with the consumption data to verify the correctness of applicable tariffs.

3.1 Off-Peak Consumption

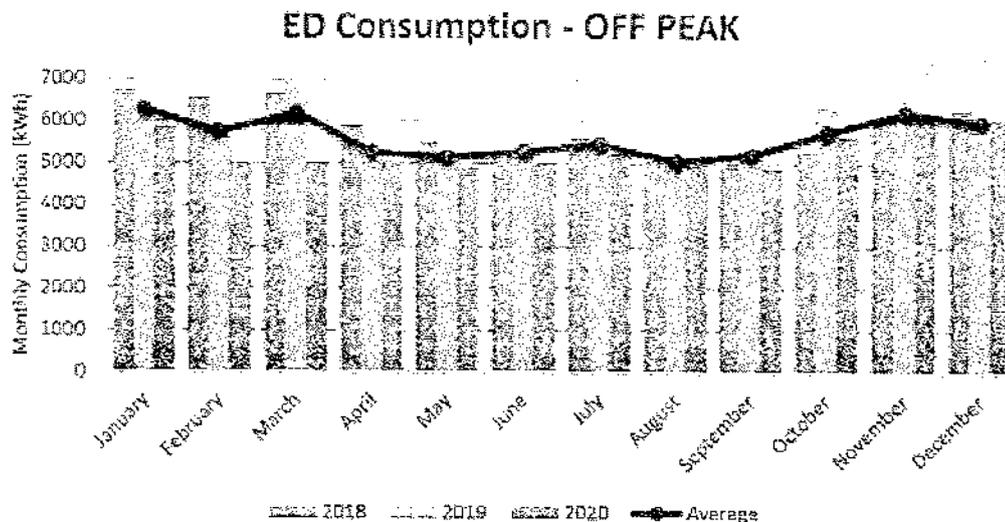


Figure 7 Off Peak Consumption – ED

Figure 7 shows the off-peak consumption history for the ED for the three years under review. TOU tariffs apply for each month. On average, the periods January - March and October to December are energy intensive. 2018 was the most energy intensive for this period whereas 2020 was the least energy intensive year. This may be attributed to the interruption in normal business operations due to the outbreak of the Corona virus in 2020.

The facility normally operates between 07h30 to 16h30 daily, but the historical consumption data reveals that there has been a much higher than expected Off-Peak consumption.

The data indicates that the average monthly Off-Peak consumption has been higher than the monthly Peak and Standard consumptions. Since Off-Peak slots apply mostly during the night and weekends, when the facility is either closed or at least operating at a very low capacity, it very remarkable that the energy consumption during the 'down time' was higher than during the office hours.

The only logical explanation for this high consumption for Off-Peak periods is either a high energy intensive base loads for the entire facility or an indication of poor energy efficiency/management practices by the employees such as leaving air conditioners, refrigerators and lights on overnight and during weekends. A closer investigation of this situation may reveal several energy saving opportunities.

3.2 Peak Consumption

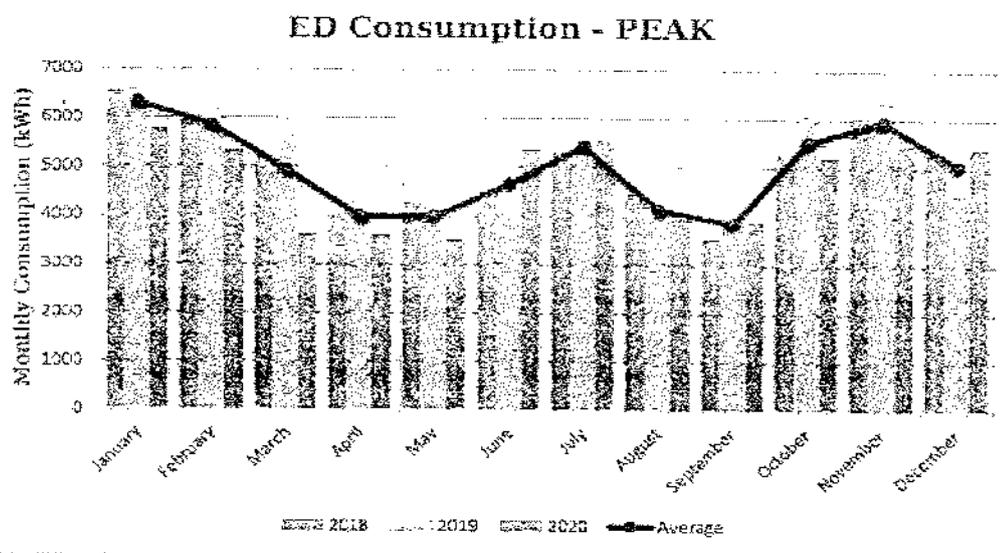


Figure 8 Peak Consumption – ED

As shown in figure 8, the overall average total monthly consumption is slightly lower compared to off-peak consumption. Peak charges are meant to discourage consumers from engaging in energy intensive activities during that time slot, however, since the ED's business hours are during the day, Peak consumption is unavoidable, and the consumption profile is as was expected.

3.3 Standard Consumption

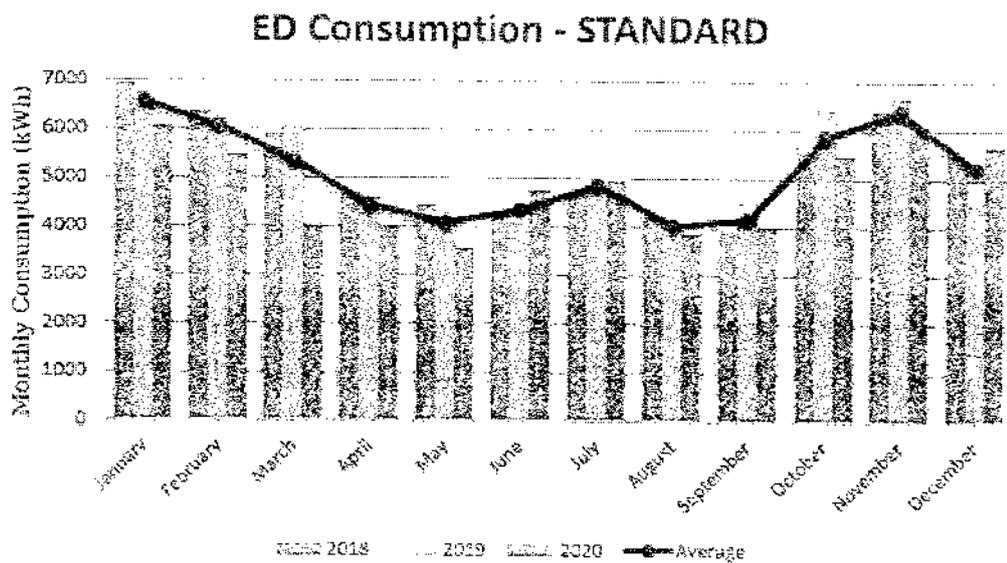


Figure 9 Standard Consumption – ED

The standard consumption profile is similar to peak consumption. This is expected because standard tariffs are also applicable during the day when the ED is fully operational.

3.4 Correlation between Energy Consumption and Heating (HDD) and Cooling Degree (CDD) Days

In order to develop a better insight into the drivers of energy consumption at the CoW facilities, a correlation between energy consumption and the productive activities at the facilities need to be analysed. However, the project team was advised by the contact person for the Energy Audit Project at City of Windhoek that there are no measurable activity metrics (productive metrics) at CoW which could be used for the purpose.

Nonetheless, an analysis was performed in order to explore the weather dependency of energy consumption at the City of Windhoek facilities. Degree days were extracted from weather related data for the City of Windhoek for the purpose of exploring the weather dependency of energy consumption at CoW facilities. Figure 10 shows the time series variation of energy consumption at the City of Windhoek Head Office and Heating and Cooling Degree Days. From the time series analysis a casual relation can be noticed between the energy consumption and the heating degree days (HDD) and cooling degree days (CDDs).

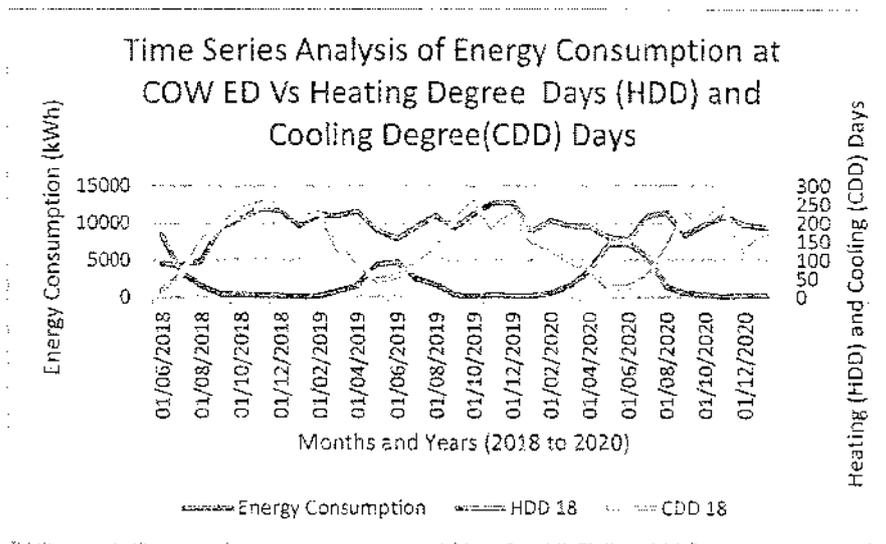


Figure 10 time series variation of energy consumption at the City of Windhoek Head Office and Heating and Cooling Degree Days

4 Measurement-based Energy Audit (Data Logging)

Actual energy consumption at various points in the distribution system were logged over differing periods of time. Each logging exercise for a particular area or building was logged for at least 5 days. Actual logging was done to give an overview of how much each building contributes to the overall monthly consumption and the total bill. There were four buildings (Gym, Construction/Labour, Streetlights and Operations) where it was not possible to connect loggers to the SDBs without disconnecting power supply. These buildings are therefore not included in the measurements below (except in the main supply).

4.1 Main Supply Log

The main supply was logged from 13 to 19 July.

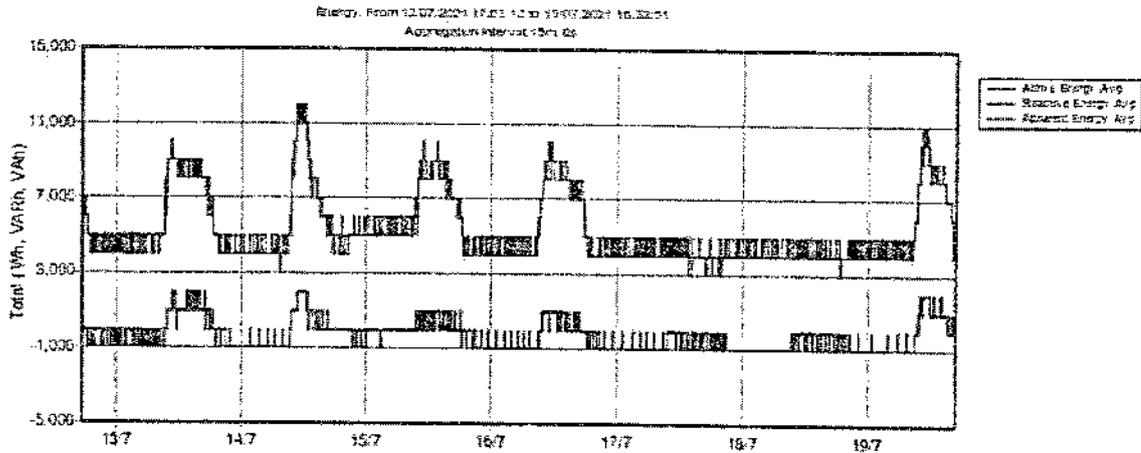


Figure 11 Electricity Department Main Supply Log

As expected, the consumption for the ED is relatively low as the historical data already indicated in comparison to Head Office.

The load demand profile for City of Windhoek Electricity Department, shows a peculiar cyclic load profile with a daily plateau and a lower off-peak (night and weekend) load demand. This characteristic is associated with energy demand profiles for commercial buildings. However, the baseload at the City of Windhoek (CoW) Electricity Department is lower compared to the baseload at the Head Office. The measurements taken during the data logging phase confirmed that the two CoW facilities (Head Office and Electricity Department) have a relatively high baseload as significant load was observed during the nights and weekends. At the Electricity Department, a maximum baseload of 15kVA-20kVA, as shown on Figures 12, 13 and 14, was observed during the weekdays.

A reduction in the baseload represents a significant energy management opportunity (EMO) at the CoW. An analysis and identification of the loads which contribute to this baseload is a necessary step in the load management of the baseload.

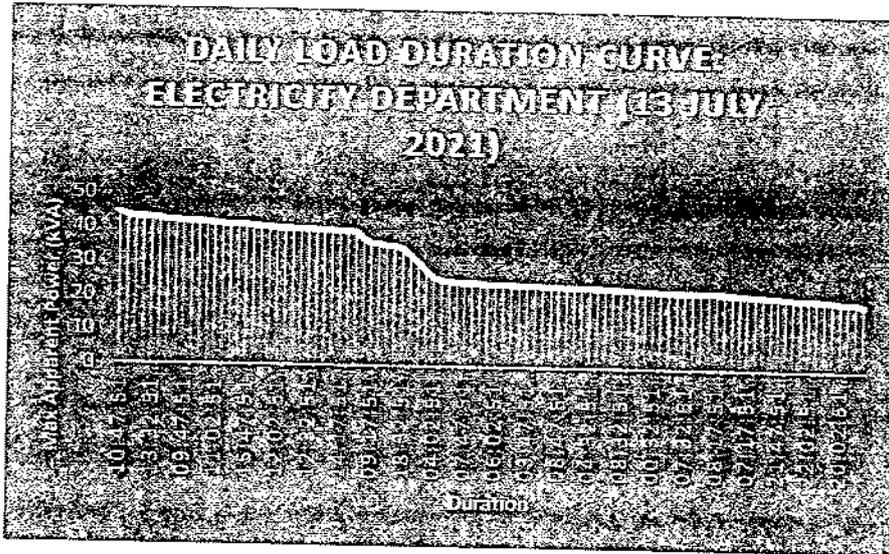


Figure 12 Daily Load Curve for Electricity Department: 13 July 2021

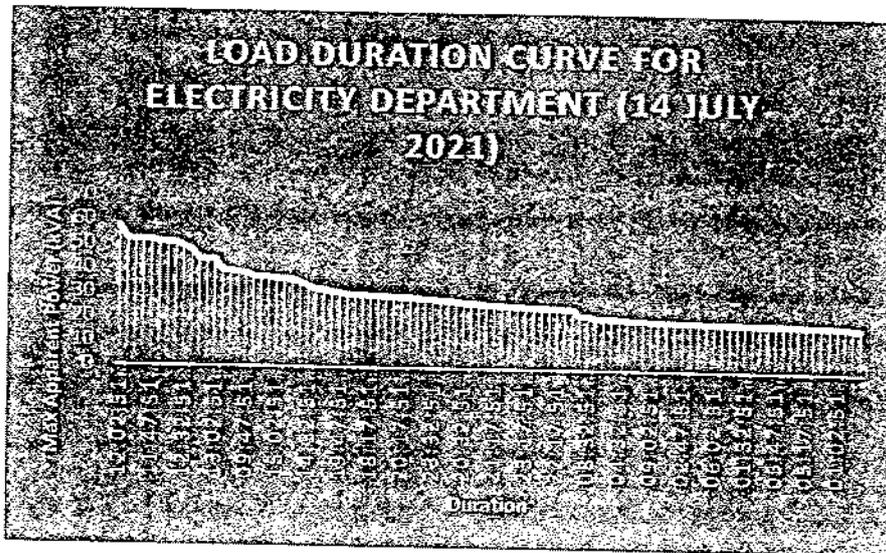


Figure 13 Daily Load Curve for Electricity Department: 14 July 2021

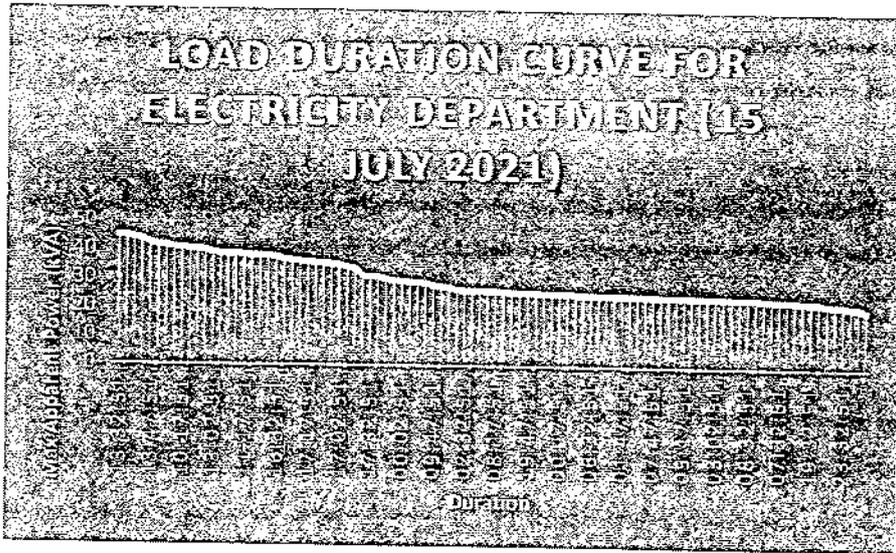


Figure 14 Daily Load Curve for Electricity Department: 15 July 2021

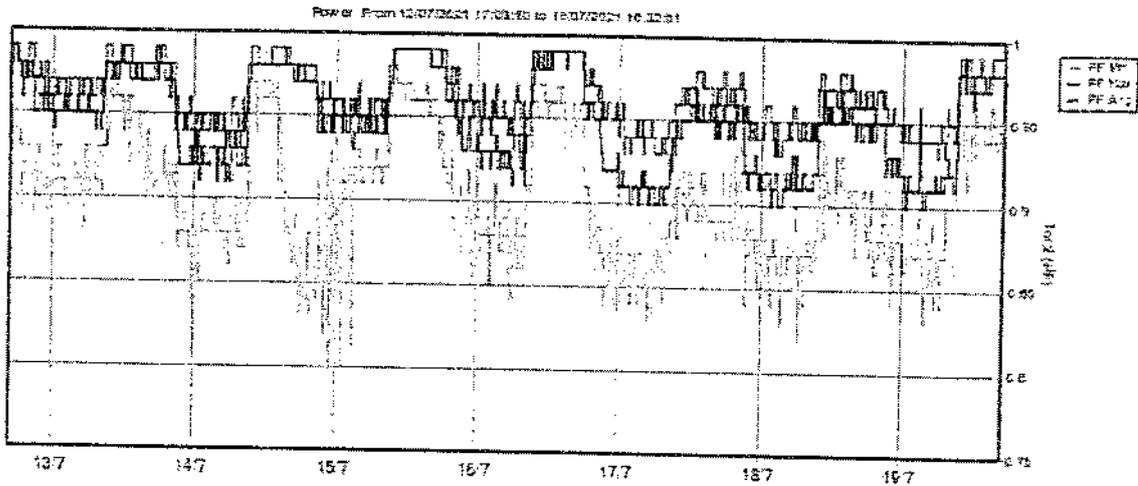


Figure 15 Electricity Department Main Supply Power Factor

The power factor for the facility is generally good, averaging 0.9-0.99 throughout. The power factor was expected to be close to unity as is the case given the type of loads in the facility.

4.2 Admin & Tech Building

The data logger used for logging the energy consumption for this building does not have the capacity to record parameters over a period of time. It can only record aggregate values (cumulative totals). The graph below shows the aggregate energy measurements for the period of 13-19 July.

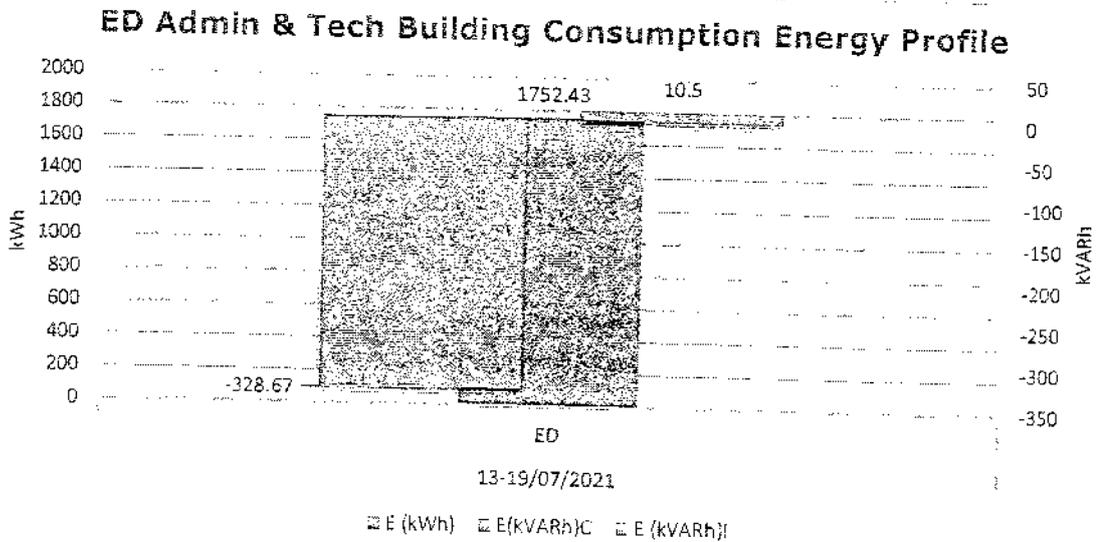


Figure 16 Admin & Tech Building Consumption Energy Profile

The Admin and Tech building is the biggest building on site, its consumption therefore was expected to be highest. Over the measurement period, a total of 1752.43 kWh was recorded, representing a daily average of about 290kWh. During the measurement period, the average power factor recorded was -0.98, which is quite good.

4.3 Protection Building

The Protection building has two offices, which seat two people each, a workshop, storeroom and a toilet. This is a relatively small building and the consumption was not expected to be significant. The power consumption profile is shown on the figure below.

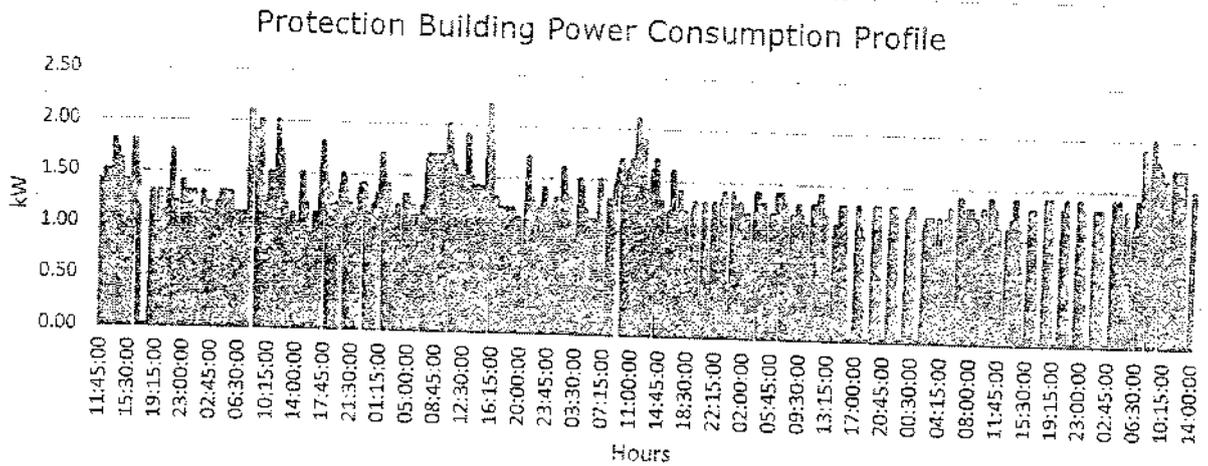


Figure 17 Protection Building Power Consumption Profile

As expected, the power consumption for the Protection building was not very significant. It remained well below 2.2kW throughout the measurement period. However, the data shows a relatively high consumption for the weekend (17-18 July) as shown in the figure below.

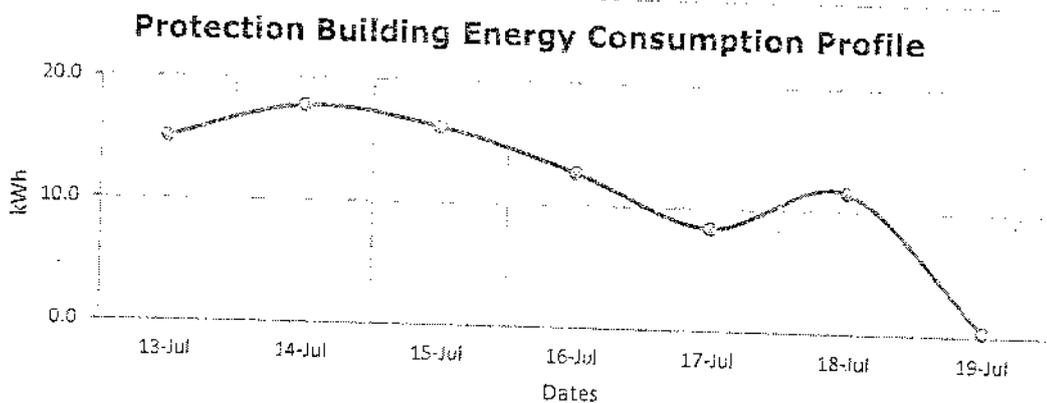


Figure 18 Protection Building Energy Consumption Profile

The average energy consumption for this building was only 12kWh daily, resulting in a total consumption of 82kWh over the measurement period. The main observation from the energy consumption profile is the recording for Sunday 18 July, which is higher than that of Saturday and close to a typical working day consumption. This was not expected given that on Sundays the building essentially has no occupancy.

As observed for the main supply log, the power factor for the protection building is very good.

Power Factor - Protection Building

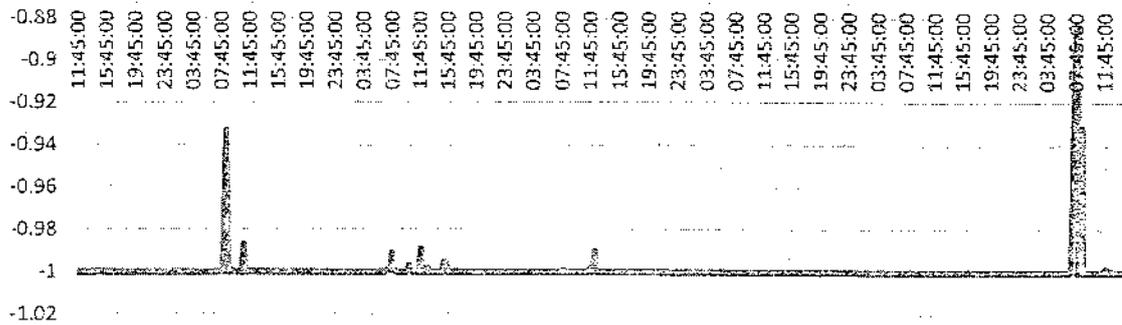


Figure 19 Power Factor - Protection Building

A power factor of mostly unity like this is very good, it means the CoW does not pay for reactive energy (charges), most of the power delivered translates into active energy consumption.

One of the main reasons for carrying out the logging exercise was to in part determine why the Off-Peak consumption is high in the historical data, despite the facility being effectively closed during this TOU slot. It was also necessary to determine at what power factor the facility operates. The results reveals that the facility has quite a significant daily baseload that keeps consuming energy during the night and weekends. This in part explains the high Off-Peak consumption. The power factor is generally very good for the facility as expected, given the type of loads found in the building.

The baseload could not be conclusively identified during this exercise, however, given the type of facility, it is hard to see a sizeable priority load except for a number of security lights, server loads and control room equipment. We therefore conclude that most of the contribution to the baseload comes from practices such as having refrigerators running (even when empty) 24/7 and leaving lights and air conditioners on after office hours.

A detailed survey of electrical loads at the facility was undertaken. This section describes the energy consumers within the facility. During the walkthrough exercise, all electrical loads were considered, but those described here are only those where energy saving opportunities (energy efficiency) exists. A detailed survey of these loads will be presented next with the recommended energy efficient alternatives.

