

ENERGY AUDIT REPORT

**DEPARTMENT OF CUSTOMS AND INLAND REVENUE
OFFICES,
LUGANVILLE- SANTO**

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1. INTRODUCTION

1.1 Objectives

The Energy Audit was defined to meet the following objectives:

- Conduct a simple Walk-Through audit or observation of the energy consumption of electrical appliances within the CUSTOMS DEPARTMENT building.
- Review and analyse energy usage history to create a baseline for which savings can be measured in the audited building.
- Determine what can be done to reduce energy consumption throughout the buildings and what options are available for system improvements if funding is available.
- Identify and evaluate measures that could improve the environmental performance of the buildings/wards and provide recommendations.

2. INTERPRETATION

In this report, unless the contrary intention appears;

Energy Conservation means steps taken to reduce and to use as much energy as necessary through changing energy consumption behavior, e.g. Switching off lights when not in use.

Energy Efficiency means using less energy to provide the same service/output, eg. Replacing inefficient light bulbs with efficient ones.

Faulty means an equipment not working or made correctly; having defects.

Potential savings means the actual reduction in operating expenses from the improved energy efficiency generated by an energy conservation or efficiency activity.

Retrofitting means upgrading an existing system to improve energy efficiency.

Tariff means the amount of money charge by the supplier (utility) per kWh for the use of electrical energy.

Vampire Load means the way power is consumed by electronic and electrical appliances while they are switched off or in standby mode (consuming electricity at a cost but not doing any work).

3. SUMMARY OF RECOMMENDATIONS

Below are some recommendations based on general observations carried out throughout the VIPAM building.

The recommendations are categorized with **A** being the most urgent where immediate actions are needed to be executed (first or second week of receiving this report). **B** can be 1 to 2 months after receiving this report, while **C** will depend on the availability of funds.

Table 1: Recommendations

Recommendations		
Category A	Category B	Category C
Apply energy conservation measures. Isolate or unplug vampire loads from power when not in use (i.e. re-chargeable equipment, computer and any other electronic devices with standby modes).	Establish Energy Efficiency and Conservation steering committee to take lead with EE&C initiatives and management within the CUSTOMS DEPARTMENT buildings.	Where applicable, replace all Double Frame light fittings (double tube) with single frame (single tube) throughout the building. Also remove unnecessary lights or reduce the number of lights per location.
Remove faulty light holders and bulbs or remove live wire from socket inside the light holder.	Renovate or improve the lighting control, i.e. add more switches to existing rooms/spaces where only one switch controls more than 10 lights, especially the lights in the conference/meeting room.	Replace all lights with energy efficient light bulbs, i.e. Replace T8 and T12 (36 watt) Fluorescent tubes with T5 (15 watt) retrofits.
Remove any faulty appliances located in the building.	Use fans in places where possible (especially in unsealed room, indoor corridor, conference room, etc.).	The conservation and efficiency mechanisms are tools for reducing the energy consumption.
Isolate or unplug faulty air conditioners if found within the building (working but no cold air coming out) and, OR service the air conditioner units quarterly.	Remove air conditioner if the room is very poorly sealed (i.e. if the room has no seals on the door and frequently open at times).	Replace old existing outdoor air conditioner units with efficient ones (if funding is available).

3.1 Description of building

-The customs department main office in Luganville (Santo) is located in the Millennium as shown on Figure 1a: Millennium Building

Figure 1 b.

- **Figures Description:** Figure 1a: Millennium Building

Figure 1 b shows the operations office that is located within the premises of the Luganville International wharf and it is less old in contrast to Figure 1a: Millennium Building

Figure 1 b.

- **Observation:** the building is quite old which suggests that its electrical system (wiring, equipment) is also old. Arrangement of rooms and electrical appliances have huge impact on monthly Bill.

- **Suggestion:** old systems are less efficient and may result in unnecessary power consumption

Fig 1: CUSTOMS DEPARTMENT buildings, Luganville



Figure 1a: Millennium Building



Figure 1 b: Main wharf

3.2 Findings

3.2.1 Vampire Loads Findings

i. Issue(s)/Observation(s)

- Electronics appliances (computer, printer, etc.) are still ON even though they are turned off.
- Appliances on STANBY MODE are draining power even though they are not doing any use full task.
- Hot water boilers are also considered as vampire loads when left to 'keep the water hot'.
- Faulty light fittings which are left without bulb and faulty bulb which is intact are also vampire loads.

ii. Recommendation(s)

- All Electronic appliances should always be 'unplugged' or turned from the power sockets, after office hours.
- try to avoid putting appliances on 'STANBY MODE'.
- Only use hot water heater to boil water instead of leaving it to 'Keep water hot'
- Remove faulty lightings.

3.2.2 Lighting

Lighting is the most common load which is used in all the rooms and outdoors. Here are some of the aspects and faults that were discovered:

i) **Findings of lightings**

a. Observation(s)/Issue(s):

- It has been observed there are a lot of unnecessary lights in one single room (see Figure 2)
- Too many lights are assigned to 1 switch.

b. Recommendation:

- Turn OFF lights when not used.
- Reduce the number of lights per switch, to better manage lighting.
- Reduce the number of lights per room.



**Too many lights in one room,
i.e. “Poor management of
lightings”**

Figure 2: Example of lack of proper lighting management

ii) **Faulty lights**

a. Observation(s)/Issue(s): Ballast of faulty light will draw power when the lights are ON even though it is not working.

b. Recommendation(s): Disconnect the live wire connected to the faulty light bulb (s) to avoid leakage of energy.

Figure 3: Faulty Lightings (vampire loads)



This faulty light still absorb power even though it is not ON.