4.4 Space HVAC

Except for the workshops and main boardroom, all offices are equipped with a variety of brands and models of split system air conditioning units (back to back installation). The state, energy rating and operation of these air-conditioning units varies from the brand new to the outright old and obsolete. The sizes of these units also range from 9 000BTU to 24 000BTU. Some of the HVAC units found in the ED are as shown in figure 20. Although still functional, the older units are not energy efficient.

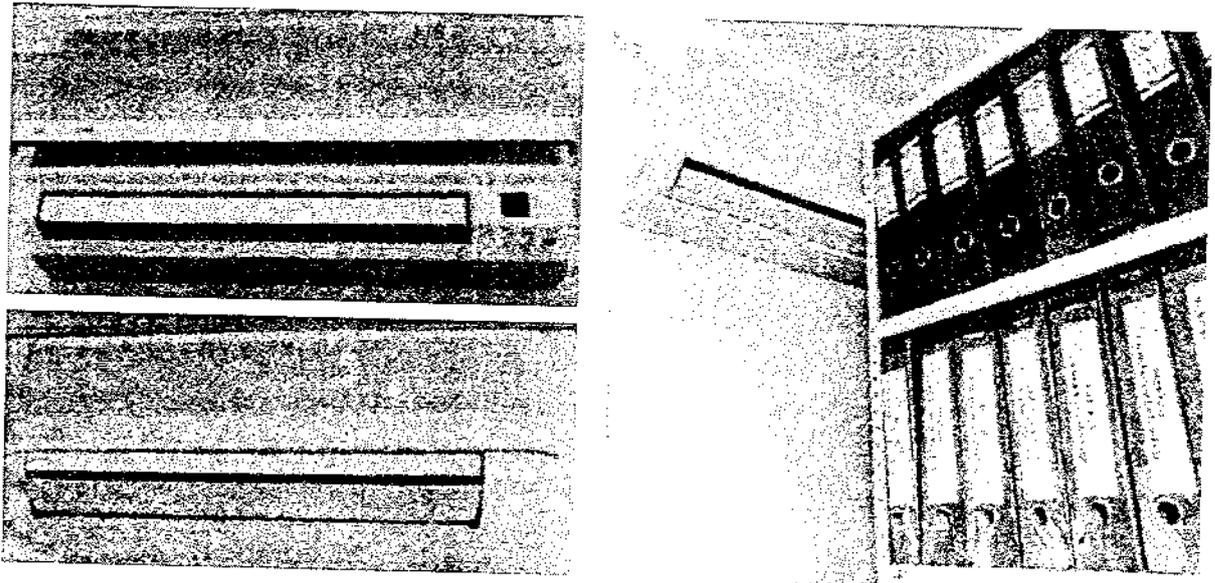


Figure 20 Some of the Split air-conditioning Units found in ED

Although there are HVAC unit with an energy star rating, they are of poor ratings such as B or C. There were also some newer units such as Samsung, of digital inverter technology which has better energy efficiency than conventional air-conditioning units. In lighting, this is analogous to having incandescent bulbs vs fluorescent lighting technology.

The main boardroom and the control room are equipped with cassette air-conditioners, Figure 21.

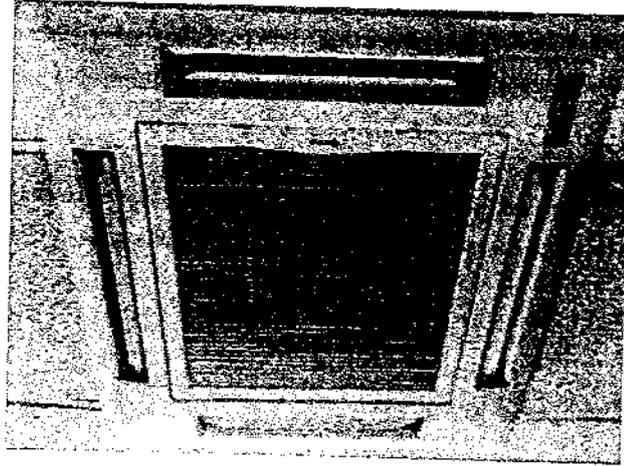


Figure 21 Main boardroom & Control room air-conditioners

Because it is not practical to list all the air-conditioning units room by room in the body of this report, for a room by room comprehensive list of all air-conditioning units found in the ED, reference may be made to the excel sheet provided with this report.

The main observation with regard to HVAC which are of energy efficiency significance were:

- Non-efficient, aged units which were still in operation.
- Newer units of digital inverter technology
- Some newer units but of poor energy ratings such as C or B.
- Offices unoccupied but ACs are left on.
- ACs switched on but windows/doors are also opened at the same time, making it almost impossible for the room to reach the set temperature on the AC remote control.
- There was evidence of poor/overdue maintenance on some units which not only impact performance but also the longevity, general operation and air quality of the units.
- Air-conditioners partly hidden behind storage shelves,

4.5 Refrigeration

Similar to air-conditioning, there were a number of makes, models and sizes of refrigerators found in the ED. They also vary from the very old to the relatively newer models. The most refrigerators found in the facility are small single door units in offices such as those shown in figure 22. Most of these refrigerators are privately owned by the employees and are not the property of CoW. There are also some small kitchenettes in the facility also equipped with

similar refrigerators. There is somewhat a larger leisure/event area with a dedicated reception which has relatively bigger double door refrigerators.

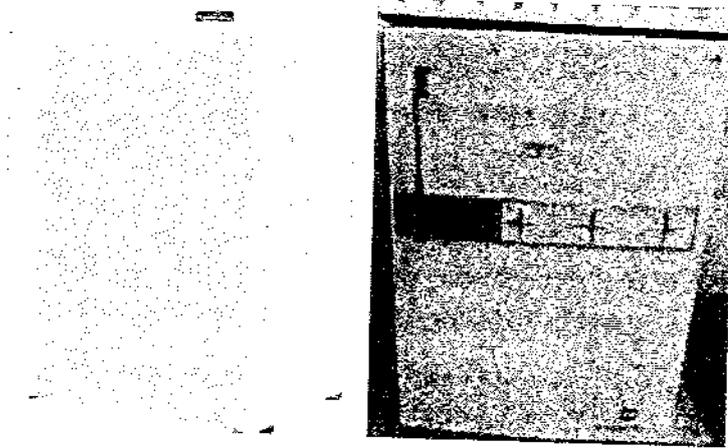


Figure 22 Some of the mini fridges in the offices

During this exercise, there were not found any refrigerator having an energy star rating even among the new ones.

For a comprehensive list of all refrigerators in the facility, reference may be made to the addendum.

Main observations:

- Refrigerators appear to be running 24/7 even when some are completely empty.
- Some refrigerators are aged, inefficient, but still functional.
- Some relatively newer refrigerators but have no energy star rating.

4.6 Miscellaneous loads

In this report, miscellaneous loads are defined as those loads that are only used on a need basis (on demand) and those for which energy efficient alternatives are either not yet available or it is not economically viable to invest in such technologies.

The loads used on demand include Microwaves, electric kettles, coffee makers, printers and photocopy machines. For this equipment, the daily duration of use cannot be realistically estimated because they may not be used at all in a day and/or the duration of use is a matter of few minutes such as warming a lunch pack in a microwave. Miscellaneous loads such as microwaves and electric kettles have energy efficient alternatives and are well documented in the addendum.

The loads for which energy efficient alternatives are not yet available in the market include office equipment such as, desktop computers, Laptops, printers, photocopier machines and water dispensers. These equipment goes into energy saving mode when idle, although switching them off when not in use would be ideal. There is therefore little further energy efficiency measures applicable to miscellaneous loads.

Except for miscellaneous loads for which energy efficient alternatives are available, others such as printers and computers were not a major focus of this study.

Main observations:

- The microwaves and electric kettles are used only on demand.
- The water coolers appear to be running 24/7, even in the offices where no one was found during this exercise.
- The office printers are modern, used only on demand and have inbuilt energy saving functionality that switches them off once idle.
- The computers also have the inbuilt energy saving functionality that switches them off once idle for a certain time.

4.7 Mechanical equipment

The workshops in different sections of the ED such as construction has a number of power tools such as drilling machines, pulleys, grinders, etc. Like miscellaneous loads, most if not all these machines and power tools in the workshops are operated on demand only and no machine was found left on idle. Likewise, for these machines, there is little energy efficiency measures applicable because alternatives of significant energy efficiency performance are either not yet available or it is not economically practicable to invest in such technologies. These loads were also not a priority of this energy audit.

4.8 Lighting

Lighting systems in the electrical department have been identified as a major area of focus during the walkthrough energy audit exercise. Apart from HVAC, lighting is the second area of significant energy efficiency potential. There are a variety lighting fixtures and lamps found in the facility, ranging from incandescent, FTL to LED lights. The incandescent lamps found in the ED ranges from 40 to 100W, while the FTLs mostly in the offices, workshops and corridors ranges from 28 to 78W. The LED tube lights and bulbs were only found at the traffic lights section, with ratings of 18W for tube lights and 9-14W for bulbs.

The FTLs fixtures found in the ED ranges from 4ft-6ft and have either two, three or four T8 lamps or T12 for the workshops, figure 23.

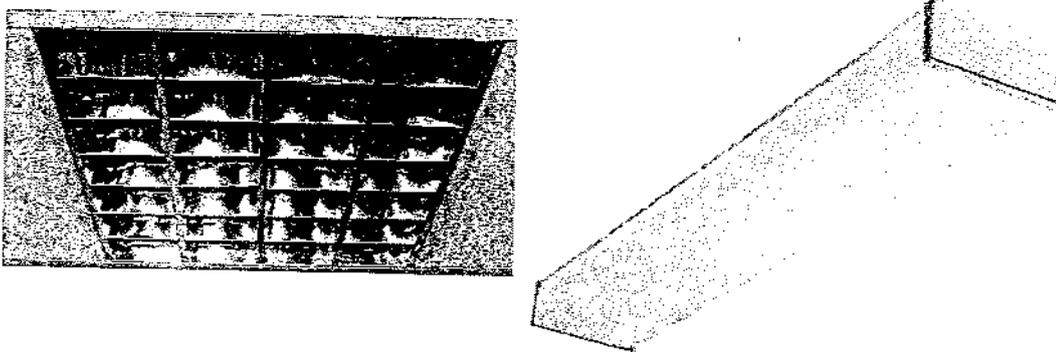


Figure 23 Some light fittings found in the ED

All interior lights are switch (manually) operated, while most outside lights and floodlights are operated by a daylight switch. For a room by room comprehensive list of all lights found in the ED, reference may be made to the excel sheet provided with this report.

The main observations were:

- Less automation for lights in the offices and corridors such that, once switched on they remain on until end of the day.
- Some offices were not occupied but lights were still found on.
- Some rooms have sufficient natural light during the day but still lights were switched on.
- A number of energy inefficient incandescent lamps still in use.

5 General Recommendations

After conducting the walkthrough energy audit in the facility, we suggest the following EE strategies which if implemented can reduce the energy usage considerably. A comprehensive sheet of recommended loads is available in the excel sheet provided with this report.

1. Retrofit all existing FTLs and incandescent lamps with LED lights.
2. Install a 360° PIR occupancy sensor for all offices to automate the lights, i.e. lights switches on/off automatically after detecting presence/absence of persons in the office. These sensors are also capable of detecting night and day (illumination level),

hence, the lights in offices that have sufficient light during the day are not unnecessarily switched on.

3. Install a 360° or 180° motion sensor to automate the corridor(s) lights. Also capable of detecting night/day conditions, preventing lights from switching on if sufficient light is detected during the day.
4. Replace old HVAC units with newer energy efficient one, preferably from A+ to A++ rating.
5. Replace existing refrigerators with energy efficient ones, preferably from A+ to A++ rating.
6. Replace existing microwaves with relatively energy efficient ones rated about 900W.
7. Replace existing electric kettles with relatively energy efficient one rated about 1200W.
8. Upgrade the EE awareness campaign initiated earlier by the ED to a CoW employee EE education program. This can be optimised by introducing incentives such as EE ambassador/champion of the month or year. The whole ED can also adopt an EE slogan to be printed on badges or shirts and/or t-shirts worn by all staff.

The suggested implementation approach and the estimated costs for each specific recommended EMO are discussed later in the report.

SECTION B: Head Office

1 Building Characteristics

Situated next to the Hilton Hotel in the centre of Windhoek, the Head Office is made up mainly of two adjoined buildings. The first building houses departments such as Department of Finance & Customer Services, Cash Hall and Department of Information & Communication Technology. This section mainly has two floors except for the IT department which has three floors. The second part of the building is eight floors, which houses other divisions such as Department of Infrastructure, Water & Technical Services, Department of Urban & Transport Planning, Department of Housing, Property Management & Human Settlements and Department of Economic Development & Community Services.

The Department of Human Capital and Corporate Services is housed in a separate building. Other sections of notable mention are the two employee parking bays and the call centre.

Figure 24 shows a schematic of the first-floor layout.

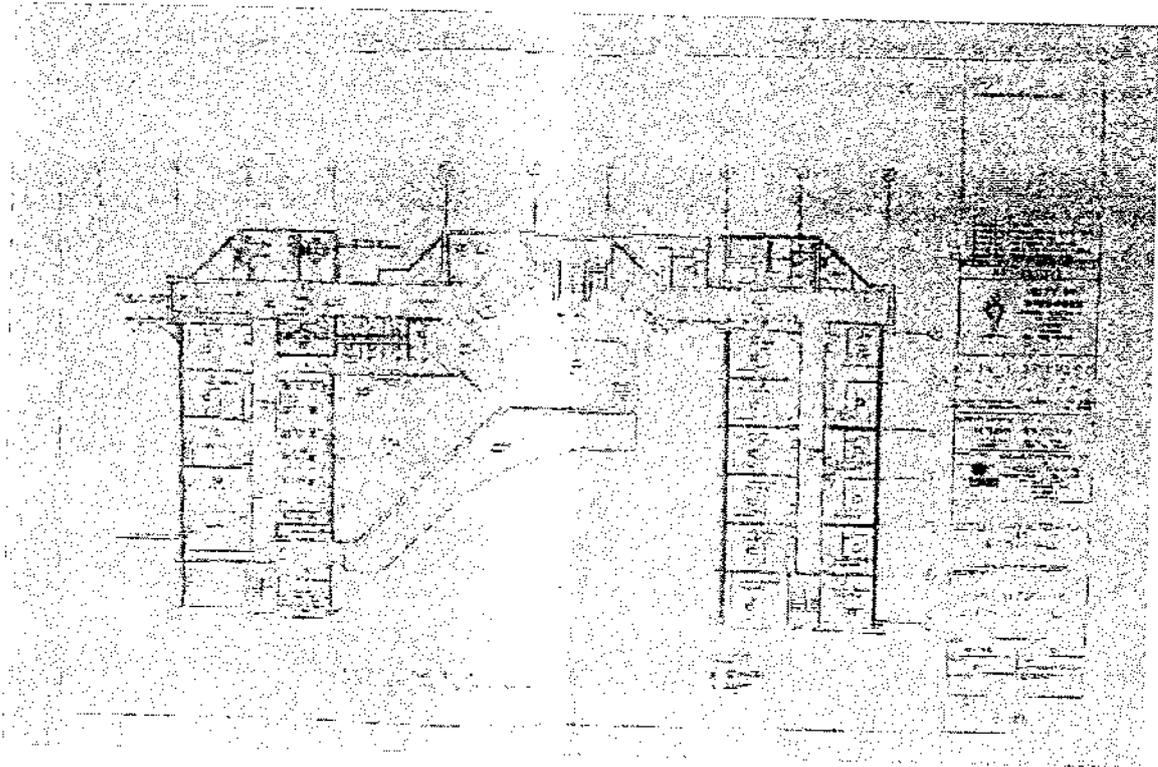


Figure 24 Head Office 1st floor Layout Schematic

All the offices are occupied between 07h00 -16h00, Monday to Friday, which is normal business operations, except for any hiatus due to Covid-19.

2 Building envelope

The City of Windhoek's head office is a multi-storey structure with a brick exterior, cardboard ceilings, corrugated iron roofing and single glazed windows. The building has three main public entrances, one at the Cash Hall, another at customer care and also at the debt management section. These public entrances consist of single glazed double swing doors.

One major observation of energy efficiency importance of this building envelope is its orientation. Built in an East - West orientation, and having its sides lined with single glazed windows, it means during the majority of the day, the building has sufficient daylight throughout. However, single glazing is not without its drawbacks. Whether during summer (cooling) or winter (heating), the insulative ability of single glazing is simply not as effective as double glazing, meaning that you could be watching your money escape through the windows, as well as leaving you with a colder space or office in winter.

3 Historical Consumption

Similar to the ED, the historical energy consumption collected was for three years, 2018-2020. In energy audit studies, 12 months data is normally sufficient for walkthrough audits, three years data is a gift in this case that will provide a better outlook of the consumption trend.

The analysis performed on the historical data of HO is the same as that applied to the ED, the results are next presented.

3.1 Off-Peak Consumption

The HO is relatively a large facility compared to ED and although the energy consumption should be reflective of that fact, it is rather unexpected by how much the consumptions differ.

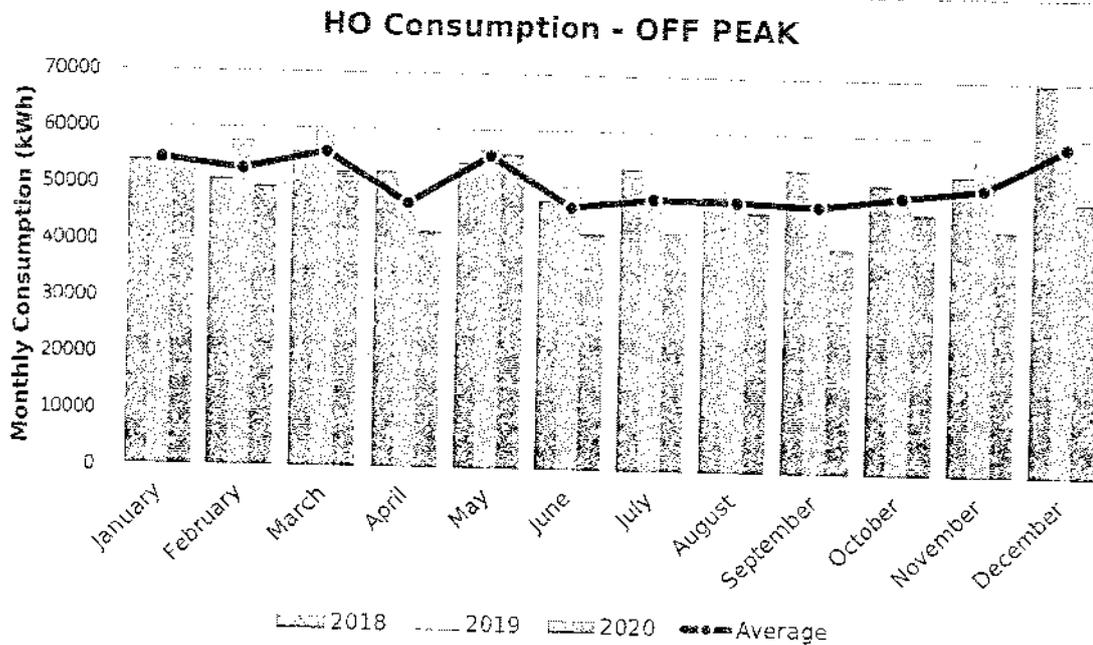


Figure 25 HO Consumption - OFF PEAK

On average, the off-peak consumption profile shows a monthly consumption of about 50 000kWh for the three years under audit, with the highest consumption of about 70 000kWh recorded in December of 2018, figure 25. At the current tariff of N\$0.96/kWh for Off-Peak, that means off-peak contributes about N\$48 000 on average every month. The months of January, March, May and December were on average the most energy intensive for the past three years. The electricity consumption for HO for this period was ten times higher than that of ED for the Off-Peak slot.

3.2 Peak Consumption

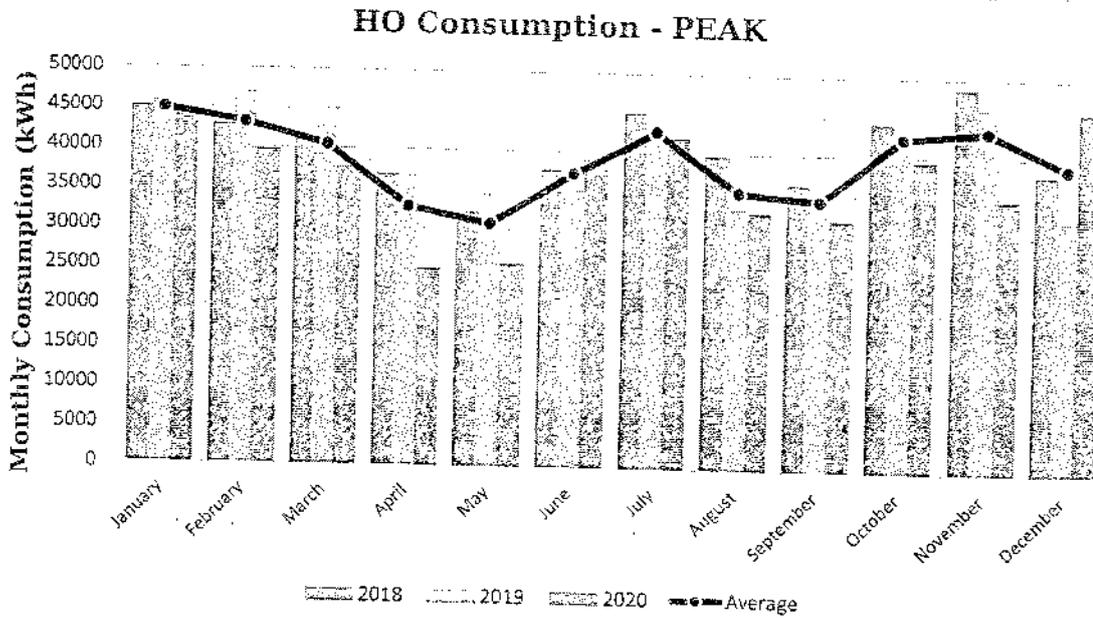


Figure 26 HO Consumption - PEAK

The peak consumption profile shows a high average energy demand for the first three months each year before dropping just below 35000kWh for April and May, figure 26. Ideally, you would want to keep the peak consumption as low as possible for June – August period especially when seasonal tariffs where applicable. The average consumption for that period is only second to November’s consumption, which means in 2018-2019, the highest energy consumption costs were incurred due to seasonal charges. The trend of consumption however remains the same, 2018 was the most energy intensive year followed by 2019 whereas 2020 was the least energy intensive year. As was the case for the ED, the Off-Peak consumption is once again worryingly higher than peak consumption by quite a large margin, further raising the concern of energy inefficient practices or running quite a large baseload.

3.3 Standard Consumption

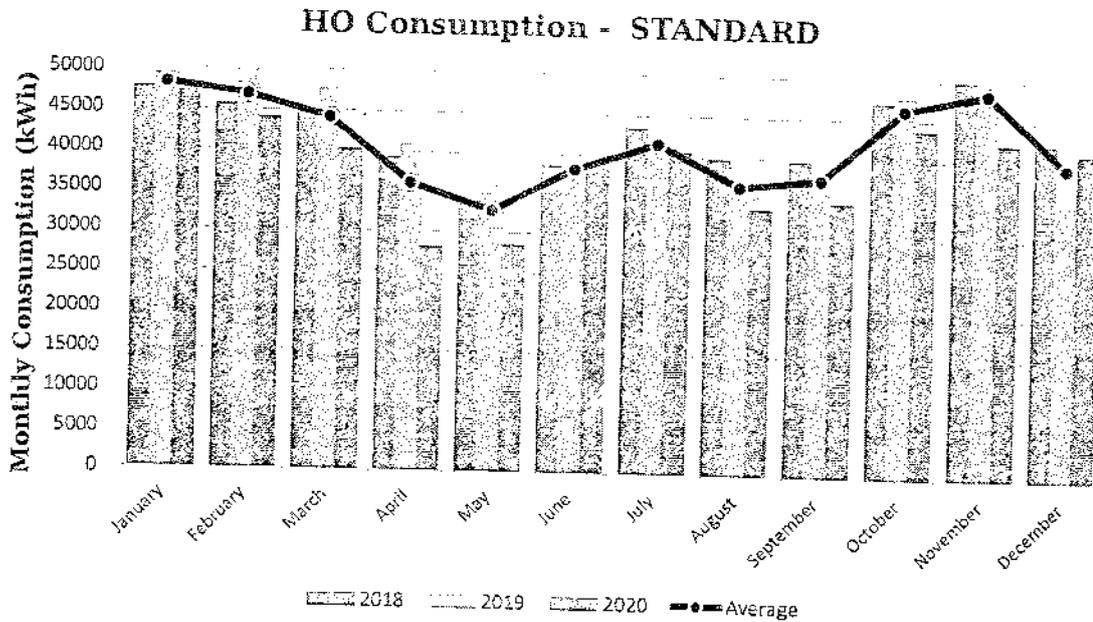


Figure 27 HO Consumption - STANDARD

The consumption profile for standard is almost identical to the peak profile, however, overall, it averages higher consumptions than peak, figure 27. This is expected because the normal business hours for head office are the same as TOU slots for both Peak and standard tariffs.

3.4 Correlation between Energy Consumption and Heating (HDD) and Cooling Degree (CDD) Days

In order to develop a better insight into the drivers of energy consumption at the CoW facilities, a correlation between energy consumption and the productive activities at the facilities need to be analysed. However, the project team was advised by the contact person for the Energy Audit Project at City of Windhoek that there are no measurable activity metrics (productive metrics) at CoW which could be used for the purpose.

Nonetheless, an analysis was performed in order to explore the weather dependency of energy consumption at the City of Windhoek facilities. Degree days were extracted from weather related data for the City of Windhoek for the purpose of exploring the weather dependency of energy consumption at CoW facilities. Figure 28 shows the time series variation of energy consumption at the City of Windhoek Head Office and Heating and Cooling Degree Days. From

the time series analysis a casual relation can be noticed between the energy consumption and the heating degree days (HDD) and cooling degree days (CDDs).

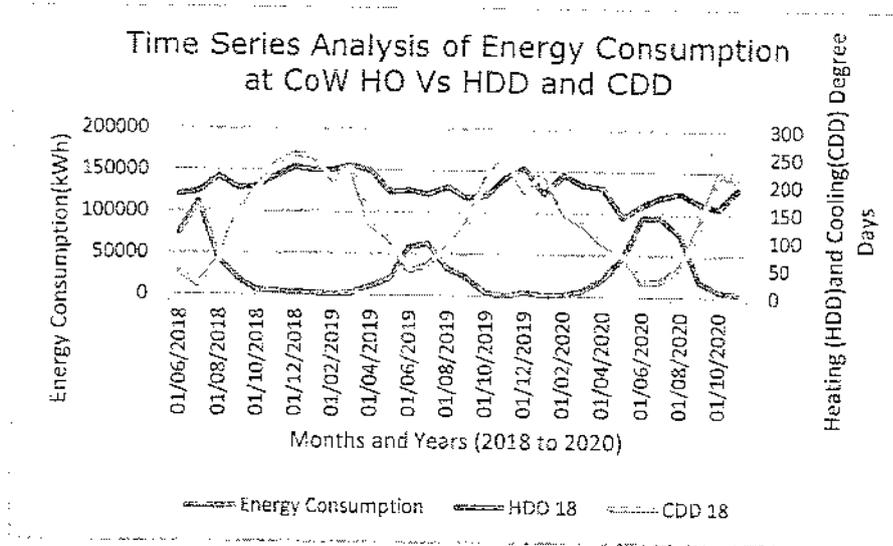


Figure 28 Time series variation of Energy Consumption and Degree Days (Heating Degree Days (HDDs) and Cooling Degree Days (CDDs)

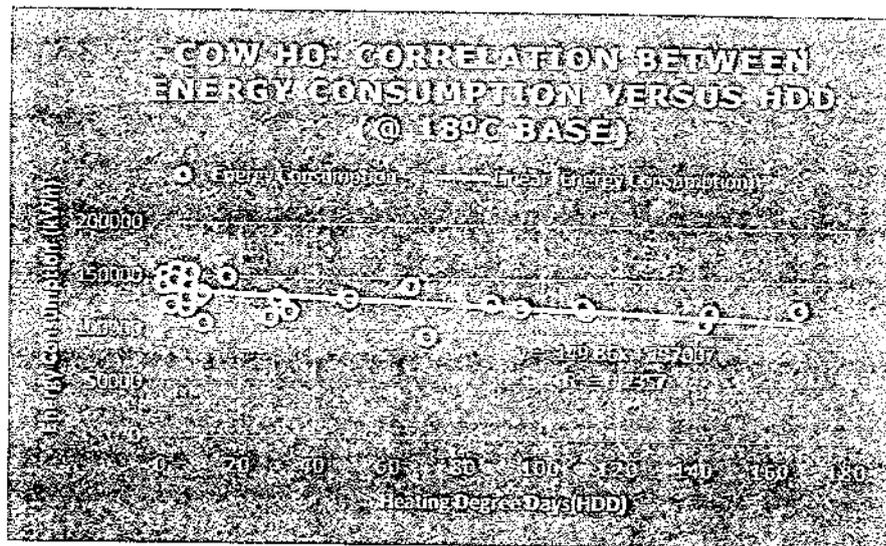


Figure 29 Correlation between Energy Consumption and Heating Degree Days (HDDs)

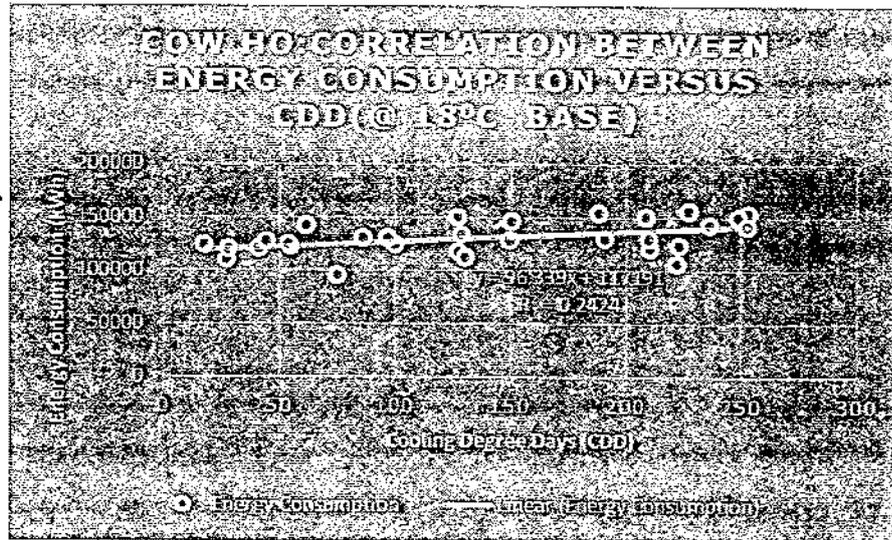


Figure 30 Correlation between Energy Consumption and Cooling Degree Days (HDDs)

Figures 29 & 30 both show a linear correlation between the Energy consumption at the CoW Head Office with the heating degree days and cooling degree days. The coefficient of determination (R^2) in the correlation between energy consumption with the heating degree days and cooling degree days is 0.2357 and 0.2424 respectively. The low coefficient of determination (R^2) indicates that there is a low correlation between the energy consumption and the corresponding degree days. The results show that, although there is a positive correlation between energy consumption and the degree days, the energy consumption at the City of Windhoek Head Office is not determined significantly by weather related conditions or climatic conditions of the City of Windhoek. As a result the Heating, Ventilating and Air Conditioning (HVAC) systems do not contribute significantly to the energy consumption observed at the City of Windhoek Head Office.

4 Measurement-based Energy Audit (Data Logging)

Load Demand Profile and Baseload

Figure 31 below shows the Load Demand Profile at the City of Windhoek Head Office.

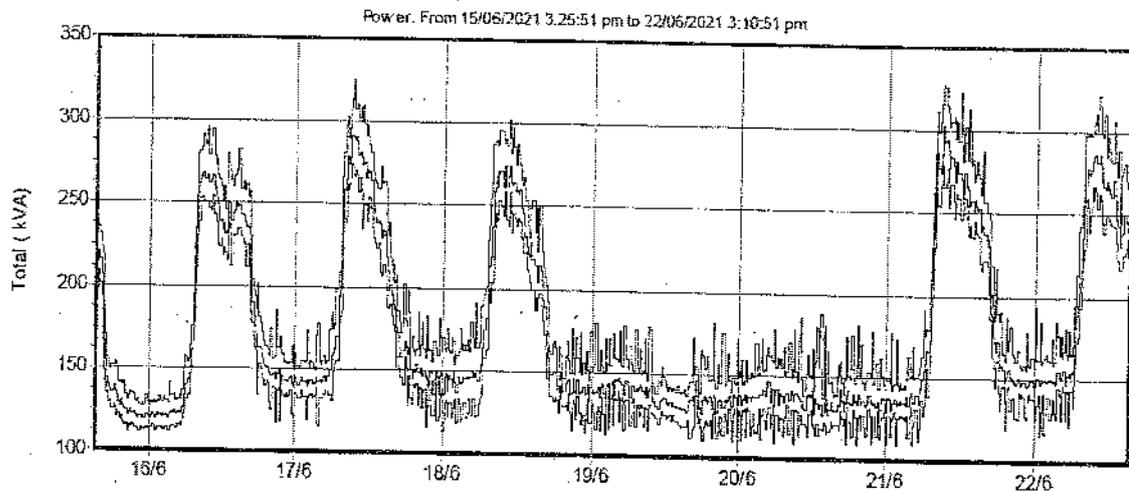


Figure 31 Load Demand Profile at Head Office

The load demand profile for City of Windhoek Head Office, shows a peculiar cyclic load profile with a daily plateau and a lower off-peak (night and weekend) load demand. This characteristic is associated with energy demand profiles for commercial buildings. However, the baseload at the City of Windhoek (CoW) Head Office is quite significant. The measurements taken during the data logging phase confirmed that the two CoW facilities have a relatively high baseload as significant load was observed during the nights and weekends. On average a baseload of 110kVA-135kVA (~110kW-135kW), as shown on Figures 32 and 33, was observed during the weekdays.

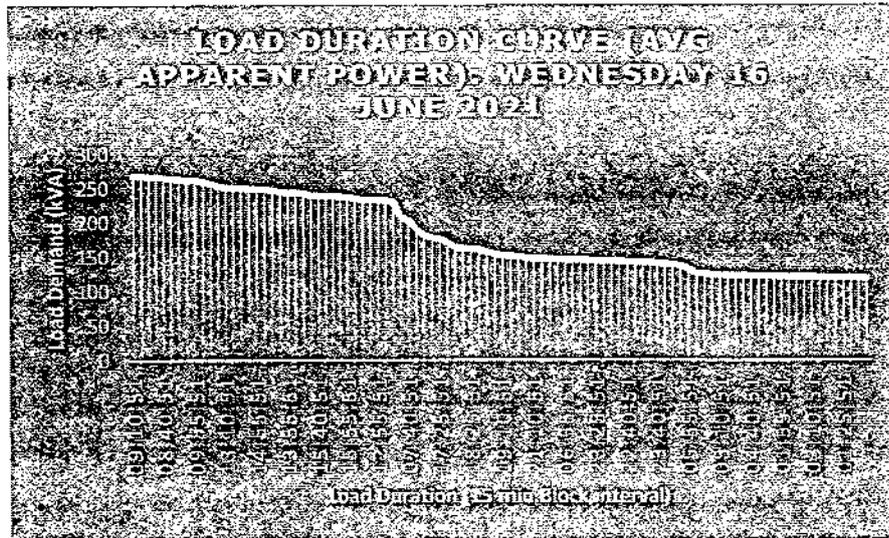


Figure 32 Load Duration Curve for a weekday at the CoW Head Office

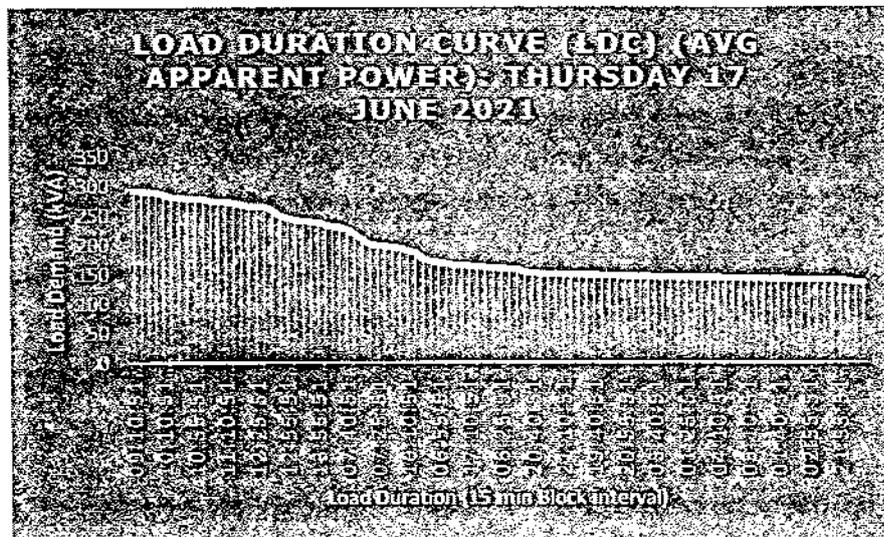


Figure 33 Load Duration Curve for a weekday at the CoW Head Office

A baseload of 126.3 kVA was observed on Sunday 20th June 2021 which was a non-working day (weekend), as shown on Figure 31.



Figure 34 Load Duration Curve for a non-weekday (weekend) at the CoW Head Office

It is quite evident that in terms of the baseload at the CoW Head Office, there seem to be no difference between a weekday and non-weekdays (weekends). The baseload at CoW, on average, remains the same during the week and during weekends. A reduction in the baseload represents a significant energy management opportunity (EMO) at the CoW.

An analysis and identification of the loads which contribute to this baseload is a necessary step in the load management of the baseload. A sample of the load demand profiles of different floors at the CoW Head Office were analysed and developed using the data provided by the measurement audit phase which was undertaken at CoW Head Office. The measurements were taken from the 15th June 2021 up to the 12th July 2021 as shown on Figures 35 & 36 for Debt Management, Figures 37 & 38 for the 6th Floor and Figures 39-41 for the 8th Floor.

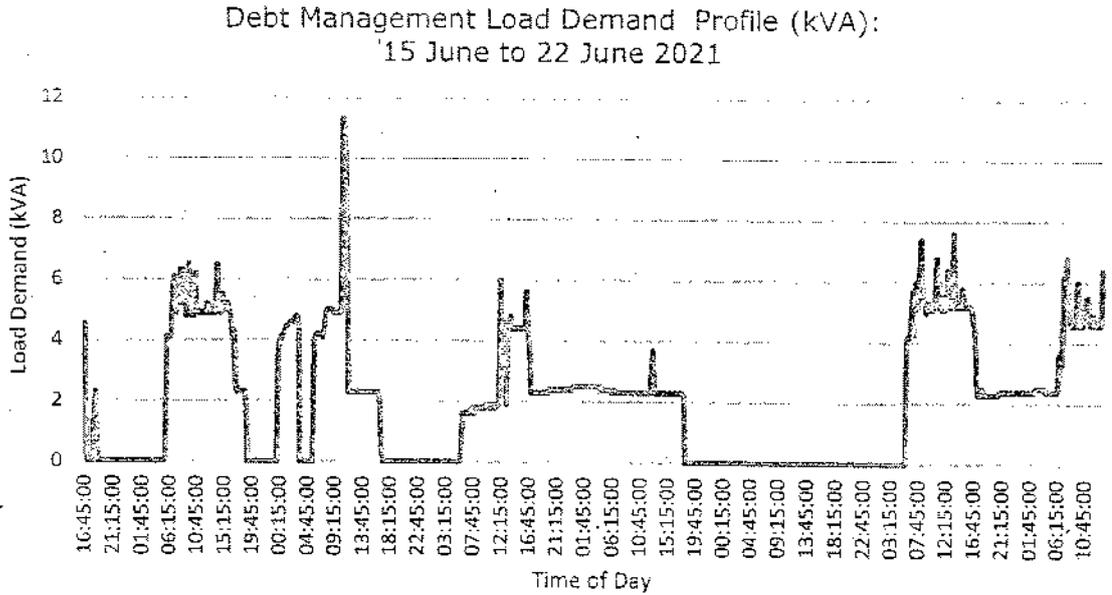


Figure 35 Debt Management Load Demand Profile (kVA) 15 June to 22 June 2021

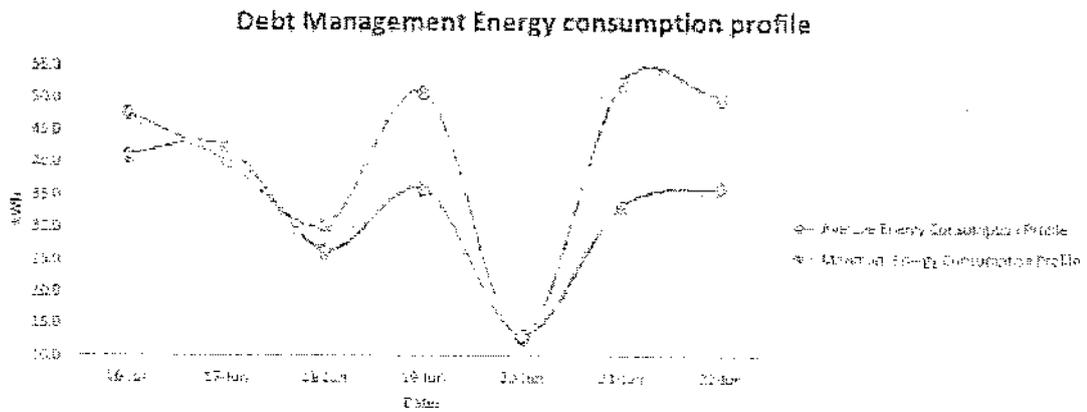


Figure 36 Debt Management energy Consumption profile

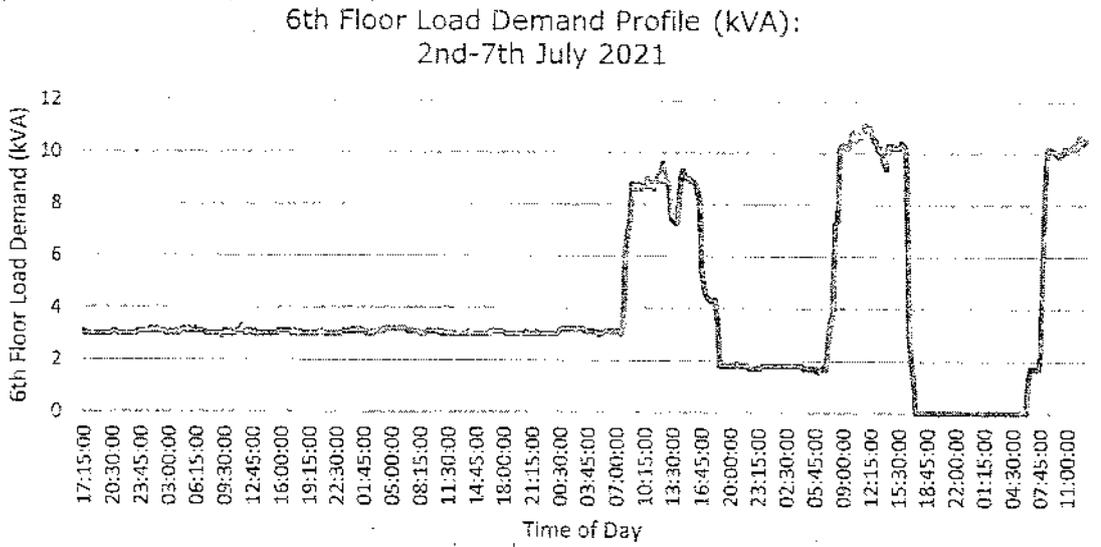


Figure 37 6th Floor Load Demand Profile (kVA) 2nd-7th July 2021

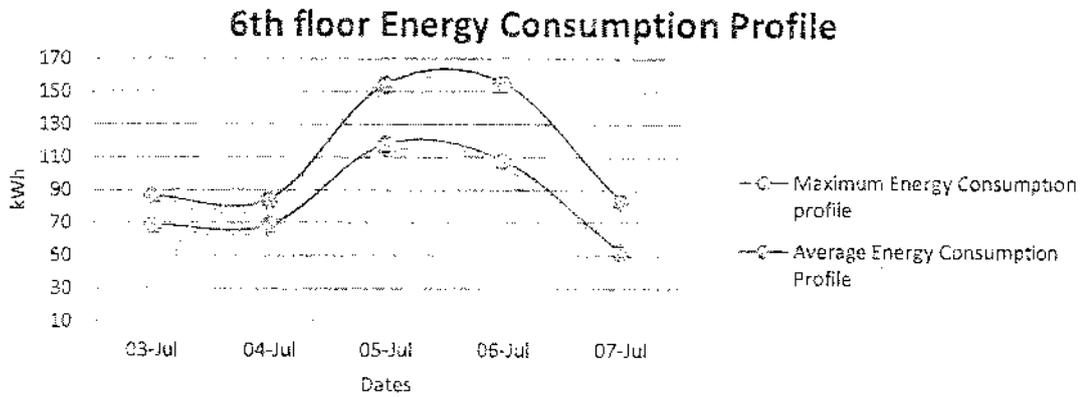


Figure 38 the 6th Floor energy consumption profile

8th Floor Load Demand Profile (kVA):
08 July-12 July 2021

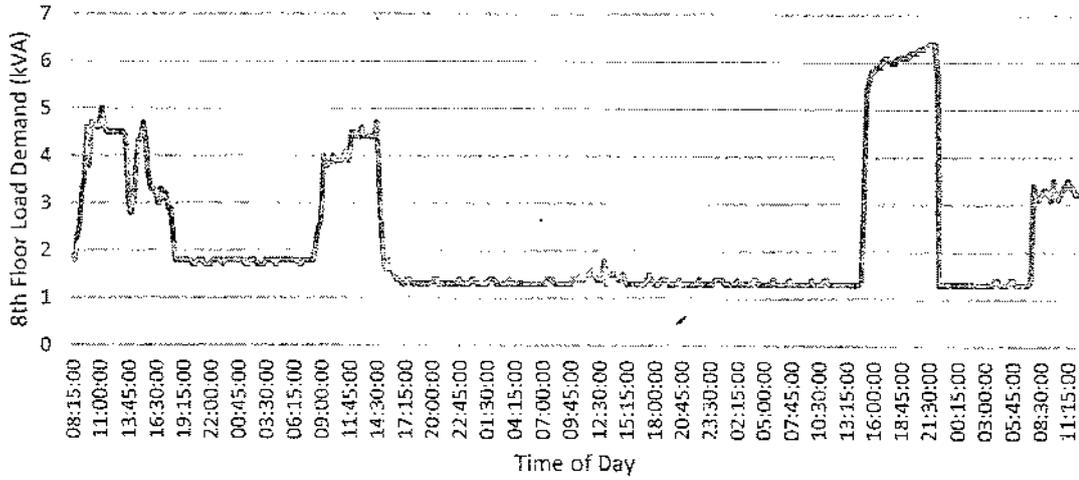


Figure 39 8th Floor Load Demand Profile (kVA): 08 July-12 July 2021

8th floor PF

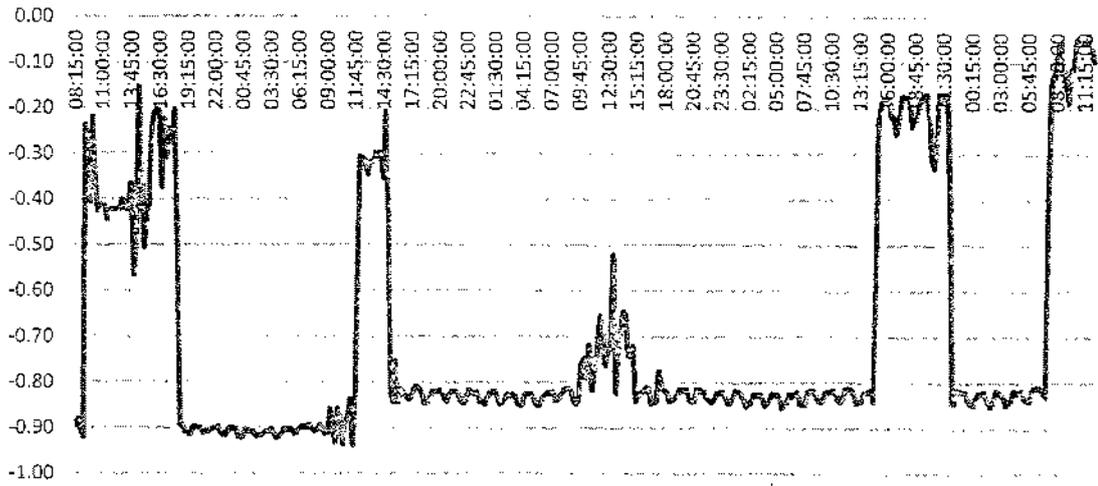
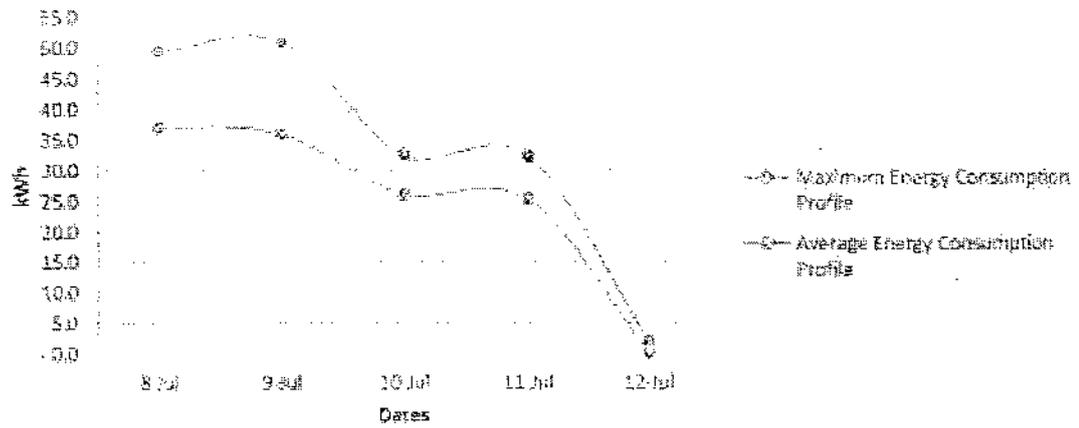


Figure 40 8th floor PF

8th floor energy consumption profile



Ta 41 8th floor energy consumption profile

SECTION C: ENERGY AUDIT FINDINGS

1 Major Energy Audit Findings

The main findings of the audit were:

- There is a high Off-Peak energy consumption at the City of Windhoek (CoW) Head Office and the Electricity Department. The two facilities are billed using the Time of Use (TOU) based tariff structure with a differentiated energy charge for the different time of use, represented as Peak, Standard and Off-Peak. The Off-peak energy charge is the lower of the three. The Off-peak period is specified as running from 22:00-06:00 during weekdays and it starts from 06:00-11:00 and 17:00-19:00 on Saturday and from 00:00- 23:59 on Sunday. The Off-peak period corresponds with the period in which the two facilities (buildings) are mostly closed or at least operating at minimum capacity.
- The measurements taken during the data logging phase confirmed that the two CoW facilities have a relatively high baseload as significant load was observed during the nights and weekends. On average a baseload of 110kVA-135kVA (~110kW-135kW) was observed during the weekdays and a baseload of 126.3 kVA was observed on Sunday 20th June 2021 which was a non-working day (weekend). In terms of the baseload at the CoW Head Office, there seem to be no difference between a weekday and non-weekdays (weekends). A reduction of the baseload represents a potential energy saving opportunity.
- Low level of awareness on good housekeeping measures for energy saving and energy efficiency improvement at the City of Windhoek facilities. This was observed and noted through the operation of space heating and cooling systems (HVAC systems). These systems are designed for closed loop control of room climate. However, it was observed that a good number of these HVAC systems were being operated while the doors and/or windows to the same office were also open. This would simply make it extremely difficult for the air conditioning unit to attain the pre-set temperature. Some of the observations at the CoW facilities which indicate an inadequate awareness of good housekeeping measures include the following:

- ✓ HVAC units were also observed to be kept running (or in operation) in some unoccupied offices.
 - ✓ The use of old HVAC units and relatively newer HVAC units with poor energy star and SEER/EER ratings.
 - ✓ Rooms that have sufficient natural lighting (350-650 lumens), yet the lights were switched on nevertheless.
 - ✓ Lights are left on in unoccupied toilets
 - ✓ Most Lighting systems are manually operated, hence, corridors, stairways, and office lights remain on the whole day and night.
 - ✓ Refrigerators appear to be running 24/7 even those that were found empty.
 - ✓ External security lighting systems (Floodlights) were observed to be on during the day.
- The use of Lighting Systems which are not the most energy efficient lighting systems available in the market (e.g. use of T12 FTLs and incandescent light bulbs). A retrofit project for interior lighting system represents an opportunity for energy saving and for improving the energy efficiency of the two facilities which were audited at City of Windhoek (CoW).
 - The use of old refrigerators and relatively newer ones of energy rating class B or C. The old refrigerators and the class B or C refrigerators are not the most energy efficient devices in the market.

2 General Recommendations on Energy Management Opportunities (EMOs)

The Energy Management Opportunities (EMOs) which were identified for the CoW facilities include:

- No Capital Cost Options
The no capital cost option requires an intervention to raise energy management awareness across the board within the City of Windhoek facilities which were audited during this exercise. Tailor-made training workshops can be developed for different target groups, management, middle and technical management and non-technical staff within the facility. The awareness training workshops are a low-hanging fruit which will have a positive impact on the utilisation of energy within and across the board at City of Windhoek.

- Retrofit Options

The retrofit projects are capital projects which are based on the identified ESOs for each of the CoW facilities which were audited. The savings given for each intervention reflect the savings achievable when implementing each opportunity independently. The recommended measures may have to be implemented in parallel. Five (5) Energy Management Opportunities (EMOs) were identified as follows:

- EMO 1: Replacement of CFL with LED Lighting systems
- EMO 2: HVAC Replacement with CoW Financing alone
- EMO 3: HVAC Replacement with CoW + EELA Co-Financing Option 1
- EMO 4: HVAC Replacement with CoW + EELA Co-Financing Option 2
- EMO 5: Refrigeration Replacement

3 General conclusions of the Financial Analysis

The client requested the facilities to be treated as different projects, but isolating them in the analysis results in longer payback periods than when looked at as a single project. EMO 1 will therefore have a combined 5.35 year payback period instead of just 2.3 year payback period if the facilities are treated as a single project. Similarly, EMO 3 will consequently have a combined 9 year payback period compared to 5 years when the analysis for the facilities is combined into one. Equally, EMO 4 will have a combined 11 year payback period compared to 10 years when the analysis for the facilities is combined into one. It is therefore advisable to consider this fact when planning for implementation.

SECTION D: Recommendations for Specific Energy Management Opportunity (EMO): Lighting Systems

1 Existing Lighting

Lighting was identified as one the loads where there exist great energy efficiency/saving opportunities. As noted in the main observations for both ED and HO, most existing lights are inefficient and better lighting technologies are available that offers not only better efficiency but also better light quality and output per unit area.

It was also observed that apart from floodlights and outside lights, all existing lights are manually switched. With lack of automation, lights remain on once switched on even when there is sufficient natural light. Employees forget to switch off lights while on lunch, meetings and even after work.

There are four main types of lights that were found in both facilities, these were:

1. FTLs – T5s, T8s and T12s. These were found in, one, two, three and four lamp fittings. The lamp wattages included 18W, 20W, 36W, 54W, 58W, 65W and 75W. The 65W and 75W lamps are now obsolete and are no longer in production.
2. CFL bulbs of wattages between 11 and 14 Watts
3. PL9 bulbs of wattages between 9 and 18 Watts.
4. Incandescent bulbs of wattages between 40 and 100 Watts.
5. Sodium Vapour floodlights, rated 400W.

1.1 Proposed Energy Efficiency Strategy

The main energy efficiency strategy proposed for both facilities is to retrofit all existing Lamps and bulbs as follows.

1. Retrofit all FTLs with LED open channel tube lights. The LED tube lights can either be 16W or 18W which is equivalent to the 36W and 58W FTLs respectively. The LEDs however have a better light quality and produces more lumens per unit area than their FTL counterparts.
2. Retrofit all CFL and PL9 bulbs with LED bulbs equivalents i.e. LED bulbs of wattages between 7 and 9 Watts.
3. Retrofit all Incandescent bulbs with LED bulbs equivalents i.e. LED bulbs of wattages between 9-11 Watts.
4. Retrofit all Sodium Vapour floodlights with LED floodlight equivalents, rated 50W.

Another advantage of retrofitting LEDs is because they give a better light output (lumens) per unit area, most fittings such as 3 and 4 bulb fittings will be replaced by just two bulb fittings without compromising the light output and quality. This will mean less luminaires per facility which is advantageous in terms of costs for future replacements.

Additionally, all offices, corridors, staircases and boardrooms should be appropriately and sufficiently equipped with PIR 3600 sensors to automate the switching on/off of the lights. There are about 401 places that need light automation i.e. offices, corridors, staircases, toilets, boardrooms, etc.

1.2 Electricity Department

The ED has 312 fixtures consisting of 678 lights (table 1). In terms of energy, the existing lights load accounts for about 39 902 kW per/year on average.

Table 1 Existing lighting load: ED

Existing Equipment		OPERATIONAL	
Existing fixtures.	Existing Lamps/Lights	Average Energy Use [kWh/year]	Energy Costs [N\$/year]
312	678	39,902	56,661.20

** For specific type of fixture and lamp, refer to the excel sheet separately provided.

1.2.1 Proposed Energy Efficiency strategy

The recommended lighting load for the Electricity Department consists of the same number of fixtures as existing, but the new lights dropped to 645. The new lights are estimated to account for 8,386 [kWh/year], which represents a saving opportunity of 31 516 kWh per annum. The complete details are summarised in table 2.

Table 2 Proposed LED lighting retrofits: Electricity Department

New equipment				Operational			New Equipment Costs			Annual Savings			Financial Analysis			
No of fixtures	No of lamps	Type of New Control	No of New Controls	Average Energy Use [kWh/year]	Energy Costs [N\$/year]	PIR Occupancy [N\$]	PIR Occupancy [N\$]	Fittings [N\$]	Lights [N\$]	Energy [kWh]	Costs [N\$]	Simple Payback	ROI	NPV (N\$)	IRR	Pf
312	645	PIR 360 deg. occupancy	131	8,386	11,908.1	28,820	28,820	45,764	26,932	31,516	44,753	2.95 years	239.11%	168,326	31.8%	2.28

** For specific type of fixture and lamp, refer to the excel sheet separately provided.

1.2.2 Costs for implementing the Energy Efficiency strategy

The implementation of the energy efficiency strategy for lighting would require a moderately high investment. It would require the CoW to follow their procurement processes such as sending out RFQs. The retrofitting measure was analysed with results indicated below. We strongly recommend that the conversion of FTLs, CFLs, PL9s and incandescent lights to LED lamps is implemented.

Most LED retrofits have life spans between 15-30 years. Fittings outlasts the lights. However, because of the PIR sensor which lasts between 10-12 years, the project life for the retrofits used for estimations is 10 years. Table 2 gives the analysis results. Looking at the results, payback is expected after just 2.95 years (i.e. 2 years, 11 months, 4 days), yielding a return on investment of 239.11% (project life) or 23.911% annually and a profitability index of 2.28. After payback, 31 516 kWh/year in potential energy savings is expected corresponding to N\$ 44 753/year in monetary terms.

1.3 Head Office

Table 3 Existing lighting load: Head Office

Existing Equipment		OPERATIONAL	
Existing fixtures	Existing Lamps/Lights	Average Energy Use [kWh/year]	Energy Costs [N\$/year]
1,560	4, 209	215,513	306,028.82

** For specific type of fixture and lamp, refer to the excel sheet separately provided.

For Head Office, the existing lighting load has 1 560 fixtures, consisting of 4209 lights (table 3). On average, this load represents 215 513 [kWh/year] in energy consumption.

1.3.1 Proposed Energy Efficiency strategy

The recommended lighting load for Head Office consists of the same number of fixtures as existing, but the new lights dropped to 2,782. The new lights are estimated to account for 39,663.5 [kWh/year], which represents a saving opportunity of 175,849.5 kWh per annum. The complete details are summarised in table 4.

1.4 Costs for implementing the Energy Efficiency strategy

Table 4 Proposed LED lighting retrofits: Head Office

New equipment				Operational			New Equipment Costs			Annual Savings			Financial Analysis			
No of fixtures	No of lamps	Type of New Control	No of New Controls	Average Energy Use [kWh/year]	Energy Costs [N\$/year]	PIR Occupancy [N\$]	Fittings [N\$]	Lights [N\$]	Energy [kWh]	Costs [N\$]	Capital Cost [N\$]	Simple Payback	ROI	NPV (N\$)	IRR	PI
1,560	2,782	PIR 360 deg. occupancy	441	39,663.5	56,322.2	96,580	210,203	145,406	175,849.5	249,707	587,845.70	2.4 years	324.78%	1,087,706	41.1%	2.85

** For specific type of fixture and lamp, refer to the excel sheet separately provided.

Table 4 gives the analysis results. Looking at the results, payback is expected after just 2.4 years (i.e. 2 years, 4 months), yielding a return on investment of 324.78% (project life) or 32.478% annually and a profitability index of 2.85. After payback, 175,849.5kWh/year in potential energy savings is expected corresponding to N\$ 249,707/year in monetary terms.

The quotation from which new equipment costs were based is attached in the pdf version of this report.

Assumptions:

The following assumptions were considered/made to come up with the analysis.

1. 250 working days a year
2. An average electricity tariffs as presently applicable to the facility are used in the analysis. The average was calculated as: $Average\ Tarrif\ (N\$/) = (Peak\ tariff + Standard\ tariff + Off - Peak\ tariff)/3 = (1.61 + 1.39 + 0.96)/3 = 1.42$
3. Discount rate 8%
4. A project life of 10 years is applied. However, in most cases 15-25 year equipment life is applicable (e.g. fittings and LED tubes). However, to allow comparison with shorter life equipment (PIR sensors averages 12 years life span), a 10-year project life is adopted throughout.
5. 30% Labour charge
6. No Maintenance costs were included in the estimations because it is virtually impractical to approximate how many luminaires or PIR Sensors will fail/breakdown each year. Maintenance on lighting systems is normally done on ad hoc basis.

SECTION E: Recommendations for Specific Energy Management Opportunity (EMO): HVAC

1 Existing HVAC

There are quite a number of air conditioners that are old and inefficient. Some units date back as far as 1993 in both facilities. There are also a few newer units of Inverter type which has a better energy efficiency than non-Inverters units. There are energy inefficient practices at both the ED and HO, such as opening windows and doors while the units are on. These were addressed in the behavioural measures.

It was also noted that there is no automation or smart control of the air conditioning units which makes them susceptible to being left on after work or even during weekends or holidays if an employee leaves the office in haste.

1.1 Proposed Energy efficiency Strategy

Apart from the behavioural measures identified earlier, another possible energy efficiency strategy applicable to HVAC is the replacement old units and energy inefficient units with new energy efficient equivalents. These units should have energy star ratings ranging from A+ to A+++ or best yet, the premium 5-star units. However, these units are not readily available locally yet, though a number of vendors can order them. One such unit is the Daikin Inverter FTKG-T SERIES (R32) unit offering the following features:

- Seasonal efficiency values up to A+++ in cooling and heating
- Practically inaudible: the unit runs so quietly, you will almost forget it is there
- Cleaner air thanks to Daikin Flash Streamer technology: you can breathe deep with no worries about impure air.
- 2 Area intelligent eye: air flow is sent to a zone other than where the person is located at that moment; if no people are detected, the unit will automatically switch over to the energy-efficient setting.
- Online controller (optional) – Control the indoor unit from any location with an app, via your local network or internet and keep an overview on your energy consumption.
- 3D airflow combines vertical and horizontal auto swing to circulate a stream of warm or cool air right to the corners of even large spaces.

- R32 Refrigerant – environmentally friendly compared to R22 and R410A.

However, unlike lighting, where energy consumption is simply a matter of the power ratings and duration of use of individual lights, air conditioners energy consumption is determined differently. There are three main factors that plays a major role in determining how much energy an air conditioner consumes; these are the unit's SEER/CSPF (Seasonal Energy Efficiency Ratio/Cooling Seasonal Performance Factor), COP (Coefficient of Performance) and EER (Energy Efficiency Ratio) ratings.

The higher the SEER or EER rating, the more efficient the unit is. The main difference between SEER and EER is that SEER is calculated taking into account seasonal variations in temperature, whereas EER is calculated at a constant temperature. SEER is normally regarded as a more realistic estimate of energy efficiency because it takes into account temperature variations compared to EER.

Therefore to estimate the amount of energy consumed by an air conditioner, the following formula is used:

$$((\text{Capacity (BTU/h)})/\text{SEER} \times \text{hrs/year})/1000 = \text{Amount of kWh used annually.}$$

1.2 Costs for implementing the energy efficiency strategy

Replacing existing HVAC is not a small task to undertake because of the high initial investment costs that would be involved. We however recommend that the CoW phase out all old units and replace them with energy efficient equivalents. Energy efficient units are more expensive than normal units. Air conditioners are a long-term investment, and quick gains are not to be realistically expected, unless the quantity to be replaced is relatively small.

An air conditioner has a life span of about 20 years; however, this depends on the environmental conditions in which the unit is operating, servicing and how frequent the unit is used. Therefore, on average, a HVAC unit is expected to last about 15 years. The average life span was used to do the estimations.

This having been considered, HVAC units having a minimum SEER rating of 18 are recommended. The results of recommended EMOs for HVAC units are presented next for each facility.

Assumptions:

The following assumptions were considered/made to come up with the analysis.

1. 250 working days a year
2. An average electricity tariffs as presently applicable to the facility are used in the analysis. The average was calculated as: $Average\ Tarrif\ (N\$) = (Peak\ tariff + Standard\ tariff + Off - Peak\ tariff)/3 = (1.61 + 1.39 + 0.96)/3 = 1.42$
3. Discount rate 8%

2 Electricity Department

Table 5 Existing HVAC Load: Electricity Department

Existing HVAC quantity	OPERATIONAL		
	Average Energy Use [kWh/year]	Energy Costs [N\$/year]	Maintenance Costs [N\$/year]
47	96,646	137,238	16,450

At the time of conducting this audit, the ED had 47 HVAC units. In terms of energy, the existing HVAC load accounts for about 96 646 kW per/year on average, (table 5).

2.1 Proposed Energy Efficiency Strategy

The recommended HVAC load for the Electricity Department consists of the same number of units as existing. The new units are estimated to account for 62,583 [kWh/year], which represents a potential saving opportunity of 34,063kWh per annum. The complete details are summarised in table 6.

2.2 Costs for implementing the Energy Efficiency strategy

EMO 2: CoW financing alone

Table 6 HVAC Replacement Analysis CoW Financing alone - (Electricity Department)

New equipment	Operational			New Equipment Costs			Potential Annual Savings			Financial Analysis				
	Number of New AC Units	Average Energy Use [kWh/year]	Energy Costs [N\$/year]	New AC Units (N\$)	Labour (N\$)	Maintenance Costs (N\$/year)	Energy (kWh)	Costs (N\$)	Maintenance [N\$/year]	Capital Cost (N\$)	Simple Payback	ROI	NPV (N\$)	IRR
47	62,583	88,868	798,200	221,605	11,750	34,063	48,369	4,700	1,019,805.00	19 years	-21.94%	-565,560	-2.95%	0.45

Evidently, the annual cost savings due to this Energy Efficiency intervention are not sufficient to pay off the initial investment within a reasonable time frame. With payback only expected after 19 years (longer than the average life span of a HVAC unit) and return on investment standing at -21.94% (project life) or -1.46% annually, this intervention is not economically viable under these financing conditions as it will never return a positive ROI during the project life. The complete analysis results are summarised in Table 6. Given that under CoW financing alone the project(s) never return a positive ROI, a different financing approach is required if the project is to be implemented. Fortunately, EELA has a standing call of Expressions of Interest (EoI) (expiring 31 December 2021) for technical and financial support to develop and implement energy efficient lighting and appliances projects in the East African Community (EAC) and Southern African Development Community (SADC) Member State(s). The EELA co-financing facility is a grant, no repayment will be required. Making use of this facility, there are two viable options whose analysis results gave birth to EMOs 3 & 4 as follows.

EELA CO-FINANCING OPTIONS

Conditions for Funding: A maximum 75% of the total costs of the project can be applied for from the facility and the applicant has to demonstrate 25% own contribution to the total project costs.

N\$3,534,000 = 200 000 Euros Maximum Available (applicable exchange rates to be taken into account at the time of implementation). Exchange rate used to do the estimation was for 01 September 2021 which was trading at 17.67 NAD = 1EUR.

Notes:

- a) *The maintenance costs do not include gas and VAT (both existing and proposed). Not all HVAC units will require gas refilling for servicing. Therefore, the maintenance costs used in the analysis are standard labour charges. The actual maintenance costs will substantially depend on the number of units requiring gas refills plus VAT charges.*
- b) *The financial analysis was computed with Capital Costs less the EELA co-financing contribution.*
- c) *The difference in maintenance costs (existing- proposed) was treated as a potential saving and was added to the energy saving costs in the overall financial analysis.*
- d) *New equipment prices includes VAT.*

EMO 3: Option 1: Target Old and less efficient HVAC Units

This option targets all old and less efficient HVAC units having a SEER rating below 14.

Table 7 HVAC Replacement Analysis - CoW + EELA Co-Financing Option 1: ED

New equipment		Operational			New Equipment Costs			Potential Annual Savings			Financial Analysis			
Number of New AC Units	Average Energy Use [kWh/year]	Energy Costs [N\$/year]	New AC Units (N\$)	Labour (N\$)	Maintenance Costs (N\$/year)	Energy (kWh)	Costs (N\$)	Maintenance (N\$/year)	Capital Cost (N\$)	Simple Payback	ROI	NPV (N\$)	IRR	PI
40	50,333	71,473	650,600	188,600	10,250	30,563	43,399	4,000	(839,200 - 629,400) = 209,800	4 years	239%	195,912	21.35%	1.93
**Total project Costs: N\$ 839,200 **N\$ 629,400 = 75% of EELA facility can be applied for and N\$ 209,800 = 25% CoW co-financing.														

The Capital cost of this intervention before EELA co-financing is considered stands at N\$ 839,200. Applying for the maximum 75% of the N\$ 3,534,000 available, a new capital cost i.e. CoW co-financing will be N\$ 209,800, a significantly lower amount. This option yields a payback period of just 4 years, a return on investment of 239% (project life) or 15.93% each year. This represents a very good value for investment for CoW as it will save the city 30,563 kWh/year corresponding to N\$ 43,399/year after the payback period. The summary of complete results is shown in table 7.

EMO 4: Option 2: Target whole Project

The number of units are the same as under EMO 2, consuming 96,646 kWh/year at an average cost of N\$ 137,238 /year. Replacing them will save 34,063kWh/year and a corresponding N\$ 48,369/year in energy costs.

Table 8 HVAC Replacement Analysis - CoW + EELA Co-Financing Option 2: ED

New equipment		Operational			New Equipment Costs			Potential Annual Savings			Financial Analysis			
Number of New AC Units	Average Energy Use [kWh/year]	Energy Costs [N\$/year]	New AC Units (N\$)	Labour (N\$)	Maintenance Costs (N\$/year)	Energy (kWh)	Costs (N\$)	Maintenance (N\$/year)	Capital Cost (N\$)	Simple Payback	ROI	NPV (N\$)	IRR	PI
47	62,583	88,868	798,200	221,605	11,750	34,063	48,369	4,700	(1,019,805 - 764,853.75) = 254,951.25	5 years	212.23%	199,293	20.35%	1.78
**Total project Costs: N\$ 1,019,805 ** N\$ 764,853.75 = 75% of EELA facility can be applied for and N\$ 254,951.25 = 25% CoW co-financing.														

The Capital cost of this intervention before EELA co-financing is considered stands at N\$ 1,019,805. Applying for the maximum 75% of the N\$ 3,534,000 available, a new capital cost i.e. CoW co-financing will be N\$ 254,951.25, a relatively significantly lower amount. This option results in a payback period of just 5 years, a return on investment of 212.23% (project life) or 14.149% each year. This represents a very good value for investment for CoW as it will save the city 34,063kWh/year corresponding to N\$ 48,369/year after the payback period. The summary of complete results is shown in table 8.

3 Head Office

Table 9 Existing HVAC Load: Head Office

Existing HVAC quantity	OPERATIONAL		
	Average Energy Use [kWh/year]	Energy Costs [N\$/year]	Maintenance Costs [N\$/year]
230	411,915	584,919	80,500

The HO had 230 HVAC functional units at the time of conducting this audit. In terms of energy, the existing HVAC load accounts for about 411,915kWh per/year on average (table 9).

3.1 Proposed Energy efficiency Strategy

The recommended HVAC load for Head Office consists of the same number of units as existing. The new units are estimated to account for 277,750 [kWh/year], which represents a potential saving opportunity of 134,165kWh per annum. The complete details are summarised in table 10.

3.2 Costs for implementing the energy efficiency strategy
EMO 2: CoW financing alone

Table 10 HVAC Replacement Analysis CoW Financing alone – Head Office

New equipment	Operational		New Equipment Costs			Potential Annual Savings			Financial Analysis					
	Average Energy Use [kWh/year]	Energy Costs [N\$/year]	New AC Units (NS)	Labour (N\$)	Maintenance Costs (N\$/year)	Energy (kWh)	Costs (N\$)	Maintenance [N\$/year]	Capital Cost (N\$)	Simple Payback	ROI	NPV (N\$)	IRR	PI
230	277,750	394,405	3,636,300	1,084,450	57,500	134,165	190,514	23,000	4,720,750	22 years	-32%	-2,893,184	-4.507%	0.39

Again, although there are significant potential energy savings, this project is not economically viable with CoW Funding alone, it will never yield a positive return on investment for the duration of the project (15 years). Payback is expected only after 22 years, long after some units have already reached the end of their equipment life. The complete analysis results are summarised in table 10.

EELA CO-FINANCING OPTIONS

Conditions for Funding: Identical to chapter above (2.2).

EMO 3: Option 1: Target old and less efficient HVAC Units

These were found to be 174 units consuming an average 202,083 kWh/year at an average cost of N\$ 286,958/year. Replacing them will save 112,447 kWh/year and a corresponding N\$ 159,674/year in energy costs.

Table 11 HVAC Replacement Analysis - CoW + EELA Co-Financing Option 1: Head Office

New equipment	Operational		New Equipment Costs			Annual Savings			Financial Analysis					
	Average Energy Use [kWh/year]	Energy Costs [N\$/year]	New AC Units (NS)	Labour (N\$)	Maintenance Costs (N\$/year)	Energy (kWh)	Costs (N\$)	Maintenance [N\$/year]	Capital Cost (N\$)	Simple Payback	ROI	NPV (N\$)	IRR	PI
174	202,083	286,958	2,676,100	820,410	43,500	112,447	159,674	17,400	(3,496,510 - 2,607,382.5) = 889,127.5	5 years	199%	626,535	18.32%	1.70

**Total project Costs: N\$ 3,496,510 **N\$ 2,607,382.5 = 75% of EELA facility can be applied for and N\$ 889,127.5 = 25% CoW co-financing.

The Capital cost of this intervention before EELA co-financing is considered stands at N\$ 3,496,510. Applying for the maximum 75% of the N\$ 3,534,000 available, a new capital cost i.e. CoW co-financing will be N\$ 889,127.5, a relatively significantly lower amount. This option yields a payback period of just 5 years, a return on investment of 199% (project life) or 13.267% each year. This represents a very good value for investment for CoW as it will save the city 112,447kWh/year corresponding to N\$ 159,674/year after the payback period. The summary of complete results is shown in table 11.

EMO 4: Option 2: Target whole Project

The number of units are the same as under 3.2 (EMO 2), consuming 411,915 kWh/year at an average cost of N\$ 584,919/year. Replacing them will save 134,165kWh/year and a corresponding N\$ 190,514/year in energy costs.

Table 12 HVAC Replacement Analysis - CoW + EELA Co-Financing Option 2: Head Office

New equipment		Operational			New Equipment Costs			Potential Annual Savings			Financial Analysis			
Number of New AC Units	Average Energy Use [kWh/year]	Energy Costs [N\$/year]	New AC Units (N\$)	Labour (N\$)	Maintenance Costs (N\$/year)	Energy (kWh)	Costs (N\$)	Maintenance (N\$/year)	Capital Cost (N\$)	Simple Payback	ROI	NPV (N\$)	IRR	PI
230	277,750	394,405	3,636,300	1,084,450	57,500	134,165	190,514	23,000	(4,720,750- 3,534,000) = 1,186,750	6 years	170%	640,816	16.07%	1.54
** Total project Costs: N\$ 4,720,750 ***N\$ 3,534,000 =100% of EELA facility maximum which is 75% of total project costs can be applied for and N\$ 1,186,750 = 25% CoW co-financing														

The Capital cost of this intervention before EELA co-financing is considered stands at N\$ 4,720,750. Applying for the maximum of N\$ 3,534,000 available, a new capital cost i.e. CoW co-financing will be N\$ 1,186,750, a relatively significantly lower amount. This option results in a payback period of just 6 years, a return on investment of 170% (project life) or 11.333% each year. This represents a very good value for investment for CoW as it will save the city 134,165 kWh/year corresponding to N\$ 190,514/year after the payback period. The summary of complete results is shown in table 12.

Targeting the whole project is the best option because the SEER 14 units will be deemed inefficient in the next 5-7 years given the current trends in HVAC energy efficiency technology. Additionally, after the CoW's initial investment is paid off, this option has the most energy savings for each facility. Therefore, EMO 4: CoW + EELA Co-Financing option 2 is recommended.

The quotations from which new equipment and service costs were based is attached in the pdf version of this report.

SECTION F: Recommendations for Specific Energy Management Opportunity (EMO): Refrigeration

The refrigeration found in the two facilities varies from the brand new to the very old and outright outdated. Some fridges dates back to the 1990s, which by today's standards, are considered obsolete. The new refrigerators are a mixture of energy star rated and none rated ones. The energy star rated ones belongs to substandard classes such as B or C.

Most refrigerators in the two facilities are privately owned by the employees and are not the property of CoW. Those found in common areas (kitchens) may be owned by the CoW but most aren't used as employees prefer to have their own in the offices.

Electricity Department

Table 13 Existing Refrigeration Load: ED

Existing Refrigerators quantity	OPERATIONAL	
	Average Energy Use [kWh/year]	Energy Costs [N\$/year]
13	23,555.64	33,449.01

The existing refrigerators in the ED consumes 23,555.64 kWh/year, at a cost of N\$33,449.01. Replacing them with at least A+ equivalent units will save the City 20,127.64 kWh annually, corresponding to N\$28,581.25 saved over the same period. The complete summary of the results are shown in table 14.

The quotation from which new equipment costs were based is attached in the pdf version of this report.

Table 14 Proposed Refrigeration Replacements: ED

New equipment		Operational		New Equipment Costs		Annual Savings		Financial Analysis					
Number of New fridge Units	Energy star Rating	Average Energy Use [kWh/year]	Energy Costs [N\$/year]	Fridges	Costs (N\$)	Energy (kWh)	Costs (N\$)	Capital Cost (N\$)	Simple Payback	ROI	NPV (N\$)	IRR	PI
13	A+	3,428	4,868	70,396	28,581.25	20,127.64	70,396	70,396	2.46	427.81%	155,504	40.09%	3.21

Town house

Table 15 Existing Refrigeration load: Town House

OPERATIONAL	
Existing Refrigerators quantity	Energy Costs [N\$/year]
51	113,055.29

The existing refrigerators at Town House consumes 79,616.40 kWh/year, at a cost of N\$113,055.29. Replacing them with at least A+ equivalent units will save the City 69,563.40 kWh annually, corresponding to N\$98,780.03 saved over the same period, table 16.

Table 16 Proposed Refrigeration Replacements: Town House

New equipment		Operational		New Equipment Costs		Annual Savings		Financial Analysis					
Number of New fridge Units	Energy star Rating	Average Energy Use [kWh/year]	Energy Costs [N\$/year]	Fridges	Costs (N\$)	Energy (kWh)	Costs (N\$)	Capital Cost (N\$)	Simple Payback	ROI	NPV (N\$)	IRR	PI
51	A+	10,053	14,275.26	215,368	98,780.03	69,563.40	215,368	215,368	2.18	496.25%	565,367	45.52%	3.63

Assumptions:

- 1 Fridges are operating the whole year i.e. 365 days as observed during the walkthrough exercise.
- 2 Average Price per kWh = N\$ 1.42
- 3 Discount rate 8%
- 4 A project life of 13 years is applied. However, in most cases fridges last between 10-20 years, but on average, the refrigerator will become less efficient after 13 years.

Notes:

The refrigerators are mostly privately owned, except for the ones in the Leisure hall/restaurant. It is therefore not known to the consultant whether the employees will commit to these investments. Furthermore, between the walkthrough exercise and the time of submitting this report, employees who did not have fridges then may have now brought in new fridges in their offices. Equally, some employees may have as well taken their fridges home or replaced them with different units than the ones recorded during the walkthrough. Nevertheless, due to significant energy saving potential that exists, the CoW is advised to implement an institution wide policy that accomplishes two goals:

1. Institute common tea areas for every division/department equipped with energy star rated refrigerators between A+ and A+++.
2. (a) Gradually phase out the use of personal refrigerators in the offices or else those who want to continue the practice MUST necessarily acquire A+ or better class refrigerators. (b) Completely phase out the use of personal refrigerators in the offices.

Refrigerators were identified as some of the baseline loads that runs 24/7 even when some were completely empty. For instance, the ones in the leisure area in the ED were empty and at the time of conducting this audit exercise, they appear not to have been in use for quite some time, but yet they were running 24/7. They need to be switched off after the end of events.

1 Miscellaneous Loads - Recommendations on EMOs

As per the definition of miscellaneous loads in this report, miscellaneous loads for which there exist energy saving opportunities includes loads such as kettles and microwaves. In the local market, there exists 900W microwaves compared to the 1000 - 2000W

microwaves currently used. On the other hand, the local market has 1850W kettles compared to the 2000 -2200W kettles in use currently. However, the international market has kettles of 1200W which may provide a better energy efficiency, however, at comparably higher prices.

However, since these loads are only used on demand for relatively shorter periods, it is not realistically possible to approximate how much energy they consume and what impact the possible replacements may have on the overall energy consumption of each facility. For these reasons, these loads were not a priority of this exercise and no further strategies will be proposed for action.

2 Considerations for Implementation Planning

The aim of this section is to briefly suggest the best ways the identified energy efficiency measures can be implemented within a reasonable timeline.

In general, the CoW need to establish a company-wide energy management plan with quantifiable energy targets monthly or yearly. This strategic energy management plan perhaps to be championed by the Electricity Department, is to at least include but not limited to the following:

- 1) **Develop an energy use profile** - An energy use profile will demonstrate how energy use is distributed among a number of building systems such as, lighting, HVAC, office equipment, heating, refrigeration, etc. Sub-metering can be provided for discrete building systems to further distinguish the performance of these systems and to help identify further energy saving opportunities. Breaking down energy consumption data by discrete systems allows a more strategic approach to targeting EE efforts.
- 2) **Build teams, get leadership support, and assign EE specific resources** - Create a multi-disciplinary (multi-stakeholder) energy team with representatives from departments that share responsibility for energy planning, usage, and management.
- 3) **Train, educate, and empower** - Effectively communicate the need for energy management and providing training and guidance on how to implement specific strategies will help the CoW to achieve greater EE and gain more support for such initiatives. Success is easier to achieve when employees are educated on the reasons for any changes (the goals), trained on work practice changes, and regularly informed on how action plan progress is matching up to goals.

- 4) **Track, measure, and report** - It's important to begin to track the energy reductions for several reasons: (1) to verify they are meeting the intended goal, (2) to track cost and operational savings, (3) to monitor staff satisfaction, and (4) to report on all successes or failures in order to inform the next steps and CoW's traction in preparation for the next project.
- 5) **Implement projects** - Execute EE measures that will result in energy and consumption reductions for the facilities.

Evidently, energy management is never a once off exercise; it requires a coordinated effort that seeks to both reach short- and long-term goals

Therefore, the following action plan is recommended:

- (a) **Short term** – measures with no or relatively low investment are recommended to be implemented right away with the benefits expected almost immediately.
 1. It is recommended that behavioural measures should be implemented right away. Build on the success of the awareness campaign and improve on the missed targets.
 2. Lighting – it is recommended that the retrofits be implemented right away. For the ED, a payback period of just 2.95 years is expected and a return on investment of 239.11% (project life), and potential savings of 31, 516 kWh corresponding to N\$44,753 expected thereafter. For Head Office, a payback period of 2.4 years is expected and a return on investment of 324.78% (project life), and potential savings of 175, 849 kWh corresponding to N\$249,707. These are good investments, but payback could be reduced to just 2.3 years if the facilities are treated as one project.
- (b) **Long term** – projects that have a payback period from 5 years and more are regarded as long-term projects. The recommended HVAC replacement projects (EMO 4) have a combined payback period of up to 11 years, which is a long-term commitment. This option has initial investments of N\$ 254,951.25 and N\$ 1,186,750 for ED and HO respectively. It is recommended that the CoW take advantage of the EELA co-financing facility before it expires on 31 December 2021. Due to this expiration date, the short- and long-term investments may have to be carried out in parallel. Conversely, the long-term investment may have preceded the lighting retrofits to take advantage of this funding opportunity.

However, if the CoW cannot commit to these initial investments, there is a second option (EMO 3), still making use of the EELA co-financing facility but only targeting old and less efficient HVAC units of SEER ratings below 14. Although not ideal, it also provides good energy savings potential at lower initial investments of N\$ 209,800 and N\$ 889,127.5 for ED and HO respectively, with payback expected after 4 years for ED and 5 years for HO. For both options, combining the projects yields shorter payback periods.

Normally, the short-term investment should precede the long term investment. However, because the EELA co-financing facility is closing by 31 December 2021, if the CoW have the resources to commit to both projects (lighting retrofits + HVAC replacement) simultaneously, it is recommended that the projects be implemented concurrently, preferably with the tender given to one company to allow for possible discounted rates/prices negotiations.

3 Conclusion

An Energy Audit of City of Windhoek's Head Office and Electricity Department was conducted to determine the consumption profiles and identify energy efficiency ways of reducing the overall energy consumption of the two facilities. The facilities have a lot of aged and energy inefficient equipment such as refrigerators, HVAC units and lamps (incandescent & FTLs) which were found to be of significant energy wastage.

The culture of energy conservation is also not yet adopted by all employees as some leave their offices with running air conditioners, sitting in the office with a well-functioning air conditioner but opening the door and/or windows also, unoccupied offices with lights left switched on and empty fridges running 24/7.

There is also a lack of automation, given the current trend of technology in lighting, there is a need to retrofit existing lamps with LED lights coupled to PIR motion sensors to automate the switching on/off of all lighting systems.

It is believed that should the CoW implement the recommended energy efficiency measures, substantial energy savings are expected and corresponding reduction in operational costs. It is hoped that this study has laid the foundation for the CoW to foster its demand side management framework and/or EE policy moving forward.



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Quote

Date 01/09/2021
 Quote No 3875
 Your Reference Aircon Service
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Namiba University
 P.O Box. Namibia
 13388
 Windhoek

Code	Description	Qty	Unit Price	Amount	Vat
Labour 1	Service of Aircon	1	250.00	250.00	S
Gas R32	Gas R32	1	250.00	250.00	S
<p>*Please find quote on services of Aircons based on all units service and will not apply if less than 50 units. *Gas is quoted additional as not all aircons will require gas as part of the service, but we check gas levels as part of the service. *Please note that this exclude all additional parts or labour.</p>					

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VAT Total N\$65.22

Total N\$500.00

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Quote

Date 24/02/2021

Quote No 3159

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Account

Penti Paulus
 Lab Technician
 Electrical & Computer Engineering
 Namibia University of Science and Technol
 pepaulus@nust.na

Code	Description	Qty	Unit Price	Amount	Vat
Aircon	Aircon-9000 BTU-Inverter R32 MIDWALL	1	12,453.10	12,453.10	S
Aircon	Aircon-12000 BTU-Inverter R32 MIDWALL	1	13,282.50	13,282.50	S
Aircon	Aircon-18000 BTU-Inverter R32 MIDWALL	1	18,867.20	18,867.20	S
Aircon	Aircon-9000 BTU-Inverter R32 MIDWALL	1	23,018.70	23,018.70	S
Labour l	Installation Back-To-Back(New)	1	2,550.00	2,550.00	S
Labour i	Installation Replacement of old unit	1	1,550.00	1,550.00	S
	*				

Banking Details:
 FNB N/Industrial
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Subtotal N\$62,366.52

VAT Total N\$9,354.98

Total N\$71,721.50

Company VAT Reg.

534 5717 15



10 Edison Street, Southern Industrial Area, Windhoek, Namibia
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 Email: info@megatech.com.na
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Quotation

Cash Customer
 CASH SALES ACCOUNT
 0

Document Number: 0001/ 218778

Date: 3rd March 2021 16:36

Account: CASHIER

VAT Reg No.:

Order No.:

STOCK CODE	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE (EXCL)	DISC%	TOTAL PRICE (EXCL)
BU10899	LED TUBE 18W T8 4FT 6500K RD - RLL007	1	EA	54.3800		54.38
LF76058	4FT LED OPEN CHANNEL DOUBLE - BR FTL006	1	EA	131.9300		131.93
BU10627	LED 9W E27 A60 865 6500K	1	EA	18.9500		18.95
BU10823	LED 7W E27 STICK 4000K OSR - 4058075067456	1	EA	21.2300		21.23
LF90059	FLOODLIGHT LED 50W 6500K - RAD RFS61 / LSF0903	1	EA	194.2700		194.27
LF10025	MOTION SENSORS INFRARED 360° CEILING MT-PIR36	1	EA	172.5800		172.58
BU10970	LED TUBE 16W T6 4FT 6000K BRI - BULB LED 203	1	EA	51.0300		51.03

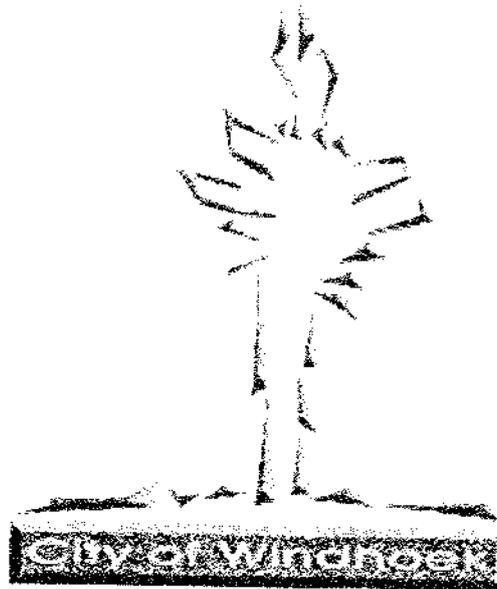
CREATED BY Ane Coetzee	LAST OPERATOR CODE Ane Coetzee	QUOTE NUMBER 218778	PAGE 1
QUOTE EXPIRES 02/04/2021	CONTACT Cash Customer		

Prices subject to material adjustment. Subject to stock availability.
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 No returns or credit on special ordered goods. No cut lengths cables may be returned for credit.
 Prices are ex Works 10 Edison street, unless specified otherwise

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VAT: N\$	96.66
TOTAL: N\$	741.03

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CITY OF WINDHOEK

COUNCIL REPORT: ENERGY SAVINGS BEHAVIORAL
METHOD

Department of Electricity
Systems and Protection
City of Windhoek
P O Box 59
Windhoek

27 April 2022

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1. Behavioural Method

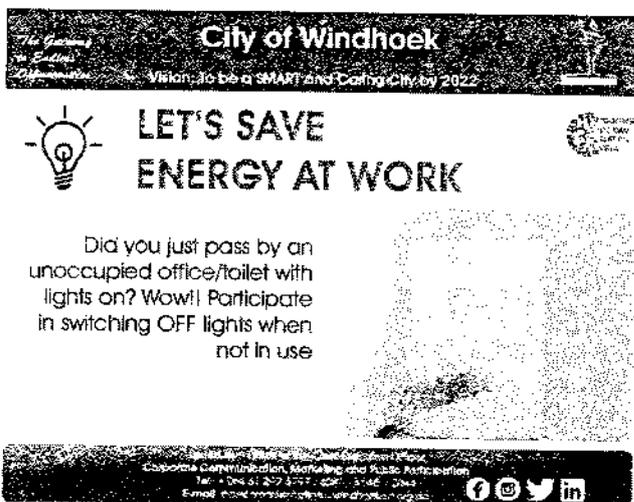
The behavioural methods for energy saving are not financially intensive as they only concentrate on human behaviour. This can be accomplished when the organisation works together as a unit to save energy by being responsible for their actions with regards to power conservation.

Below is some of the methods that were communicated during the roadshow:

- a) Unplugging all appliances or drop cords that are barely used.
- b) Switching air conditioners ON after 9h00 or 10:00 A.M to take advantage of the cooler morning hours
- c) Collectively having coffee/tea sessions in various divisions
- d) Participating in switching OFF lights when not in use
- e) Using natural lighting whenever possible
- f) Using common refrigerators (to be discussed)
- g) Surveying the office including neighbouring offices to identify any appliance that is ON and not in use. Especially the last man leaving the office.
- h) Properly planning tasks that draw large amounts of power i.e. welding to avoid repetition
- i) Encouraging the use of the elevator only for more than two floors up

2. Circulated energy savings methods

Below is a constant and continuous communique serving as a reminder to the organisation to save energy :



The poster is for the City of Windhoek and features the following text and graphics:

- Header:** City of Windhoek, Vision: to be a SMART and Doing City by 2022.
- Graphic:** A lightbulb icon with the text "LET'S SAVE ENERGY AT WORK".
- Main Text:** "Did you just pass by an unoccupied office/toilet with lights on? Wow! Participate in switching OFF lights when not in use".
- Image:** A photograph of a person's hand flipping a light switch.
- Footer:** Corporate Communication, Marketing and Public Relations, Tel: +264 61 297 277 / 229 / 3146 / 3144, Email: corporate@windhoek.na, www.windhoek.na. Social media icons for Facebook, Instagram, Twitter, and LinkedIn.



LET'S SAVE ENERGY AT WORK



Martha: John, please you can use this fridge. Use common refrigerators wherever possible



LET'S SAVE ENERGY AT WORK



Last man standing: Survey the office space and corridors including neighbour offices to identify and switch OFF any appliance that is ON and not in use. Especially the last person leaving the office.



LET'S SAVE ENERGY AT WORK



Collectively have coffee/tea sessions in various divisions (maybe at 10h00), this improves productivity through improved communication. And saves energy drawn by the kettle

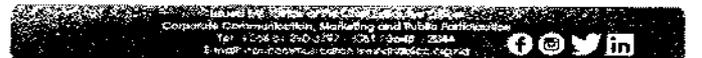


Figure 1 Energy saving methods

3. Results interpretation

Below is the results in energy savings achieved by the behavioural change energy saving method after conducting the energy roadshow in late 2020. The results are the reduction in energy consumptions recorded by the various electricity meters at the various City of Windhoek (CoW) centres

	Month	Total savings Monthly (N\$)	projected savings yearly (N\$)	projected savings 30 years (N\$)
2021	July	4,011.95	48,143.43	1,444,303.01
	August	36,540.11	438,481.38	13,154,441.33
	September	11,889.36	142,672.34	4,280,170.18
	October	2,183.35	26,200.16	786,004.85
	November	100,356.88	1,204,282.54	36,128,476.08
	December	49,234.33	590,811.91	17,724,357.22
2022	January		-	-
	February	78,208.09	938,497.06	28,154,911.68
	March	-	-	-
	April			
Total		282,424.07	3,389,088.81	101,672,664.34

Table 1 Organisational savings

4. Energy Champions

The energy roadshow campaign has selected energy champions for the CoW based on the efforts they put in to save energy. They are chosen as on a percentage-based difference between the previous consumption recorded in the previous month and the recent consumption for the focus month. The Energy Champion are presented with a Floating Trophy that rotate on a monthly basis. Below is the list of energy champions.

	Month	Total savings Monthly (N\$)	projected savings yearly (N\$)	savings (%)	Energy Champions
2021	July	2,374.04	28,488.42	20.11	Okuryangava centre
	August	150.97	1,811.68	14.55	Khomasdal centre
	September	1,854.82	22,257.79	39.90	Wanaheda centre
	October	636.4188	7,637.03	7.25	Solid waste
	November	636.4188	7,637.03	7.25	Single quarter
	November	33,374.38	400,492.54	84.68	City Police newcastle
	December	2,597.89	31,174.67	20.40	Okuryangava centre
	2022	January	Data being analyzed	Data being analyzed	
February		2,182.32	26,187.85	31.96	Diaz Fire station
March		Data being analyzed	Data being analyzed	-	Data being analyzed
April					
Total		43,807.25	525,687.00	226.10	

Table 2 Energy Champion savings

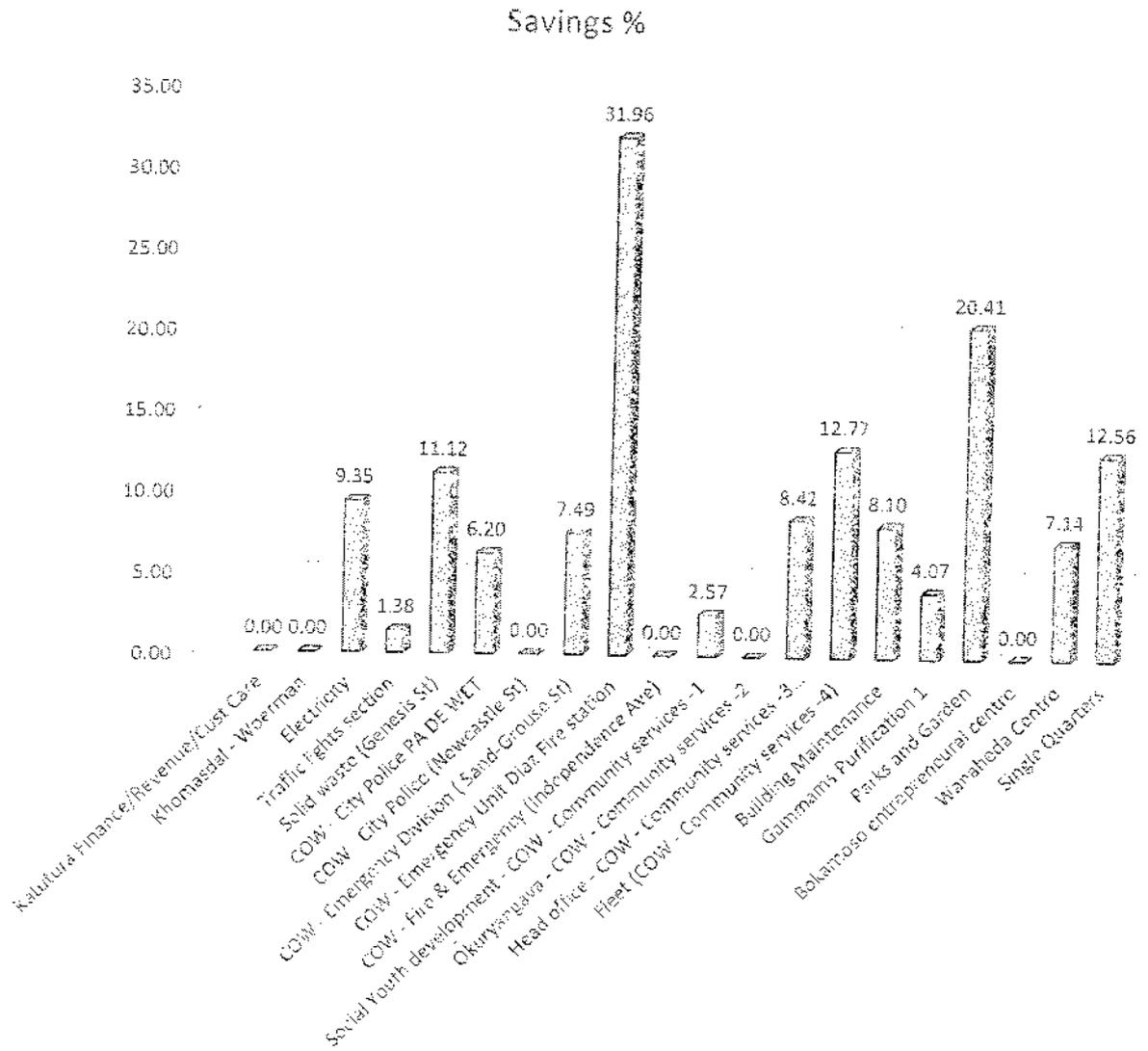


Figure 2 Graphical representation of various centres (February 2022)

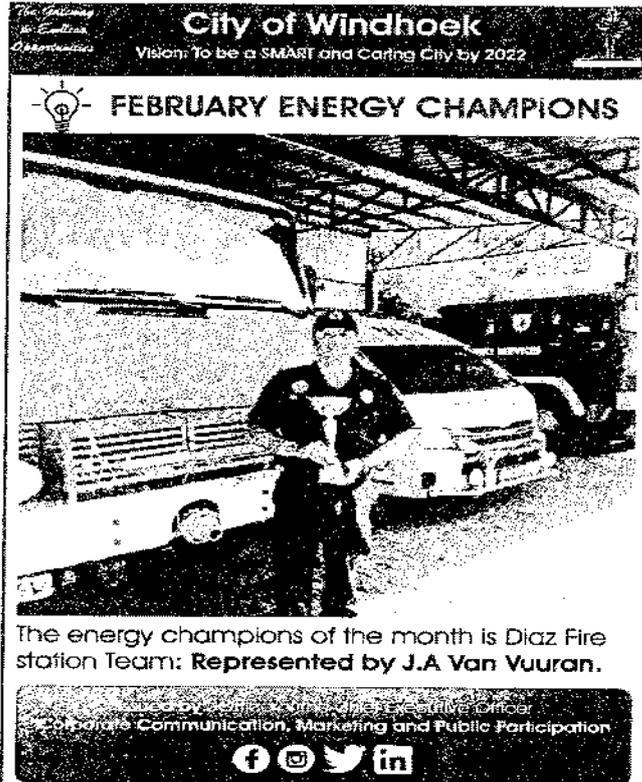


Figure 3 Energy Champions for February 22: Diaz Fire station



Figure 4 Energy Champions for July 2021: Okuryangava center

5. Conclusions

Various centres have whole heartedly taken part in the initiative with some centres becoming energy champions more than ones (i.e. Okuryangava customer care centre). Others continue to work hard at energy savings to be eventually crowned as champion one day.

The initiative results look promising as seen from the results and CoW hopes that it will continue to drastically improve the results now and in the next financial year. The Electricity Department will keep on monitoring energy savings for the various building through the Floating Trophy initiatives as a way of cultivating the culture of energy savings.

Table 1: Capital investment and savings to be made for the Department of Electricity's building

New equipment		Operational			New Equipment Costs			Annual Savings			Financial Analysis					
No of fixtures	No of lamps	Type of New Control	No of New Controls	Average Energy Use [kWh/year]	Energy Costs [NS/year]	PIR Occupancy [NS]	Fittings [NS]	Lights [NS]	Energy [kWh]	Costs [NS]	Capital Cost [NS]	Simple Payback	ROI	NPV [NS]	IRR	PI
312	645	PIR 360 deg. occupancy	131	0,336	11,909.1	20,820	43,764	26,992	31,516	44,753	194,870.00	2.95 Years	389.11%	1,68,525	51.0%	2.00

Table 2: Capital investment and savings to be made for the Head Office building

New equipment		Operational			New Equipment Costs			Annual Savings			Financial Analysis					
No of fixtures	No of lamps	Type of New Control	No of New Controls	Average Energy Use [kWh/year]	Energy Costs [NS/year]	PIR Occupancy [NS]	Fittings [NS]	Lights [NS]	Energy [kWh]	Costs [NS]	Capital Cost [NS]	Simple Payback	ROI	NPV [NS]	IRR	PI
1,580	2,701	PIR 360 deg. occupancy	441	29,663.5	56,322.1	95,500	210,293	445,406	175,049.5	149,707	587,543.70	2.4 Years	324.76%	1,06,770	42.1%	1.05



22 May 2020

For attention: The Chief Executive Officer

Re: CRITICAL NOTICE AFFECTING ALL STS PREPAYMENT METER USERS INCLUDING UTILITY SUPPLIERS

On 24 November 2024 all prepayment meters based on STS technology will stop dispensing electricity, thus presenting a significant risk to the service levels of all utility suppliers to end-user customers in the electricity, water and gas utilities business.

Each credit token has a unique token identifier (TID) encoded into the 20 digits to prevent token replay at the meter. The TID is referenced to a base date of 1993 and will run out of range in 2024 (known as the TID Rollover event), thus causing the prepayment meter to stop accepting new tokens.

The technical remedy is to "reset" each meter to reference a new base date of 2014 by means of entering two (2) special tokens before November 2024. This requires a substantial time, effort and resource loading on the part of the utility suppliers, so it is imperative that the remedial action process commences as a matter of urgency.

1 REMEDIAL ACTION

The STS Association advises utility suppliers to take the following steps as a matter of urgency:

- 1) Ensure that the prepayment token vending system and security modules are upgraded and certified to comply with the latest STS Edition 2 specifications. An STS Edition 2 certified vending system will be fully backward compatible with current installed meters. This needs to be done in collaboration with your vending system supplier.
- 2) Apply to the key management centre for a new supply group code (SGC) key that is linked to the new 2014 base date and load it into the vending system security module. Both the current and the new SGC are thus loaded together, enabling the vending system to vend to current meters on base date 1993 and also to new meters on base date 2014.
- 3) It has been a mandatory requirement for all meters to comply with the "reset" functionality from inception in 1993, but this could only be tested since 2014. There is thus a small risk that some meters which were certified prior to 2014 may not comply, so we recommend that these be re-checked on a sample basis. A list of suspect meters is available on the TID Rollover website. A sample of such meters can be sent to the STS Association to be tested and certified.
- 4) Once the vending system has been upgraded and certified to STS Edition 2, new meters purchased should be coded to the new base date of 2014. This will be done by the meter manufacturer, but the municipality has to specify this requirement on the tender document or purchase order.

- 5) Formulate an execution plan to visit each installed meter to insert the two special "reset" tokens. This part of the process requires the most resources and should not be underestimated. Two options can be considered:
- Issue the two tokens to the end customer when he does his next credit purchase. The customer then enters the two special tokens into the meter before entering the newly purchased credit token. A dedicated help-desk needs to deal with exceptions;
 - Make use of a dedicated task team that enters the two special tokens into each meter in the field. This method has the advantage that a technical audit can be performed on each meter and detect/remedy any fraud or faults at the same time;
 - A selective combination of the above two methods, depending on particular circumstances and customer demographics.

2 SUPPORT FROM THE STS ASSOCIATION

A help line, guidelines and reference documents may be found on the dedicated website <https://www.tidrollover.com> or an email may be sent to tid@sts.org.za.

The STS Association will also test sample meters (certified prior 2014) upon request and free of charge. Arrangements can be made by sending an email to tid@sts.org.za or via the website.

Yours faithfully



Don Taylor

Director

STS Association



STS ASSOCIATION

STS Association

STS 1800-3-1

Edition 1.0

November 2020

**Standard Transfer Specification – TID Rollover process –
Guidelines for Utilities**

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Revision History

Edition	Clause	Date	Change details from previous edition
1.0		03/11/2020	First publication

STANDARD TRANSFER SPECIFICATION ASSOCIATION

**STANDARD TRANSFER SPECIFICATION –
TID Rollover process – Guidelines for Utilities**

FOREWORD

- 1) The Standard Transfer Specification Association (STSA) is a worldwide organization for standardization comprising all members of STSA. The object of STSA is to develop, maintain and promote international use of the Standard Transfer Specification (STS). To this end and in addition to other activities, STSA publishes Standards, Technical Specifications, Technical Reports, Codes of Practice and Guides (hereafter referred to as "STSA Publication(s)"). Their preparation is entrusted to technical working groups; any STSA member interested in the subject dealt with may participate in this preparatory work. STSA collaborates closely with the International Electrotechnical Commission (IEC) in accordance with conditions determined by agreement between the two organizations. As such STSA performs the role of Registration Authority of IEC 62055-41, IEC 62055-51 and IEC 62055-52 on behalf of IEC.
- 2) The formal decisions or agreements of STSA on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each working group has representation from all interested STSA members.
- 3) STSA Publications have the form of recommendations for international use and are accepted by STSA Board of Directors in that sense. While all reasonable efforts are made to ensure that the technical content of STSA Publications is accurate, STSA cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 5) STSA provides attestation of conformity. Independent testing bodies provide conformity assessment services and recommendations to STSA Board of Directors who provides conformance certificates and access to STSA marks of conformity.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to STSA or its directors, employees, servants or agents including individual experts and members of its technical working groups for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this STSA Publication or any other STSA Publications.
- 8) Attention is drawn to the normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this STSA Publication may be the subject of patent rights. STSA shall not be held responsible for identifying any or all such patent rights.

INTRODUCTION

The Standard Transfer Specification (STS) is a secure message protocol that allows information to be carried between point of sale (POS) equipment and payment meters and it caters for several message types such as credit, configuration control, display and test instructions. It further specifies devices and codes of practice that allows for the secure management (generation, storage, retrieval and transportation) of cryptographic keys used within the system.

On 24 November 2024 all prepayment meters based on STS technology will stop accepting new credit tokens and will then stop dispensing electricity after existing credit is used up, thus presenting a significant risk to the service levels of all utility suppliers to end-user customers in the electricity, water and gas utilities business.

Each credit token has a unique token identifier (TID) encoded into the 20 digits to prevent token replay at the meter. The TID is referenced to a base date of 1993 and will run out of range in 2024 (known as the TID Rollover event), thus causing the prepayment meter to stop accepting new tokens.

The technical remedy is to "reset" each meter to reference a new base date of 2014 by means of entering two (2) special key-change tokens before November 2024. This requires a substantial time, effort and resource loading on the part of the utility suppliers, so it is imperative that the remedial action process commences as a matter of urgency.

This document specifies the TID Rollover process and recommended step-wise procedures to be followed by utilities to manage the TID Rollover project.

A help line, guidelines and reference documents may be found on the dedicated website <https://www.tidrollover.com> or an email may be sent to tid@sts.org.za.

STANDARD TRANSFER SPECIFICATION – TID Rollover process – Guidelines for Utilities

1 Scope

This document provides guidelines in terms of processes and procedures for utilities to follow to manage the TID Rollover process and take timeous remedial action before the 2024 TID Rollover event.

It describes procedures to follow to upgrade vending systems to STS Edition 2 in compliance with STS 001-1 in readiness for the execution of the TID Rollover process.

It also covers verification of meters that were certified prior to 2014.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

STS 001-1 Edition 1 2019: Standard Transfer Specification - Framework for STS Edition 2

3 Terms and definitions

For the purposes of this document, the terms and definitions given in STS 001-1 apply.

4 TID Rollover process

The TID Rollover process comprises 4 procedures and should be executed in the flow sequence as outlined in Figure 1.

Procedures "Prepare vending system" and "Check meter certification prior 2014" may be executed simultaneously, but the procedure "Execute TID Rollover key change" can only start after both the former procedures have been completed.

The procedure "Purchase new meters coded to base date 2014" is optional, but it can only start after the vending system has been prepared.

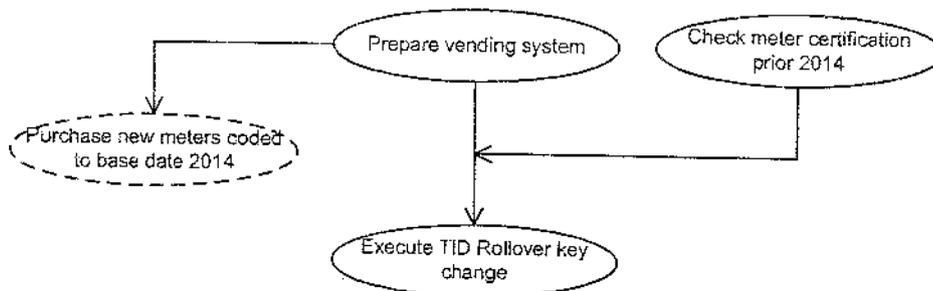


Figure 1 – Process for TID Rollover project execution

5 Prepare vending system

This procedure will prepare the vending system for compliance with STS Edition 2 and ensure its state of readiness for executing the TID Rollover key change.

Steps 1, 2 and 3 are the minimum required to prepare the vending system.

Steps 4, 5, 6, 9, 10 and 11 are optional and may be implemented by those utilities who wish to do an additional check of the actual process that will be followed in the field during the execution of the TID Rollover key change.

The flow diagram is given in Figure 2.

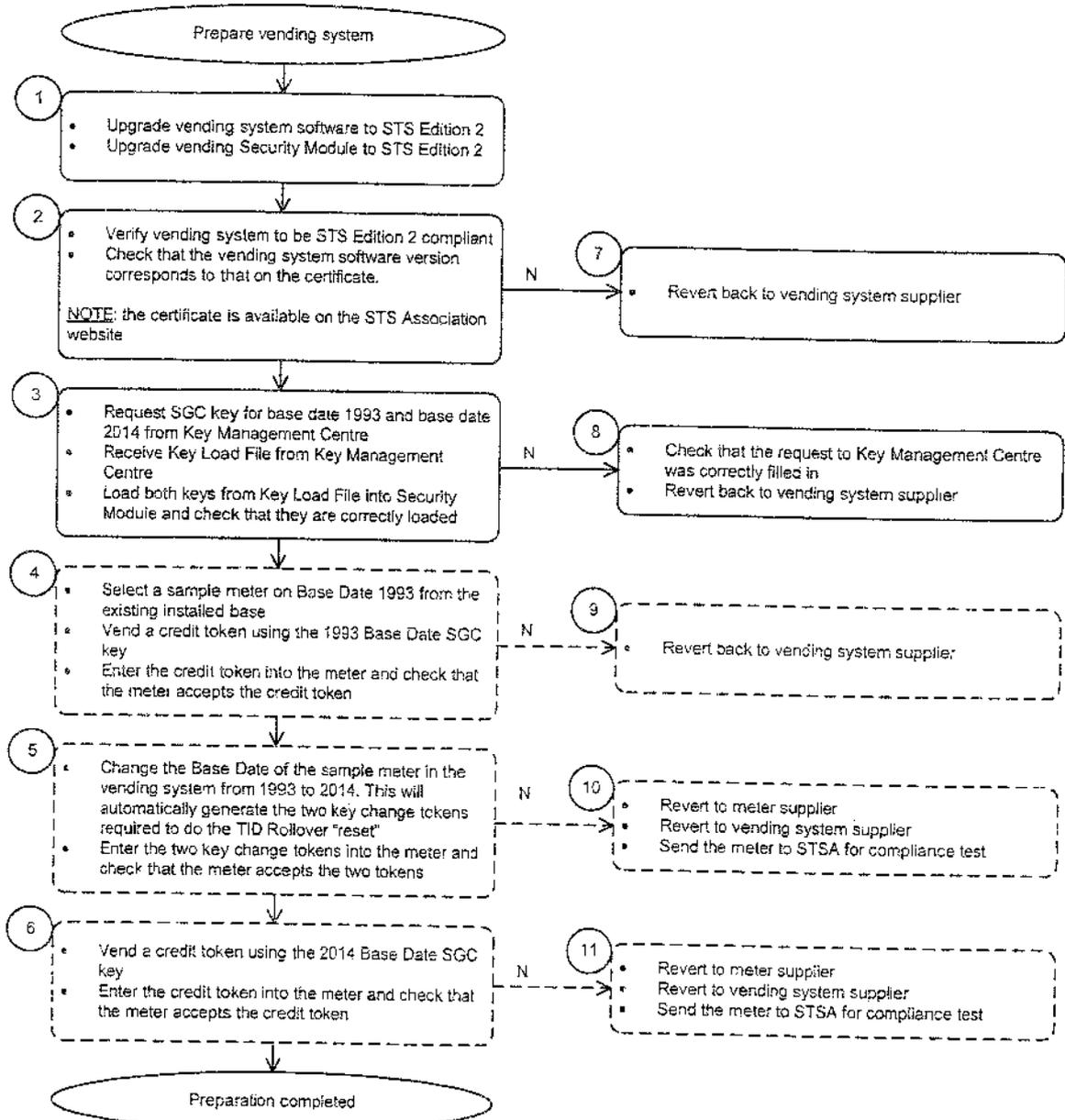


Figure 2 – Procedure for vending system preparation

6 Check meter certification prior 2014

Meters that were certified prior to 2014 could not be tested for TID Rollover compliance at that time as there were no security modules available that could generate the required TID Rollover key change tokens. There is thus a small risk that these meters might not comply. To mitigate this risk the utility is advised to check the installed base against the list of meters that were certified prior to 2014. This list is published on the TID Rollover website (www.tidrollover.com). If any such meters are identified in the installed base, a representative

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sample can be sent to the STS Association for re-testing free of charge. However, the cost of transport will be for the utilities account.

The flow diagram is given in Figure 3.

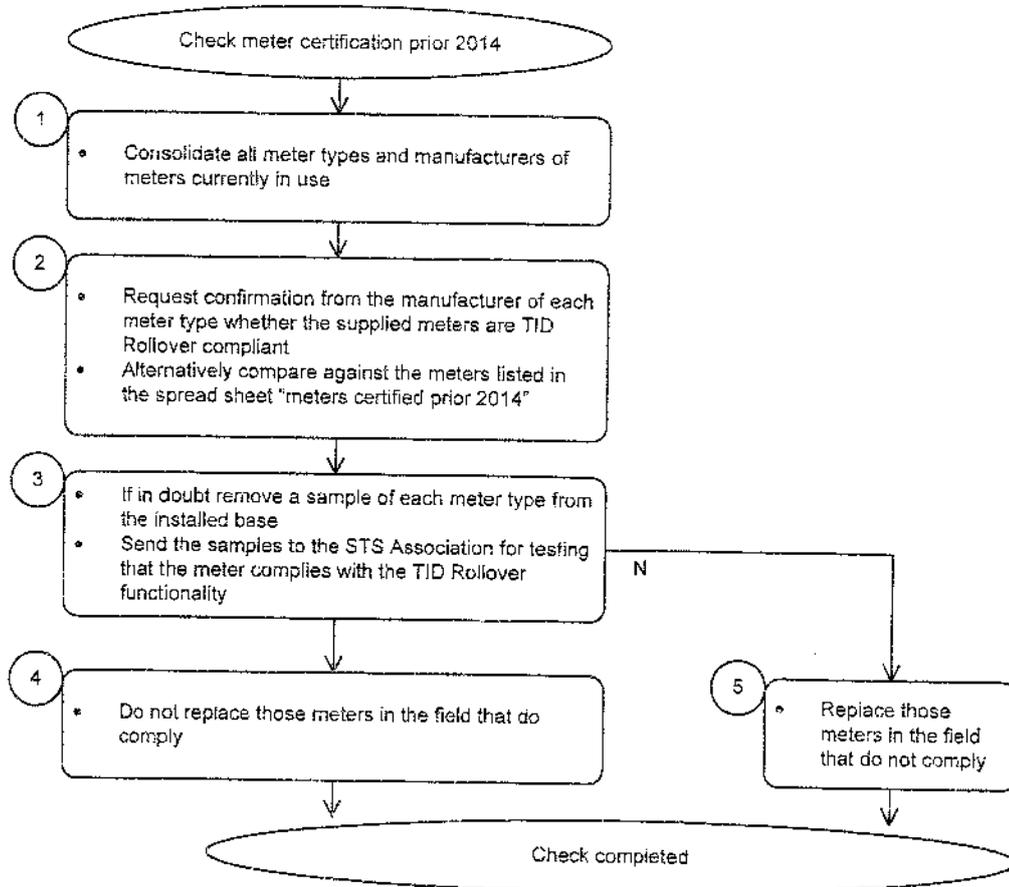


Figure 3 – Procedure to check meter certification prior 2014

7 Purchase new meters coded to base date 2014

This procedure is entirely optional and intended to be used by those utilities who wish to purchase new meters already coded to base date 2014.

Manufacturers should be contacted to ensure production readiness to manufacture meters using the 2014 base date.

In all cases new meters on base date 2014 should not be installed before the vending system has been upgraded and certified to comply with STS Edition 2.

New meters already coded on base date 2014 need not be key-changed during the TID Rollover key change execution.

Steps 3 and 4 may be optionally used to check that supplied meters are correctly coded to base date 2014.

The flow diagram is given in Figure 4.

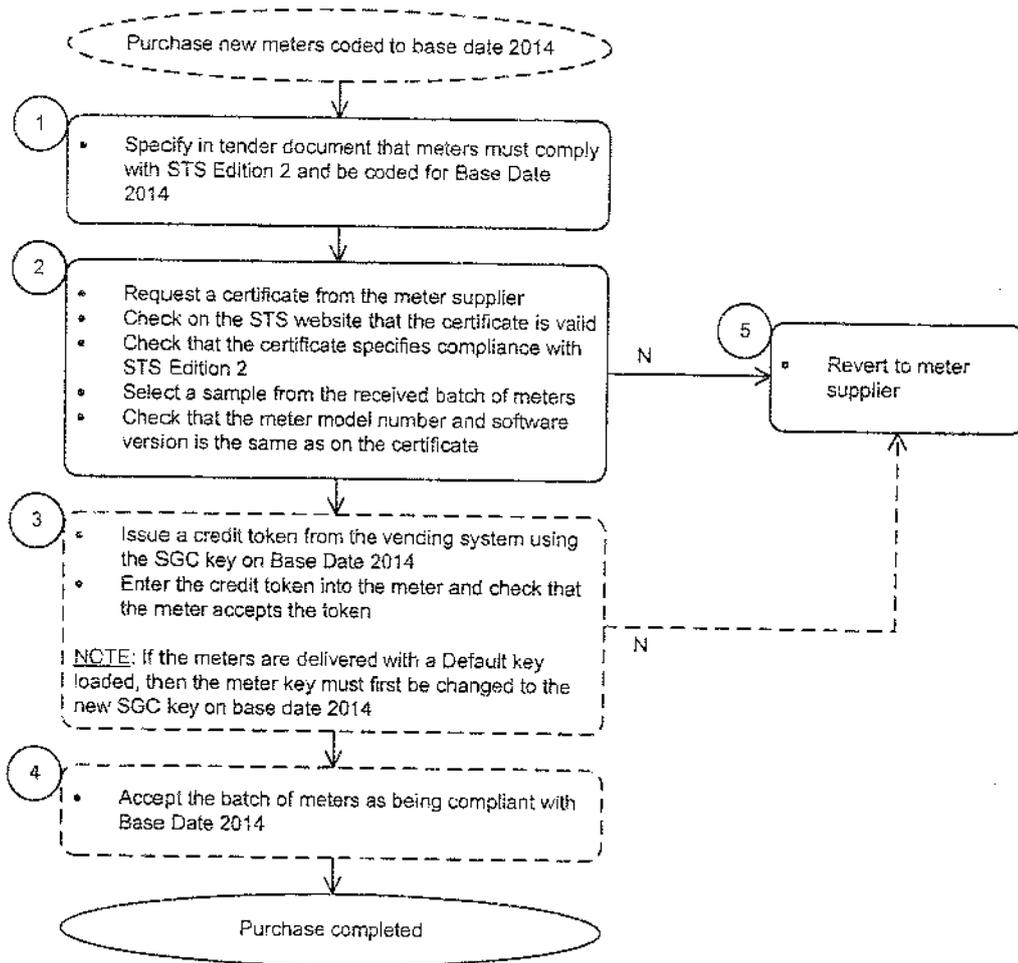


Figure 4 – Procedure to purchase new meters coded to base date 2014

8 Execute TID Rollover key change

This procedure presents two possible choices for entering the key change tokens into the meter. Option (4) makes use of a dedicated team, while option (5) makes use of the customer.

In practice the utility may use a combination of the two options, depending on the customer demographics.

Special note of caution:

After the TID Rollover key change tokens have been entered into the meter it will no longer accept credit tokens that were coded on base date 1993. It is thus important that all previously unused credit tokens are entered into the meter before the key change takes place.

The flow diagram is given in Figure 5.

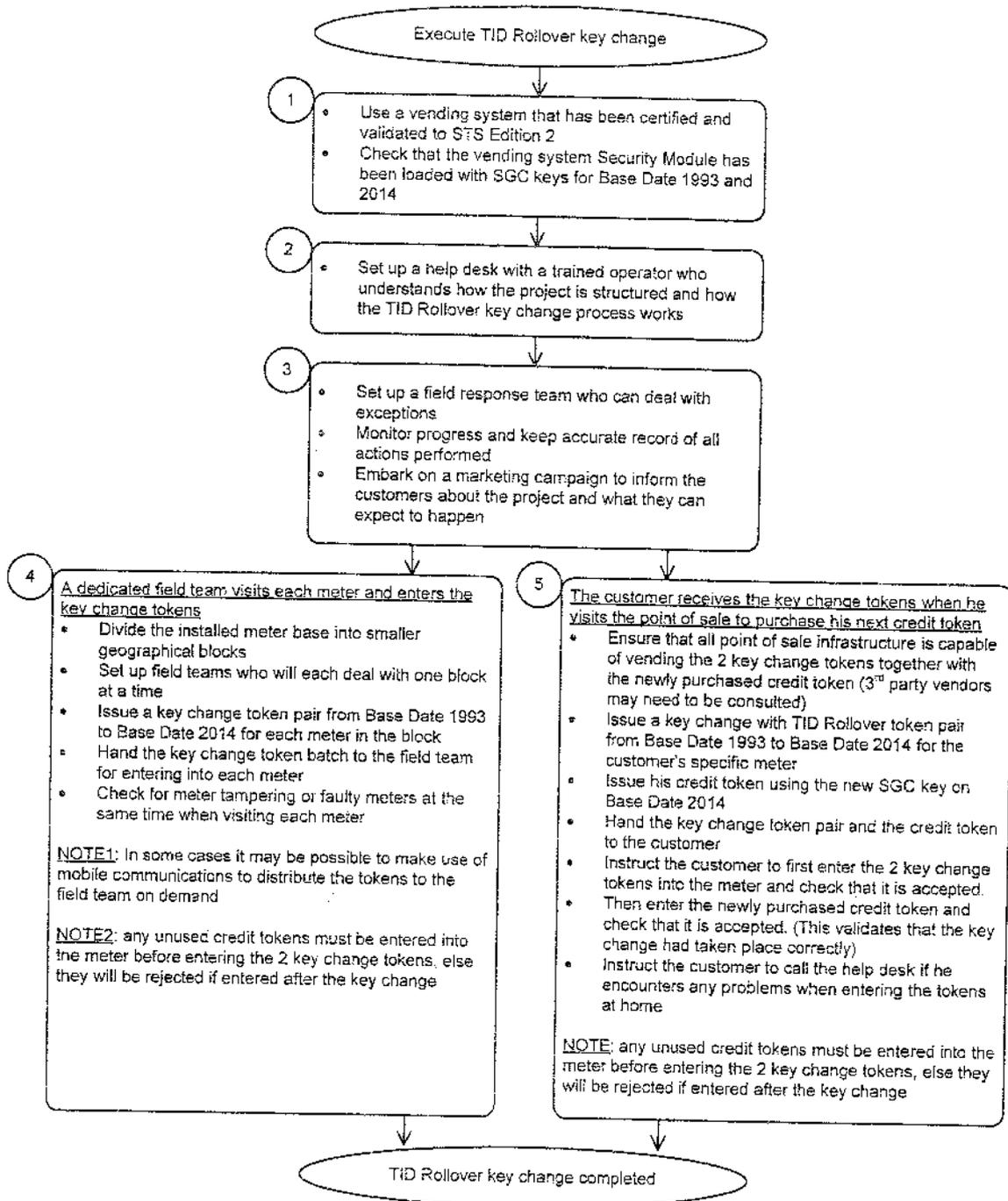


Figure 5 – Procedure to execute the TID Rollover key change

TID COMPLIANCE TEST CONFIRMATION MAIL AND REPORT OF THE TEN TESTED ELECTRICITY METERS

RE: Parcel has been delivered

Reply Reply All Forward

 Jason Faro <Jason@syntel.co.za>
To: Blaauw (H); Johannes (PA)
Cc: Etienne Thomas; Martin Moss; Usama (LK); Simuda (CS); Nizaam Dramat; Kavalata (M); Zahir Lalla

 You replied to this message on 2/23/2022 11:05.

 Windhoek TID results.xlsx
11 KB

Good Day all,

I trust this email finds you well.

Great news! All meters has passed the tests and accepts the TID change tokens. Attached is a summary of the test results.

If you want more details (images, tokens etc), please do not hesitate to contact me.

Kind regards,
Jason Faro
Metering Engineer – Revenue Systems
Syntel (Pty) Ltd
Helpdesk: 087 237 7011
Mobile: +27 84 010 8489
Office: +27 21 204 6397 (working from home)

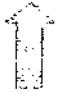
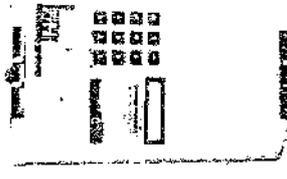
www.syntel.co.za

FIELD
TECHNICAIN
METHOD

Technician
Hand Held
Unit.



GPRS Connectivity
for REAL TIME
TOKEN
PROCESSING



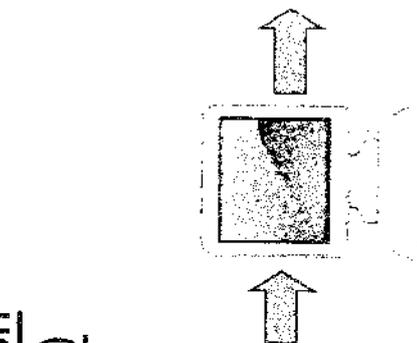
Technician / Auditor makes use of a
Hand Held Unit to produce the
required Tokens in REAL TIME

Technician / Auditor
enters the Tokens into
the Meter



CUSTOMER
APPROACH
METHOD

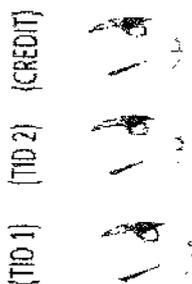
Vendor at
Vending
Terminal



Consumer Vending
Platform

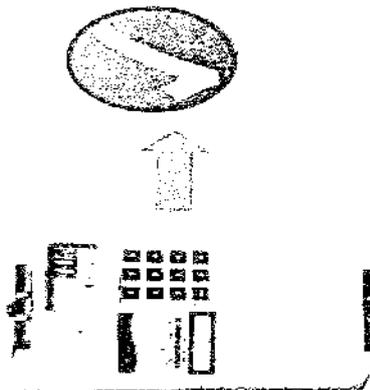


Three
Tokens
Vended



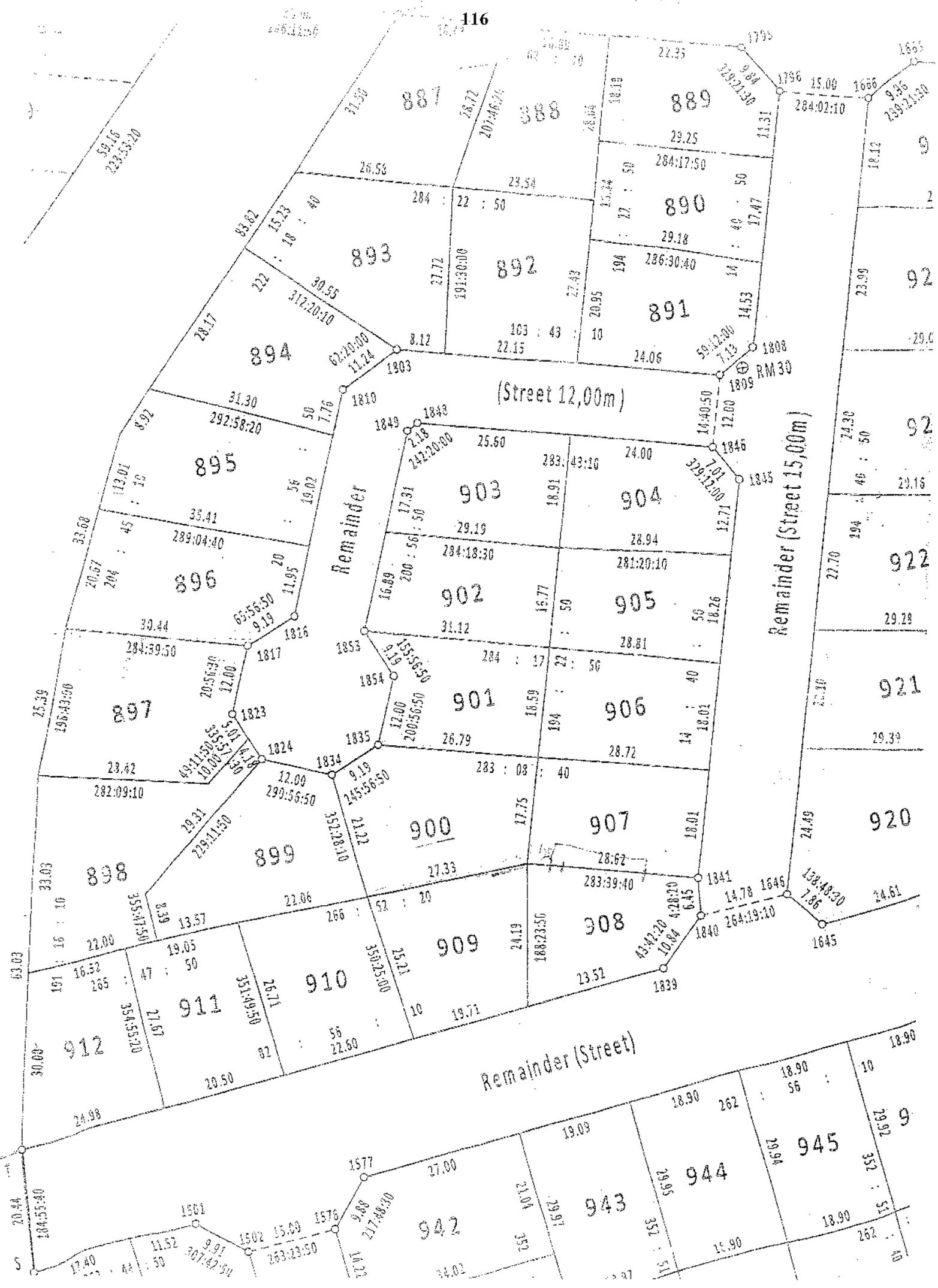
Consumer receives
Token for entry into the
Meter

(TID 1) (TID 2) (CREDIT)



Consumer enters the
Tokens into the Meter in
the correct sequence





(Street 12,00m)

Street 15,00m

Remainder (Street)

895

896

897

899

912

911

910

900

909

901

902

903

906

907

908

904

905

889

890

891

893

894

887

888

9

92

92

922

921

920

9

945

944

943

942

S

- 11 That if a purchaser default in payment, no repurchase or substitution of the purchaser of a property be allowed as long as the property is registered in the name of the City.
- 12 That approval be granted that 20 % of the two hundred and thirty one (231) single residential erven, being forty six (46) erven, be reserved for Council's employees.
- 13 That the resolution be implemented prior to confirmation of the minutes.

Financial implications

None

RESOLUTION 232/09/2019

[Municipal Council Minutes: 2019-09-26]

19.3.4

**FNS.3 [UTP] BUILDING LINE RELAXATION
DISPUTE ON ERF 3274, WINDHOEK –
OBJECTION FROM ADJACENT
NEIGHBOUR ERF 3275, WINDHOEK
(L/3274/W)**

On proposal by Councillor M Shiikwa, it was

RESOLVED

- 1 That the Building Permit application for Building Plan 3884/2015 requesting for the relaxation of the rear 3 and 5 metre building lines on Erf 3274, Windhoek be granted.
- 2 That the applicant and Objectors be informed of Council's decision, in writing, and be given the opportunity to appeal against Council's decision to the Ministry of Urban and Rural Development within twenty eight (28) days from the date of notification thereof.
- 3 That any notice of an intention to appeal this Council Resolution be submitted to Council within twenty eight (28) days from the date of notification thereof, in terms of clause 51(3) of the Windhoek Town Panning Scheme.
- 4 That it be noted that paragraph 3 of Council Resolution 287/08/2007 is herewith amended to read as follows:
 - 3 *That any building permit application for the relaxation of building lines where objections have been received be presented to Council for a final determination in the matter.*

- 5 That the resolution be implemented prior to confirmation of the minutes to allow for prompt feedback to the applicant.

RESOLUTION 233/09/2019

[Municipal Council Minutes: 2019-09-26]

10.3.5

**FNS.4 [UTP] BUILDING LINE RELAXATION
DISPUTE ON ERF 881, 12 GARIBES STREET,
KLEINE KUPPE – OBJECTION FROM
THE ADJACENT NEIGHBOUR
ERF 880, KLEINE KUPPE
(L/881/KK)**

On proposal by Councillor M Shiikwa, it was

RESOLVED

- 1 That the Building Permit application for Building Plan 3571/2016 requesting for the relaxation of the rear 3 and 5 metre building lines on Erf 881, Kleine Kuppe be granted, subject to the following conditions:
 - 1.1 That the western part of the balcony of Unit A (first floor), be constructed up to 2 metres high.
 - 1.2 That the bedroom two (2) window facing Erf 880, Kleine Kuppe, be moved to the south, so that no windows face Erf 880, Kleine Kuppe.
- 2 That the applicant and Objectors be informed of Council's decision, in writing, and be given the opportunity to appeal against Council's decision to the Ministry of Urban and Rural Development within twenty eight (28) days from the date of notification thereof.
- 3 That any notice of an intention to appeal this Council Resolution be submitted to Council within twenty eight (28) days from the date of notification thereof, in terms of clause 51(3) of the Windhoek Town Planning Scheme.
- 4 That it be noted that paragraph 3 of Council Resolution 287/08/2007 is herewith amended to read as follows:
 - 3 *That any building permit application for the relaxation of building lines where objections have been received be presented to Council for a final determination in the matter.*
- 5 That the resolution be implemented prior to confirmation of the minutes to allow for prompt feedback to the applicant.

RESOLUTION 234/09/2019

Without Prejudice

Lawrence Hamilton
 Owner erf 907 Academia ext 1
 28 September 2021

The CEO
 City of Windhoek
 P.O. box 59
 Windhoek

And

Joseph Kakololo
 Owner erf 900 academia ext 1

Sir

Re: Building Border Line Relaxation Application – Erf 900 academia extension 1

I am the owner of erf 907, Academia. I received an application from Mr J Kakololo owner of erf 900, applying for the approval of the relaxation of the 3 meter building border lines for building an entertainment area on the border between the two erven. I informed Mr Kakololo that I am prepare to approve a relaxation of up to 1.5 meter but not up to the border lines. This was unacceptable for Mr Kakololo and he have requested me to put my objection in writing, which I do hereunder.

Academia ext 1 erven have their own challenges due to the small size of the erven. Notwithstanding this the height and building line requirements was clearly defined in the sales agreements when purchased. The full utilization of the whole erf, as reasoning by Mr Kakololo, as reason for the relaxation make no sense as the size of the erf was known with purchase. Herewith our reasoning for relaxation up to 1.5 meters:

1. Our erf 907 are fully developed. We manage to stay away from the border lines with a minimum of 1.5 meter, from all our neighbours. We expect our neighbours to do the same, which means that all building is at least 3 meters apart from each other. This contribute to a feeling of openness for both owners and a sure increase in the value of the property and the quality of life. In the one instance where it was not possible to keep the 1.5 meter, it was done with the consent that the owner of the neighbouring erf will build his garage next to ours which will have no influence on any of the owners of the respected erven.
2. The building of an entertainment area on the border to our existing house will have a sure negative influence on the resale, the value of our existing house, and the quality of living there. I am sure that you will be in agreement with this.
3. Building house height on the border line, when walking out of your home, you walk into a wall. This have also an influence on the resale, the value, and living conditions of the existing house owners and the owners around. We have for this reason make sure that we don't build on erf 900 building line, and expect the owner of erf 900 to respect our decision in doing the same.

Due to the fact that erf 907 building is already finish, as this border line relaxation will have a definite influence on the current build property, we need you to please refrain from overriding our objecting. In doing so will leave us with no option but to take further action, which may include legal action.

Your urgent response will be appreciated.
 Regards

L. Hamilton
 Tel 081-128 0103
 P.O. Box 20198, Windhoek
 E-mail: kobus@hamilton.com.na



1st floor Bridgeview Offices & Apartments, No. 4 Dr Kwame Nkrumah Avenue, Klein Windhoek, Namibia
PO Box 6871, Ausserspannplatz, Windhoek, Phone: +264 81 248010, Fax: +264 81 248606, Mobile: +264 81 281 0838, Email: elmarie@dutoitplan.com

Strategic Executive
Department of Urban and Transport Planning
Windhoek City Council
P O Box 59
WINDHOEK

July 28, 2020

For attention: Mr Hugo Rust

Dear Mr Rust

REZONING OF ERF 543 (A PORTION OF ERF 209), HELIODOOR STREET, EROSPARK FROM 'OFFICE' WITH A BULK OF 0.4 TO 'OFFICE' WITH A BULK OF 0.75;

REZONING OF ERF 542 (A PORTION OF ERF 209), ANDRADLET STREET, EROSPARK FROM 'GENERAL RESIDENTIAL' WITH A DENSITY OF 1 DWELLING PER 250.m² TO 'OFFICE' WITH A BULK OF 0.75;

CONSOLIDATION OF ERVEN 542 AND 543 (PORTIONS OF ERF 209), EROSPARK INTO ONE ERF;

CONSENT IN TERMS OF TABLE B OF THE TOWN PLANNING SCHEME TO USE THE ERVEN FOR A 'BUSINESS BUILDING' FOR MEDICAL CONSULTING ROOMS AND A KIDNEY DIALYSIS CENTRE AND RELATED USES;

CONSENT IN TERMS OF SECTION 23 (1) OF THE TOWN PLANNING SCHEME AND COUNCIL POLICY TO ALLOW FOR ADDITIONAL FLOOR AREA WHICH SHALL BE DEVOTED SOLELY TO RESIDENTIAL USE (FREE RESIDENTIAL BULK)

Application is herewith submitted on behalf of the owners of the erven, Jary Enterprises and Messrs van Rooyen, Volker, Petkar, le Roux, Murphy, van der Merwe and Hollick for the:

- rezoning of Erf 543 (a Portion of Erf 209), Heliodoor Street, Erosark from 'office' with a bulk of 0.4 to 'office' with a bulk of 0.75;
- rezoning of Erf 542 (a Portion of Erf 209), Andradlet Street, Erosark from 'general residential' with a density of 1 dwelling per 250m² to 'office' with a bulk of 0.75;
- consolidation of Erven 542 and 543 (Portions of Erf 209), Erosark into one erf;

CONSENT IN TERMS OF SECTION 23 (1) OF THE TOWN PLANNING SCHEME AND COUNCIL POLICY TO ALLOW FOR ADDITIONAL FLOOR AREA WHICH SHALL BE DEVOTED SOLELY TO RESIDENTIAL USE (FREE RESIDENTIAL BULK)

- consent in terms of Table B of the Town Planning Scheme to use the erven for a 'business building' for medical consulting rooms and a kidney dialysis centre and related uses and
- consent in terms of Section 23 (1) of the Town Planning Scheme and Council Policy to allow for additional floor area which shall be devoted solely to residential use (Free Residential Bulk)

The locality of the erven, zonings and consolidation is shown on the attached plans. The diagrams are attached. Power of Attorney and Amended Founding Statement of the CC is also attached.

1. Previous application

Following a previous application for the above, the application was turned down by the City per letter dated January 14, 2019 (CR 351/11/2018) for the reason that the erven are located outside the interim office policy area.

The policy area was in the meantime extended under Council Resolution 204/09/2019, and the application is now herewith resubmitted in terms of this amended policy area.

2. Erf information

Erven 543 and 542 are located next to each other on the southern side of Heliodoor Street opposite the MediCity Hospital. Erf 543 lies directly adjacent to Heliodoor Street, and Erf 542 adjacent and to the south of Erf 543.

Erf 543 is zoned 'office' with a bulk of 0.4 and is 604m² in extent. The Windhoek Kidney Dialysis Centre was established on the erf.

Kidney Dialysis Centre on Erf 543:



Erf 542 is zoned 'general residential' with a density of 1 dwelling per 250m². There is a dwelling house on the erf.

Various medical consulting rooms as well as specialized medical centers already establish along Heliodoor Street and the character of the neighbourhood has changed from a residential nature to a business orientated area.

Access to Erf 543 is from both Heliodoor and Andradiet Streets, and access to Erf 542 is from Andradiet Street, which is a short cul-de-sac.

3. Proposal

The Kidney and Dialysis Centre was constructed on Erf 543. As it is the only private dialysis Centre in the City, it has become too small to accommodate all patients who require dialysis and the need for such a service is still growing. It is estimated that there are more than 200 people in Namibia in need of regular dialysis. The public health service provides dialysis services on a very small scale, putting more pressure on private facilities to provide the necessary service and treatments.

- The centre offers a very specialized service and treatments and needs to be located close to medical doctors and hospitals. The current location of the Centre is ideal as it is close to many medical consulting rooms, two hospitals and the Cancer Hospital, all located in Heliodoor Street.
- The facility and medical service now urgently needs to expand.
- The only way the facility can be extended, is by increasing the bulk to allow for a larger building floor area, and to add additional land to the current site (Erf 543).
- The owners then purchase the adjacent Erf 542 with the intention to consolidate it with Erf 543 to create a larger site to accommodate the intended additions to the building.
- To be able to consolidate the two erven, Erf 542 also needs to be rezoned to 'office', as erven with different zonings cannot be consolidated.

Application: Application is now herewith made to increase the bulk of Erf 543 from 0.4 to 0.75 and to rezone Erf 542 to 'office' with a bulk of 0.75 in order to create enough floor area for the planned extensions and to be able to consolidate the two erven.

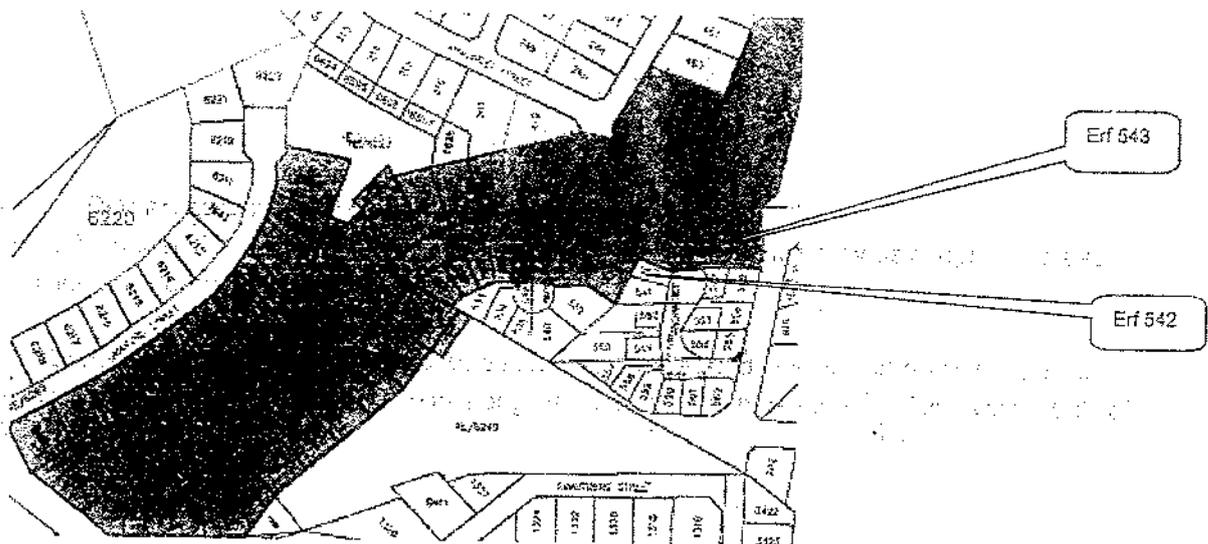
As it is also the intention of the owners to include a residential component, consent is applied for in terms of Section 23 (1) of the Town Planning Scheme and Council's policy on 'free residential bulk' to allow for additional floor area for dwelling units.

4. Demarcated Interim Eros Medical policy Area

The City, under Council Resolution 204/09/2019 extended various policy development areas to guide development in Windhoek.

The Eros Policy Area (extended and amended under paragraph 1.6 of said resolution), now allows for rezonings of erven inter alia along Heliendoor Street to rezone to 'office' with a bulk of 0.75.

Eros Interim Policy Zone:



Erf 543 falls within this interim policy zone and a bulk of 0.75 is in line with the bulk allocation in this zone.

The adjacent Erf 542 is not located within this interim policy area as it is not located directly adjacent to Heliendoor Street.

As it is the intention to consolidate the two erven, the consolidated erf will face Heliendoor Street and as the erven cannot be consolidated if the zonings differ, Erf 542 also needs to be rezoned to 'office'.

With the demarcation of the extended policy area which was done by our office together with the CoW, it was the understanding that if the erven located in the Granaat and Andradiet Street area, are to be consolidated with one of the Heliendoor Street erven, such rezoning can also be considered.

Conclusion: Due to the location of Erf 543, Windhoek within this newly approved Interim Policy Zone with a bulk of 0.75, the rezoning of Erf 543, Windhoek can be supported.

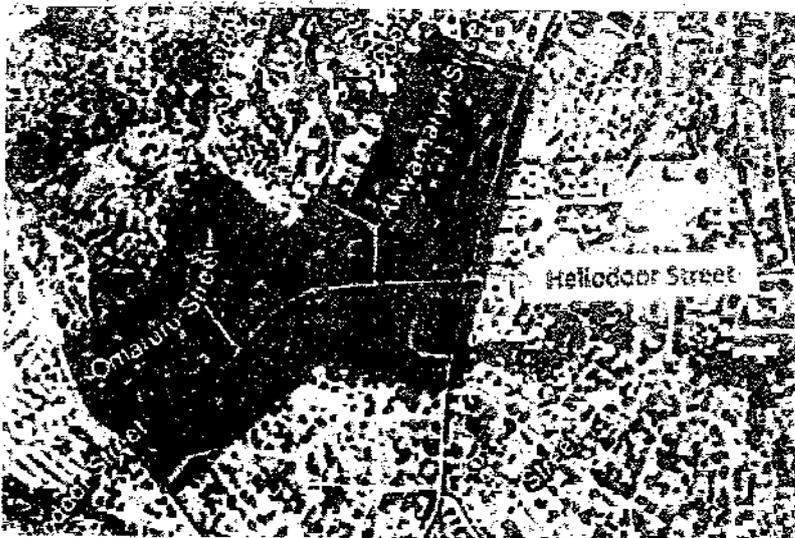
And due to the fact that Erf 542 needs to be consolidated with Erf 543, the rezoning of Erf 432 is also required.

5. Infrastructure Study

With the submission of an application for the increase in bulk of Erf 6225, Heliodoor Street, Windhoek, an Infrastructure Study was carried out by Element Consulting Engineers to provide an overview of existing infrastructure capacity and future demands (such as electricity, water, sewer discharge, traffic, solid waste and public transport) for the entire Interim Eros Policy Area.

The study, findings and recommendations were already submitted to and evaluated by the CoW and new applications in the extended demarcated policy area can now be submitted based on the outcome of the infrastructure study.

The infrastructure Study also included the entire area on the corner of Heliodoor Street and Eros Road (the Granaat and Andradiet Street area). The area covered by the study is shown in the figure below:



6. Impact of development on the existing neighbourhood

Erven 542 and 543, ErosPark are ideally located for a Kidney and Dialysis Centre, due to the location in Heliodoor Street, which area is increasingly becoming a medical care orientated area. This was triggered mainly by the location of the 2 hospitals located in Heliodoor Street: MediCity and Paramount Hospitals.

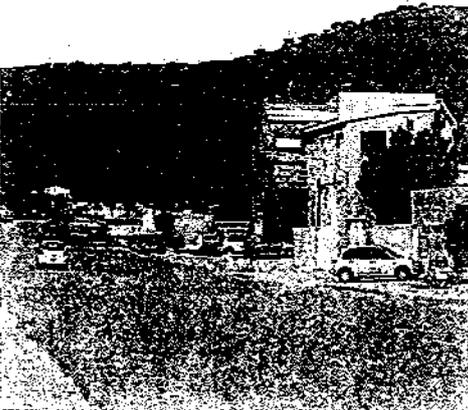
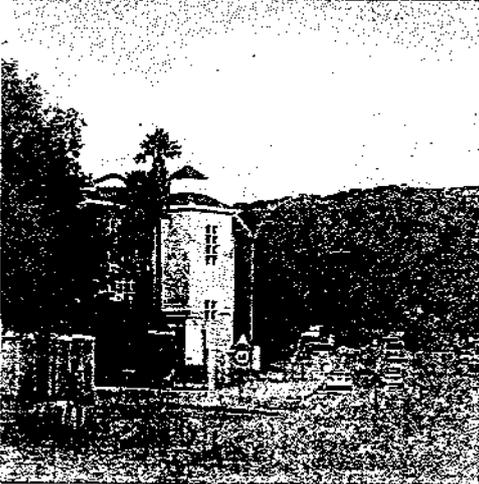
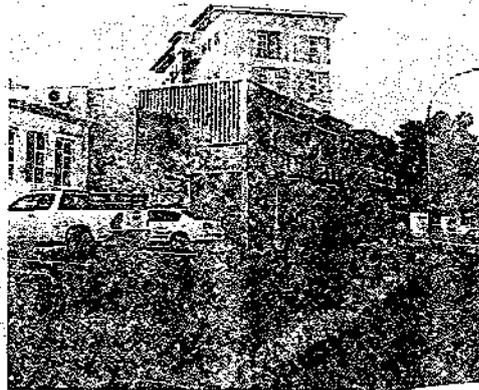
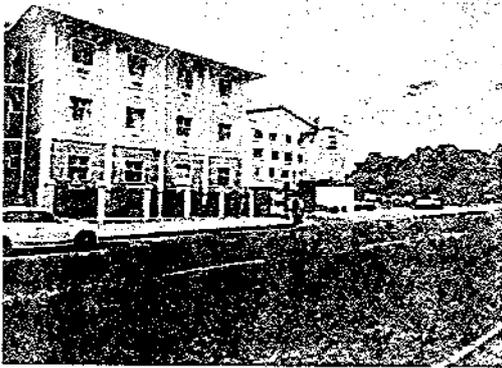
These hospitals already provide multiple medical services, and with the establishment of specialized medical centers, such as the Oncology Centre can future Cardiac Hospital, another specialized medical service, will add to much needed dedicated expert medical facilities.

Since all the erven along Heliodoor Street up to Eros Road can now obtain a bulk of 0.75, it is inevitable that the 'face' of Heliodoor Street will change to more high rising buildings.

Higher bulk factors already exist (eg MediCity, Oncology Center, Paramount Hospital) resulting already in some high rising buildings.

Conclusion: Due to the existence of already high rise buildings (hospital, consulting rooms, flats etc), it is anticipated that the rezoning of Erven 542 and 543 to increase the bulk to 0.75 will not have an adverse impact on the appearance of Heliodoor Street.

Existing image of Heliodoor Street



7. Free Residential Bulk

There is a need for accommodation for visiting specialist and medical practitioners and personnel employed at the Kidney and Dialysis Centre or other nearby facilities in the form of flats close to the workplace.

With the various office policies all over town, the opportunity was created for erf owners of residential zoned land to convert the residential property to offices. This resulted in many houses being replaced with offices. To address the shortage of housing and limited land, and to encourage erf owners to also provide housing, provision was made in the Town Planning Scheme in terms of Section 23 (1) so as to provide for housing as a development option additional to office rights.

Council therefore accepted a policy to encourage developers to create a more integrated, mixed and functional City, by adopting the 'free residential bulk' policy. This policy was introduced to enhance the vibrancy of Office Areas and to make these areas more active during the night by keeping people in the office areas at night.

Council confirmed this policy per resolution 167/06/2011 and inter alia resolved:

- 1 *That the free Residential Bulk Policy continue to be implemented as an effective means to promote urban densification.*
- 2 *That free residential bulk consent be granted, subject to the following conditions:*
 - 2.1 *.....*
 - 2.2 *That free residential bulk be limited in the office areas to only 50 % of the approved bulk factor for office use. [In the Central Business District (CBD) the free residential bulk consent shall be limited to a floor area equal to the approved office bulk factor.]*
....."

Application is also made in terms of the above provisions for Free Residential Bulk which will allow for 50% of the allowable bulk as flats.

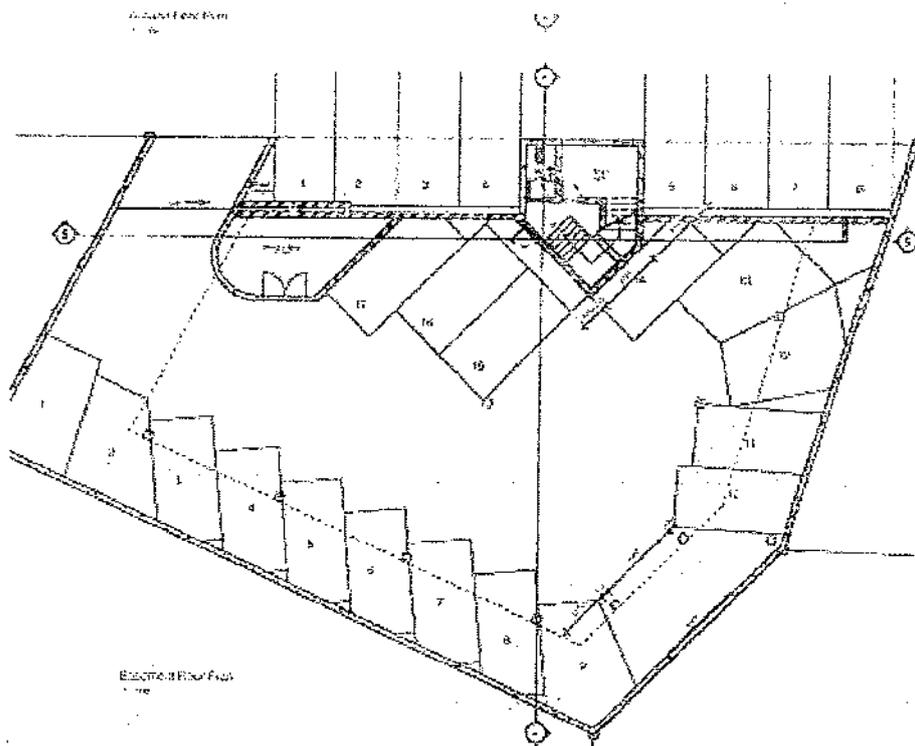
8. Parking and access

Access to the consolidated erf will be from both Heliodoor and Andradiet Streets, the two adjacent streets from where the current access is taken.

Erf 543:

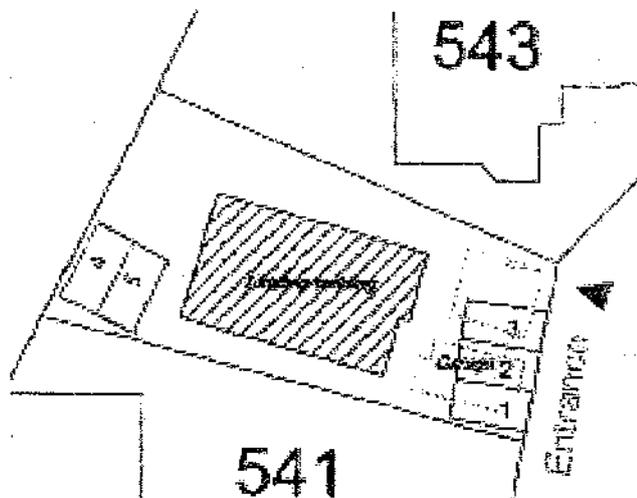
- With the approval of the rezoning of Erf 543 to 'office' with a bulk of 0.4 in 2014, CoW also under CR 167/06/2014 paragraph 7 granted permission to the owner to lease a portion of the sidewalk for parking.
- Approval was also granted for Free Residential Bulk.
- The building plan makes provision for 3 consulting rooms and two flats, for which 17 parking bays are required.

- Basement parking is provided as well as some bays on the Hellodoor Street sidewalk



Erf 542:

- The existing building is approximately 110m² in extent, for which 5 bays are required.
- The garage in front of the house needs to be demolished.



Please take note that a new building is planned on the erven, should this application be approved. Building plans, including final parking plans will be submitted to the City for approval.

9. Registered conditions

The conditions registered against Erf 542 per Deed of Transfer T4284/2017 are the standard Town Planning Scheme conditions, while the old Title conditions are registered against Erf 543 per Deed of Transfer T8362/2002.

The standard Town Planning Scheme conditions should be registered against the consolidated Erf X.

10. Advertising procedures and comments

The proposed rezoning and development on Erven 542 and 53, Erospark was advertised as required in terms of the Town Planning Scheme on 10 and 17 June 2020 in the New Era and Namibian newspapers respectively. The relevant newspaper adverts are attached.

A notice was placed on the erven (see photos attached) as well as on the notice board of the Customer Care Centre of the City of Windhoek. The comments of the surrounding neighbours were also requested in writing. Please refer to the attached list of registered letters as proof.

The final date for objections/comments was July 1, 2020.

The owners of Erven Re/458, 538 and 546 returned their forms indicating no objections.

The owner of Erf 541 (Ms Rogers), located adjacent to Erf 542 to the south, objected – see copy attached.

The objections are:

- It will block her winter sunlight
- The area is rapidly turning into a business area
- The development will lower the value of her house

Counter arguments:

- ◇ The direct sunlight in Windhoek emerges from a northeastern direction during wintertime. As the buildings will not be erected to the northeastern side of Erf 541, a large part of Erf 541 will still receive sunlight during winter times. Erven 543 and 542 are located to the north of Erf 541. With the design of the new buildings, this issue can be taken into account to limit a possible impact
- ◇ It is true that the area is rapidly turning into a business area. With this comment, the owner acknowledges that the area is changing and is not a purely residential area anymore. The area was demarcated for office use and more and more changes will happen in the future.
- ◇ The devaluation of property due to the establishment of higher value uses has not been proven. The opposite is more likely to happen since the value might rather increase as there will probably be a need for supporting services in the future and the quality and value of a building on the consolidated property is substantially higher than that of the residential properties.

11. Credit Check and payment of application fee

A Credit Clearance was conducted and the accounts were in good standing.

Proof of payment of the application fee is herewith attached.

12. Conclusion

Due to the location of Erf 543 in the new extended policy area and the fact that Erf 542 needs to be consolidated with Erf 543, it is concluded the proposal is in line with the City's vision for this neighbourhood.

Council is herewith kindly requested to support the application.

13. Application

Application is herewith made:

- 13.1 That Erf 543 (a Portion of Erf 209), Heliodoor Street, Erospark be rezoned from 'office' with a bulk of 0.4 to 'office' with a bulk of 0.75
- 13.2 That Erf 542 (a Portion of Erf 209), Andradiot Street, Erospark be rezoned from 'general residential' with a density of 1 dwelling per 250m² to 'office' with a bulk of 0.75
- 13.3 That consent be granted in terms of Table B of the Town Planning Scheme to use the erven for a 'business building' for medical consulting rooms and a kidney dialysis centre and related uses
- 13.4 That consent be granted in terms of Section 23 (1) of the Town Planning Scheme and Council Policy to allow for additional floor area which shall be devoted solely to residential use (Free Residential Bulk)
- 13.5 That Erven 542 and 543 (Portions of Erf 209), Erospark be consolidated into one erf
- 13.6 That the conditions registered against Erven 542 and 543 (Portions of Erf 209), Erospark be cancelled and that the standard conditions, including a minimum building value of 4 times the Municipal valuation of the erf, be registered against the consolidated erf.

14. Attachments

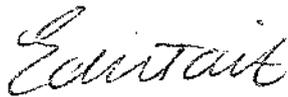
Attached 3 copies of the following documents:

- Application
- Council letter dated January 14, 2019 (CR 351/11/2018)
- Locality, zoning and consolidation maps
- diagrams
- Parking plans
- Zoning certificates

- Council Resolution 167/06/2014
- CoW letter dated June 26, 2017 - approval of FRB
- Power of Attorneys
- Amended Founding Statement
- Deed of Transfer T4284/2017
- Deed of Transfer T8362/2002
- Copies of newspaper notices
- Proof of notice on sites
- Proof of notice on Municipal notice board
- Copy of letter to neighbours
- Proof of registered letters
- Copies of returned forms
- 1 objection form
- Credit Check Clearance Certificate from City of Windhoek
- Proof of payment of application fee

Based on the above motivation and supportive documents, it is trusted that the application will favourable considered by Council. Should you need additional information, do not hesitate to contact our office.

Kind regards



Elmarie du Toit

Department of Urban & Regional Planning

#59

40 Independence Avenue

WINDHOEK, NAMIBIA

Tel: (+264) 61 2104 3000 Fax: (+264) 61 293 2101 Email: info@urp.gov.na

Eng : Mr G F De Klerk

Refs L/542 & 543/EP

Tel : 290 2104

Date : 14 January 2019

Du Toit Town Planning Consultancy

P. O. Box 6871

Ausspännplatz

Windhoek

Dear Sir,

REZONING OF ERVEN 542 AND 543, ANDRADIET STREET, EROSPARK FROM 'OFFICE' AND 'GENERAL RESIDENTIAL' RESPECTIVELY TO 'OFFICE' WITH A BULK OF 0.75, CONSENT FOR 'BUSINESS' BUILDING FOR MEDICAL CONSULTING ROOMS, CONSENT FOR FREE RESIDENTIAL BULK AND CONSOLIDATION

In accordance with Council Resolution No 35/U/2018, the application has been resolved as follows:

1. That the application for the rezoning of erven 542 and 543, Erspark from 'office' and 'general residential' respectively to 'office' with a bulk of 0.75, consent for 'business' building for medical consulting rooms and consent for free residential bulk not be supported as it is located outside the Erspark Interim Office Policy Area.
2. That subsequently no consolidation can be supported.
3. That the objectors be informed on this Council Resolution to respond within 28 days of receipt.
4. That the applicant acknowledges receipt of this Delegated Authority approval and accepts the conditions thereof in writing.

Yours Faithfully



**F Van Rensburg
STRATEGIC EXECUTIVE**

- 8 That the new Lease Agreements under Special Conditions include the following:
 - 8.1 That no business activities be permitted to spill into the pond reserve.
 - 8.2 That the Strategic Executive, Economic Development and Community Services notify the Lessee to rectify activities along the Western Bypass road reserve within one (1) month from Council resolving on this matter and to oversee the rectification.
- 9 That the Chief Executive Officer (Corporate Legal Advisor) draft the Lease Agreement.
- 10 That in terms of section 50(1)(f) of the Local Authorities Act, 1992 (Act 23 of 1992) (as amended) prior to Ministerial approval being obtained.
- 11 That the lease be advertised in terms of section 63(2) of the Local Authorities Act, 1992 (Act 23 of 1992) (as amended).
- 12 That the resolution be implemented prior to confirmation of the minutes.

RESOLUTION 350/11/2018

[Municipal Council Minutes 2016-11-28(22)]

9.1.5

**FNS.3 [UTP] 2018 APPLICATIONS – BULK
 REZONING OF ERVEN TO OTHER
 ZONINGS NOT IN TABLE 1 THAT
 CANNOT BE SUPPORTED
 (16/15/2015)**

On proposal by Councillor M Shikwa, it was

RESOLVED

- 1 That after consideration, the following applications not be supported:
 - 1.1 Application for consent to use Erf 5965, 3/0 Matje Street and Nelson Mandela Avenue, Klein Windhoek for a hotel and restaurant.
 - 1.2 Application for the rezoning of Erven 542 and 543, Andradier Street, Erosspark from 'office' and 'general residential' respectively to 'office' with a bulk of 0.75, consent for 'business' building for medical consulting rooms and consent for free residential bulk and consolidation;
 - 1.3 Application for the rezoning of Erf 1/A/29, 48, Promenade Road, Klein Windhoek from 'residential' with a density of 1:150 m² to 'general residential' with a density of 1:100 m²; and

- 1.4 Application for the rezoning of Erf 3528, Klip Windhoek from 'residential' with a density of 1:900 m² to 'general residential' with a density of 1:250 m².
- 2 That the applicants and any objectors be informed of this Council Resolution, in writing, and that the objectors may lodge an appeal against this Council Resolution in terms of section 51(1) of the Windhoek Town Planning Scheme.
- 3 That written notices of appeal against the decision of Council be given to Council within twenty eight (28) days from the date of the service on the appellants of the notice of Council's decision in terms of section 51(3) of the Windhoek Town Planning Scheme.
- 4 That the resolution be implemented prior to confirmation of the minutes.

RESOLUTION 35M/11/2018

[Municipal Council Minutes: 2018-11-28(22)]

9.2.6

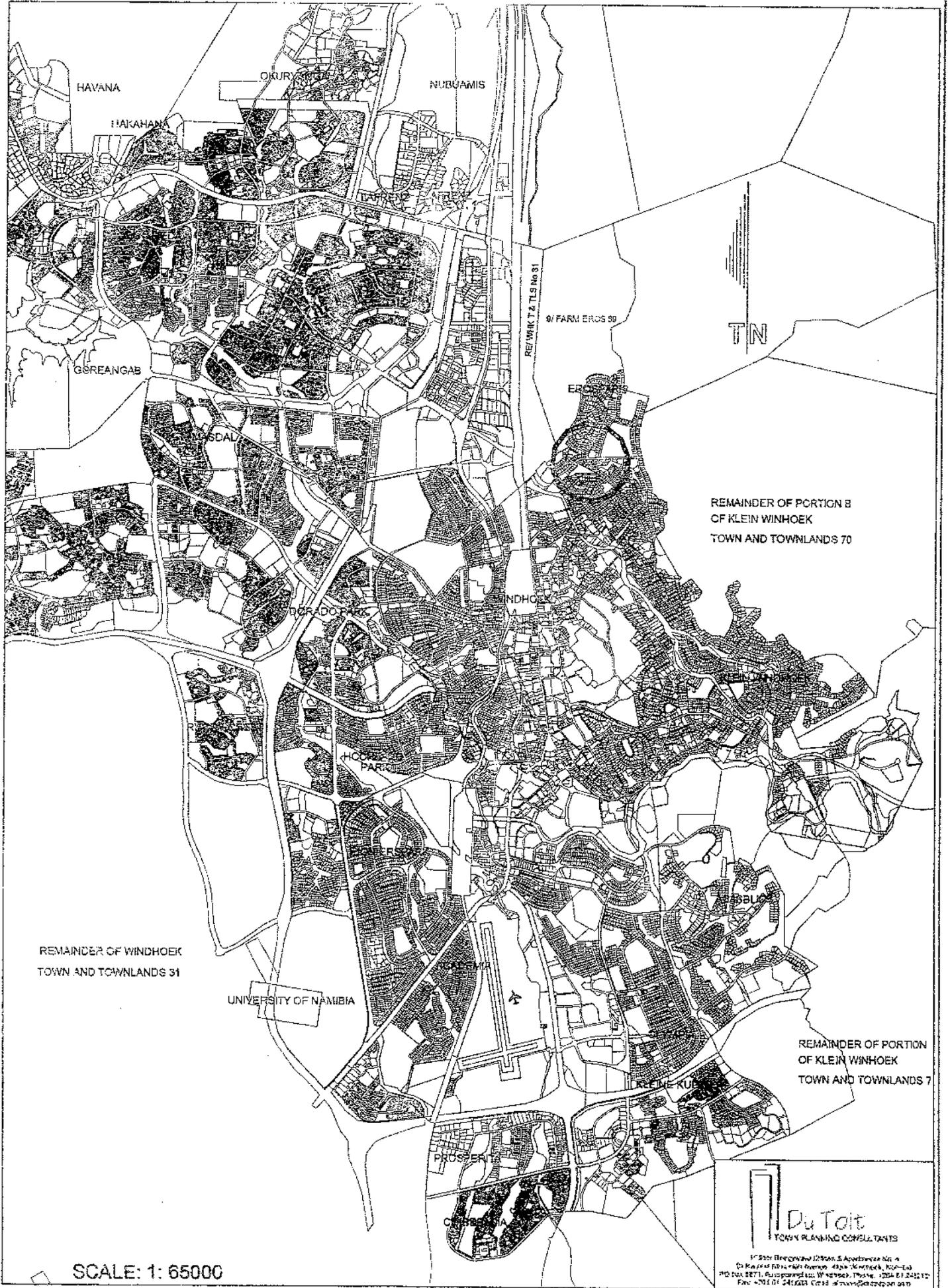
**FNS.4 [UTP] 2017 APPLICATIONS – BULK
REZONING OF ERVEN TO OTHER ZONINGS
NOT IN TABLE I THAT CAN BE SUPPORTED
(16/15/2.1/5)**

On proposal by Councillor M Shikwa, it was

RESOLVED

- 1 That after consideration, the following applications, be approved:
 - 1.1 Application for the consolidation and rezoning of Erfen 5471 and 6335, Greenshark Street, Khomasdal from 'undetermined' to 'business' with a bulk of 1.0;
 - 1.2 Application for the rezoning of Erf 6336, c/o Liszt and Kerby Streets, Windhoek from 'residential' with a density of 1:900 m² to 'business' with bulk of 1.0, the rezoning of Erf 6337, Kerby Street, Windhoek from 'office' with a bulk of 0.4 to 'business' with a bulk of 2.0 and consolidation of Erven 6336 and 6337, Windhoek into Erf 'X';
 - 1.3 Application for the subdivision and rezoning of Portion A of Portion 138/137/48, Brakwater from 'residential' with a density of 1:500 m² to 'special for a NamPower substation' and consent use while the rezoning is in process;
 - 1.4 Application for the rezoning of Erf 8960, Aues Road, Windhoek from 'undetermined' to 'office' with a bulk of 1.0; and

LOCALITY PLAN : ERVEN 542 2.1 DRADIET STREET, EROSPARK.



REMAINDER OF WINDHOEK TOWN AND TOWNLANDS 31

UNIVERSITY OF NAMIBIA

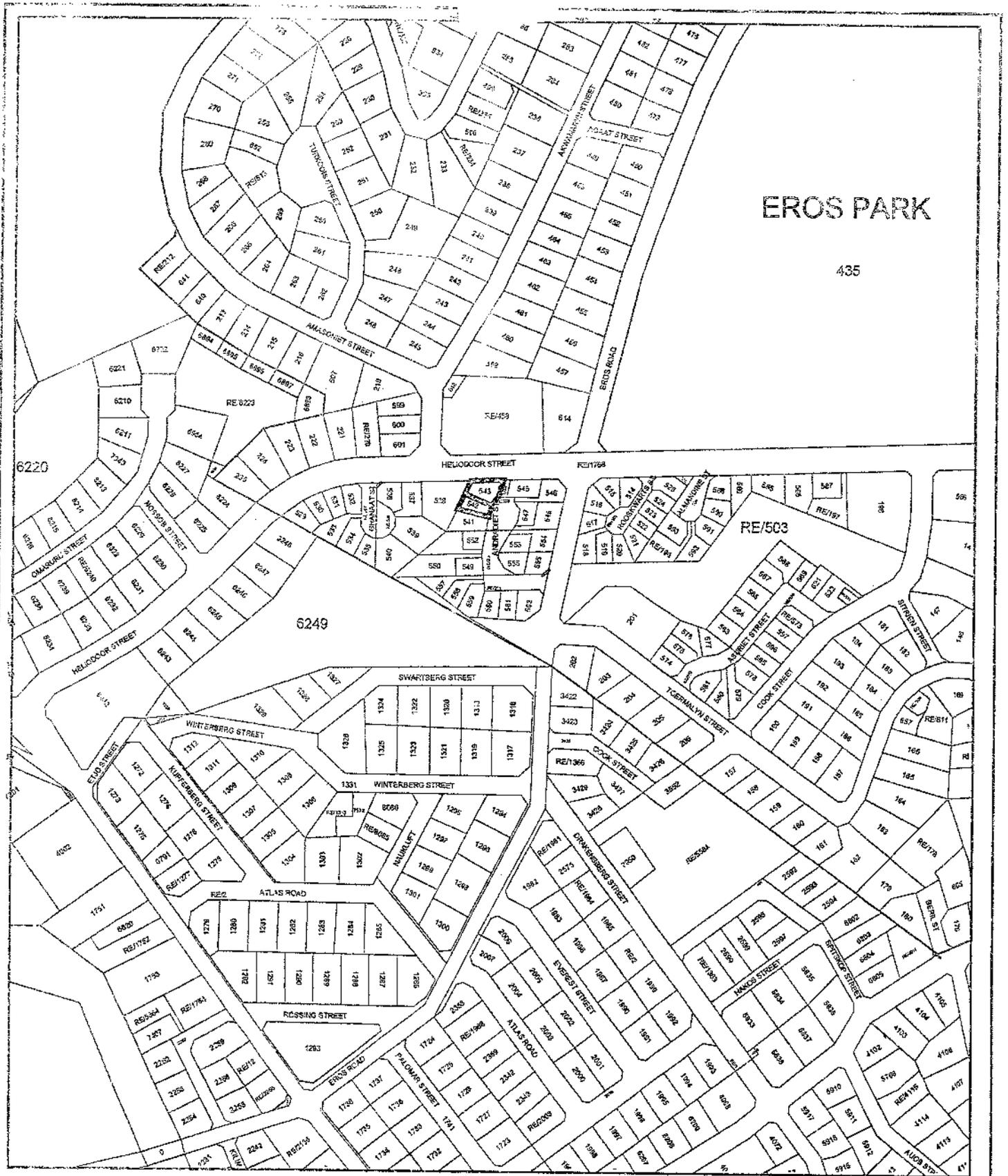
REMAINDER OF PORTION B OF KLEIN WINHOEK TOWN AND TOWNLANDS 70

REMAINDER OF PORTION OF KLEIN WINHOEK TOWN AND TOWNLANDS 7

SCALE: 1: 65000

Du Toit
TOWN PLANNING CONSULTANTS

17 Esau Street, Windhoek, Namibia
 P.O. Box 100, Windhoek, Namibia
 Tel: 061 227111, Fax: 061 227112
 Email: info@du-toit.com



EROS PARK

435

6249

RE/503

Scale: 1/5000

DATE: JUNE 2018

PLAN NO. 543WW_L

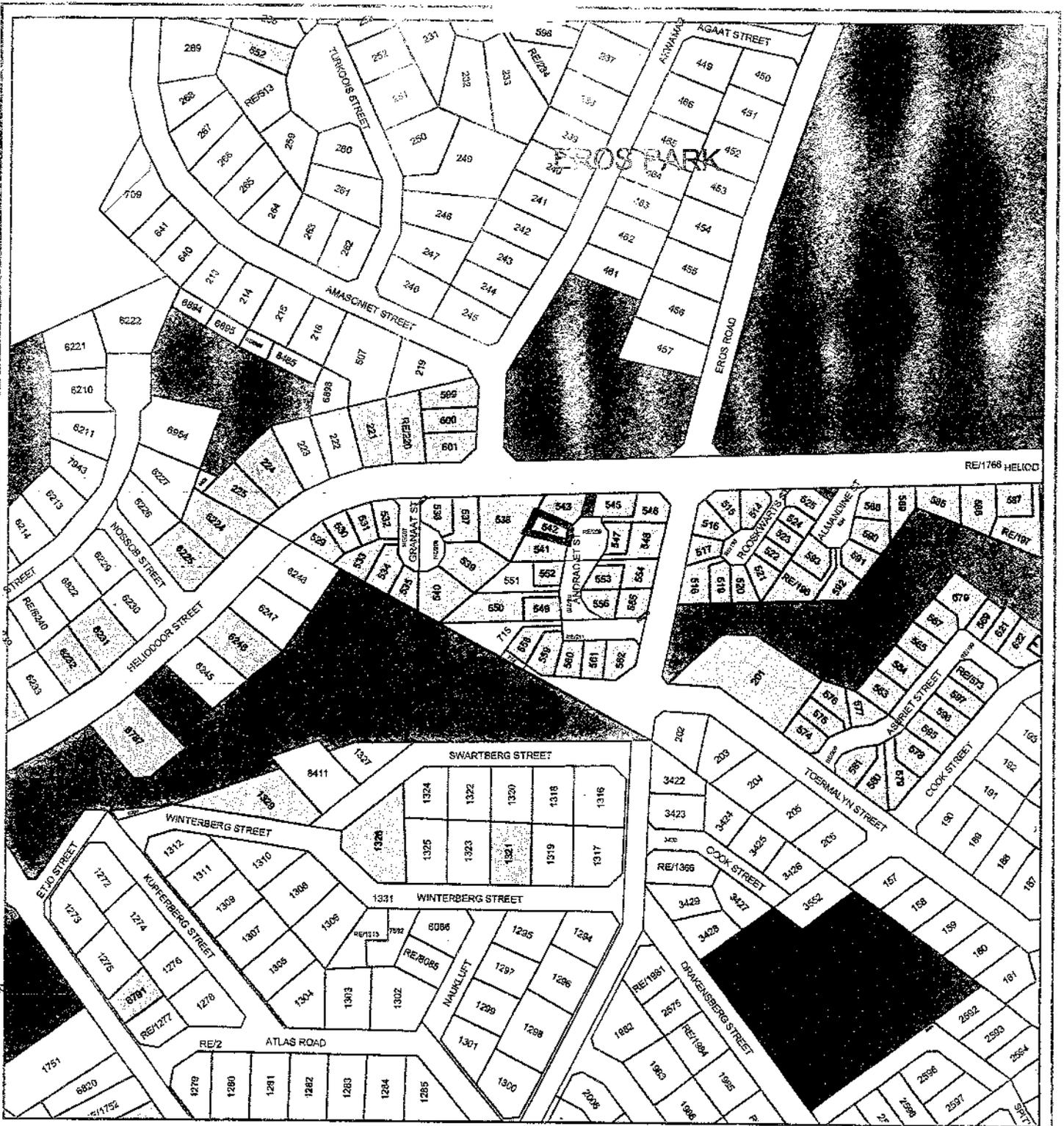


LOCALITY PLAN OF ERVEN 542 & 543
 ANDRADIET STREET
 EROSPARK



Du Toit
 TOWN PLANNING CONSULTANTS

17 Jean Bredaswa Office & Apartments No. 4
 De Kruis Nieuwland Avenue, Kees Westraek, Harare
 P.O. Box 8771, Harare, Zimbabwe. Phone: +263 91 246600
 Fax: +263 91 246604 Email: info@duitoit.com



RE/1768 HELICOD

ZONING LEGEND

- | | | | |
|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
|  RESIDENTIAL |  BUSINESS |  PUBLIC OPEN SPACE |  MUNICIPAL |
|  GENERAL RESIDENTIAL |  OFFICE |  INSTITUTIONAL |  UNDETERMINED |

**CURRENT ZONING OF ERF 542
ANDRADDIET STREET
EROSPARK, WINDHOEK**

('GENERAL RESIDENTIAL' WITH A DENSITY OF 1:250m²)



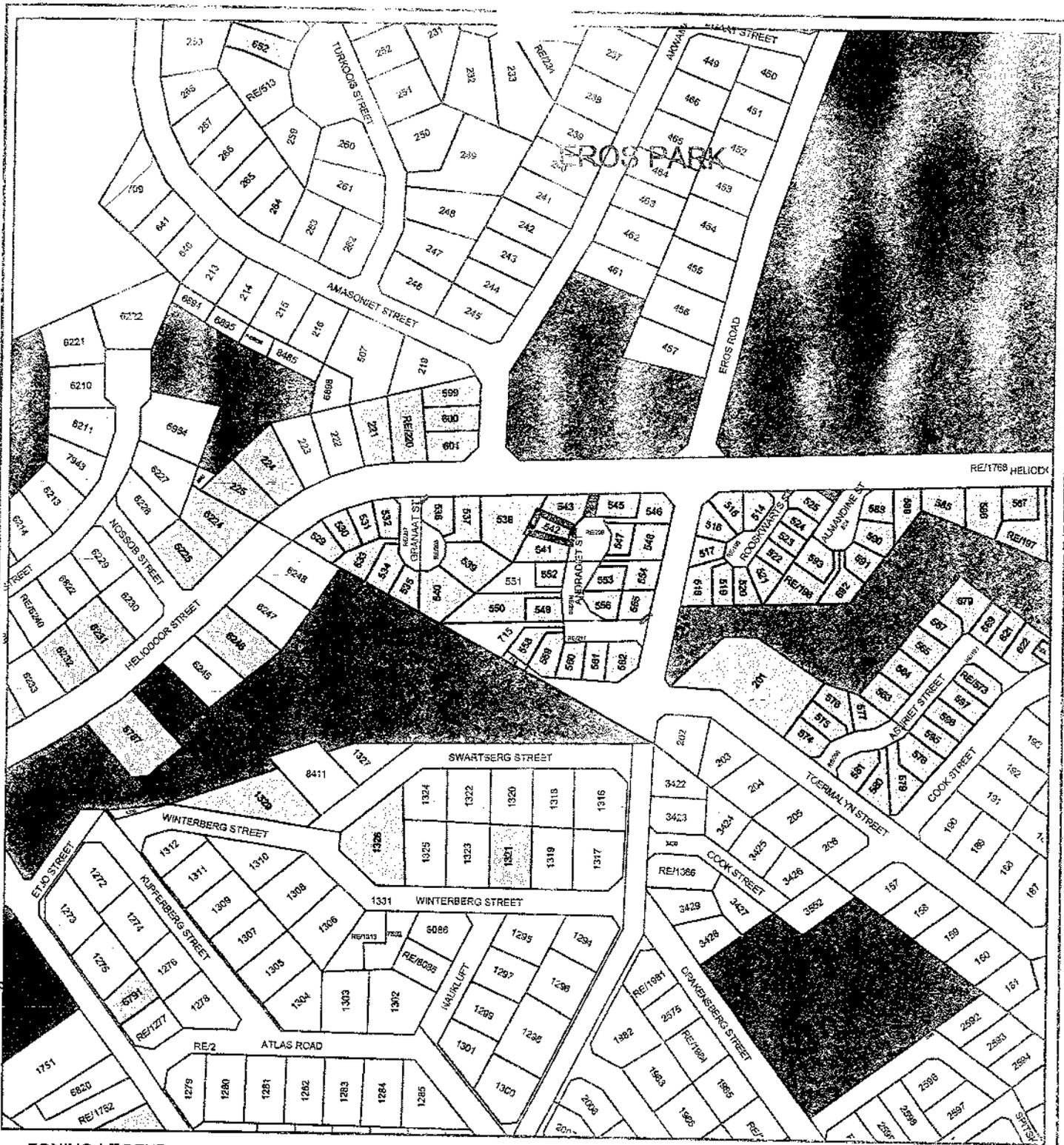
DATE: June 2018

SCALE: 1/4000

PLAN NO. AMS



1st Floor @ Regentwood Office & Apartments No. 5
De Kruisweg, Benmore, Windhoek, Namibia, Post 218
PO Box 0874, Ankerpark, Windhoek, Phone: +264 61 228811
Fax: +264 61 248303. Email: erof@duitoit.com



ZONING LEGEND

- | | | | |
|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
|  RESIDENTIAL |  BUSINESS |  PUBLIC OPEN SPACE |  MUNICIPAL |
|  GENERAL RESIDENTIAL |  OFFICE |  INSTITUTIONAL |  UNDETERMINED |

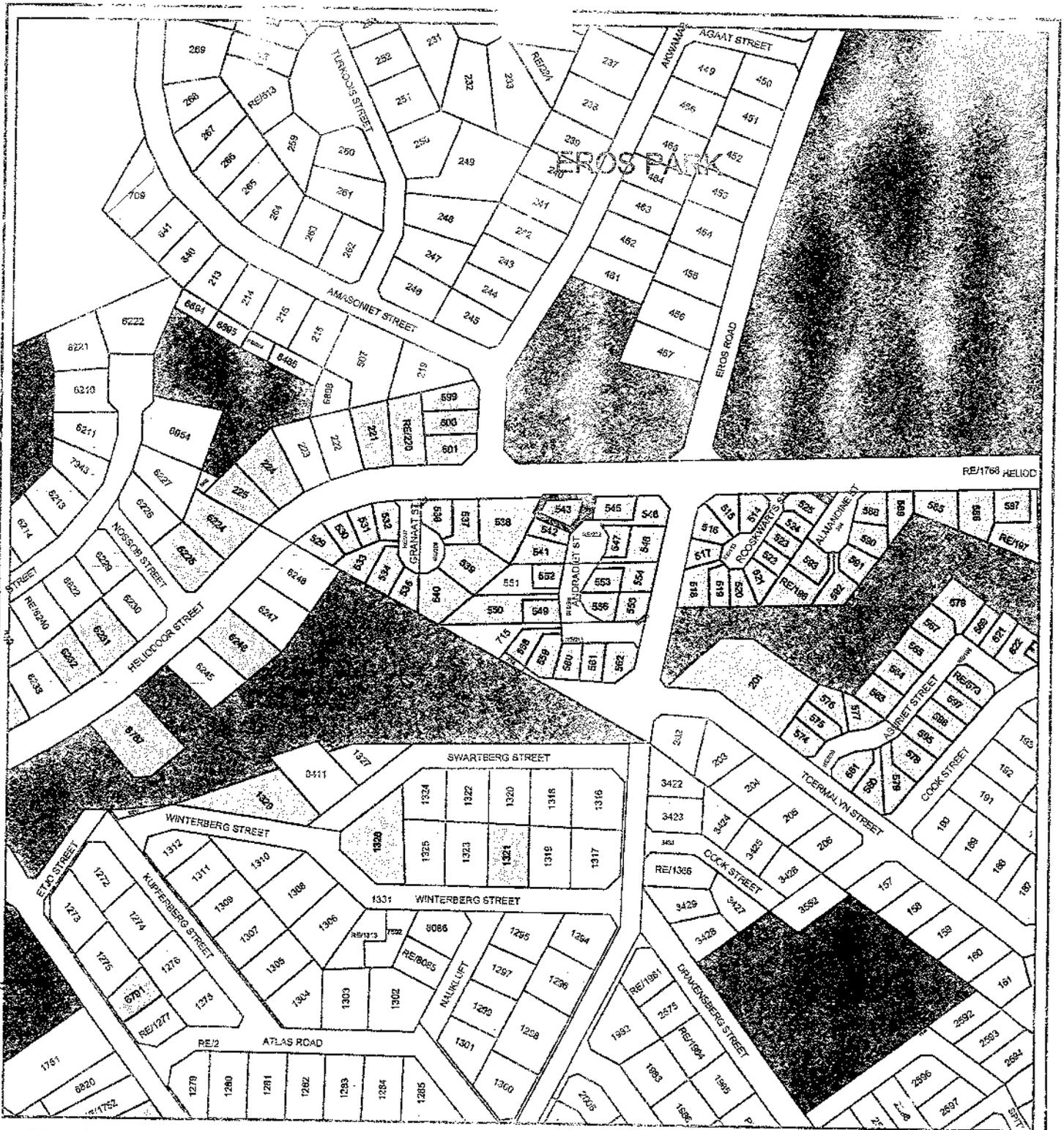
**REZONING OF ERF 542 EROSPARK
FROM 'GENERAL RESIDENTIAL' WITH A DENSITY
OF 1:250m² TO 'OFFICE' WITH A
BULK OF 0,75**



DATE: SEPT.2016
SCALE: 1/4000
PLAN NO. AMS



11 Voer Bergweg, Queens & Aparthouses, 4th Fl.
Dr. Eros, Ntshona Avenue, Kromme Riviër, Namibia
P.O. Box 1071, Windhoek, Namibia, Phone: +264 61 29000
Fax: +264 61 29000, Email: info@du-toit.com



ZONING LEGEND

	RESIDENTIAL		BUSINESS		PUBLIC OPEN SPACE		MUNICIPAL
	GENERAL RESIDENTIAL		OFFICE		INSTITUTIONAL		UNDETERMINED

CURRENT ZONING OF ERF 543
 ANDRADIET STREET
 EROSPARK, WINDHOEK
 ('OFFICE' WITH A BULK OF 0,4)



DATE: June 2018

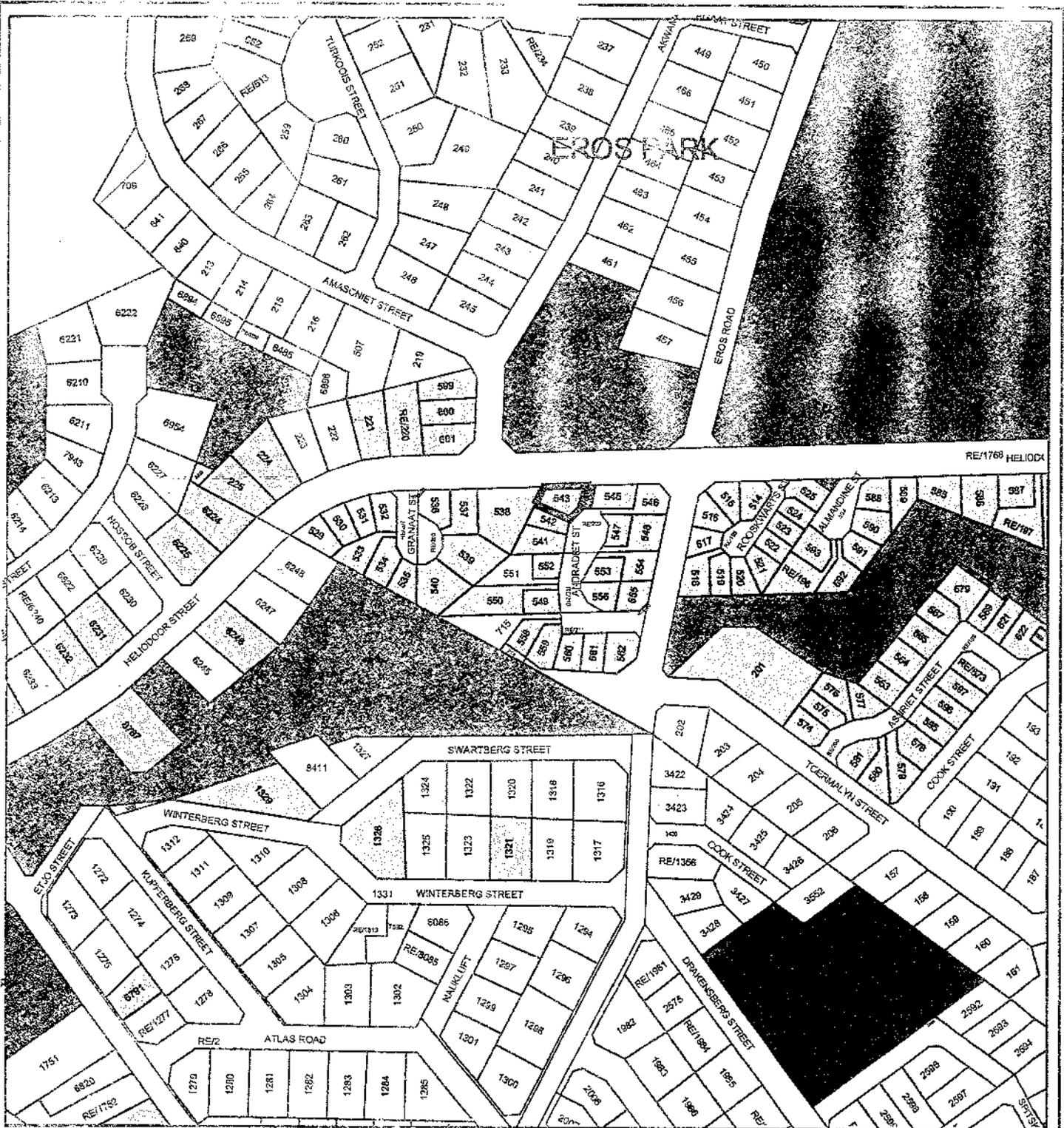
SCALE: 1/4000

PLAN NO. AMS



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ZONING LEGEND

- | | | | |
|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
|  RESIDENTIAL |  BUSINESS |  PUBLIC OPEN SPACE |  MUNICIPAL |
|  GENERAL RESIDENTIAL |  OFFICE |  INSTITUTIONAL |  UNDETERMINED |

REZONING OF ERF 543 EROSPARK
 FROM 'OFFICE' WITH A BULK OF 0,4 TO
 'OFFICE' WITH A BULK OF 0,75



DATE: JUNE 2018

SCALE: 1/4000

PLAN NO. AMS



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