3.2.4 Air conditioners

i. Air Conditioning Management:

a. Observation(s)/Issue(s):

- Brand & model not consistent throughout the building which is expensive for maintenance.
- Officers leaving the door open when entering and exiting the room where the air conditioner is located.
- air conditioning contributes to about 62% of the overall power consumption of the buildings.
- windows and doors of the air conditioned rooms not sealed properly i.e. using louvers is 'highly Not recommended'.

b. Recommendation(s)

- Use same brand throughout (cheap for maintenance cost)
- It is recommended that the air conditioners be serviced quarterly.
- use sealed glass windows and sealed glass doors.
- always close door when entering/exiting an air-conditioned room (put a notice on the front and back of the door as a reminder).
- Keep and maintain the temperature at 23 °C during summer and occasionally used in winter.
- Switch OFF when not in use but avoid reducing to a lower temperature and leave it ON
- Use electric fan whenever possible.
- Use outside breeze when possible, should the air conditioner be turned off completely to minimize the cost of electricity.
- Installation of correct sizing of air conditioner in the rooms.
- All installed air conditioners should be service at least twice or three times a year.

Figure 4: Air conditioners used within the CUSTOMS DEPARTMENT building.



This needs to be replaced with Glass windows and sealed properly to minimise power consumption of air conditioning to reduce electricity bill.

3.2.5 Office Equipment (Computers, printers and network accessories)

i. Findings of Office Equipment

a. Issue(s)/Observation(s):

- Most of the office equipment are usually left without turning them off after working hours and are using electricity as Vampire loads.
- Electronics appliances (computer, printer, etc.) are still ON when connected to power point even though they are turned off.

b. Recommendation(s)

- all office equipment such as printers, computers i.e. PC, monitor, etc. must be turned off on the power point or unplug from the power point
- Avoid putting equipment on 'STANDBY MODE'

Figure 5: Sample Office Equipment



**Clear example of equipment
on STANDBY MODE
wasting power.**

4. HISTORICAL DATA ANALYSIS

4.1 Energy Balance

Table 2 shows the electricity consumption of Customs department (both offices combined) for a 1-year period. Raw data was not provided accordingly, hence an average estimated power consumption was calculated

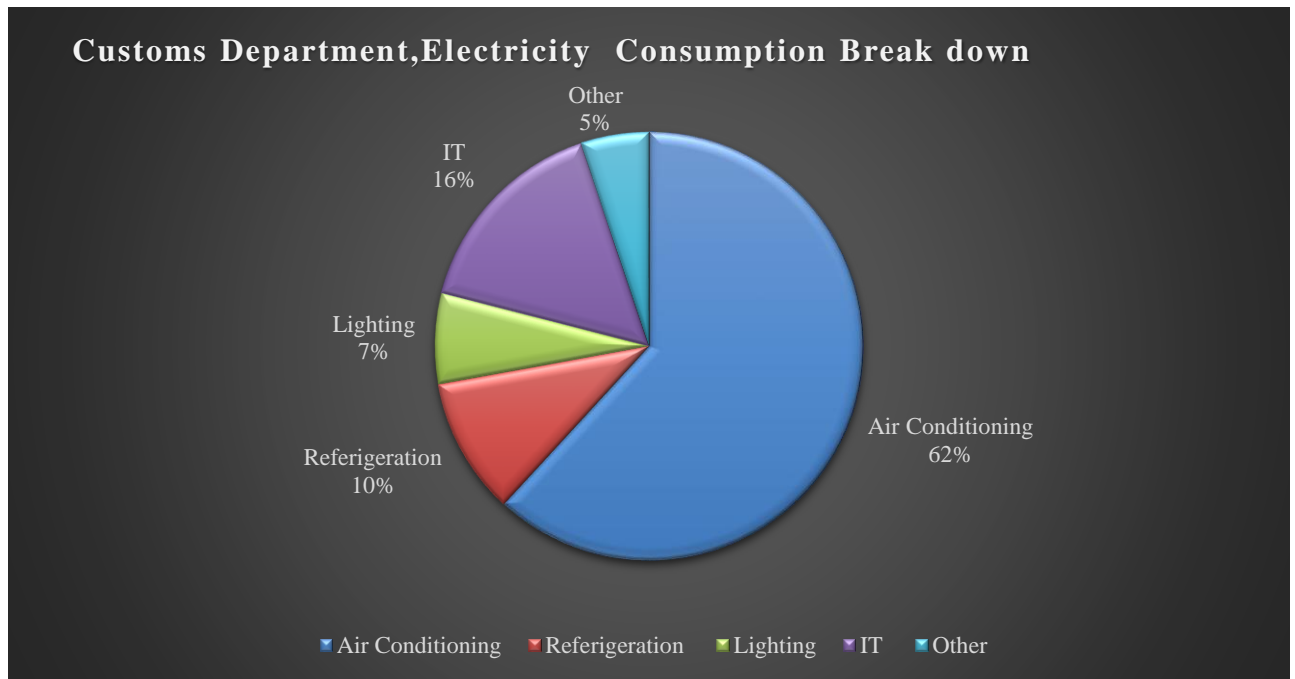
Table 2: Electricity bill budget for CUSTOMS DEPARTMENT (April 2018 – March 2019)

Month	Power Consumption(kWh)/Month	Total Electricity Cost (Vatu)/Month	
April/2018	1,161 kWh	67,820 VT	
June/2018	1,068 kWh	61,975 VT	
September/2018	844 kWh	47,946 VT	
February/2019	1023 kWh	61,709 VT	
March/2019	1,219 kWh	75,241 VT	
Total	5,315 kWh	314,691 VT	

From Table 2, the average cost of the monthly consumption is calculated to be: **62,938 VT**,

Thus, the cost of the yearly consumption is **755,258 VT**

Figure 3: Power Consumption breakdown for CUSTOMS DEPARTMENT building

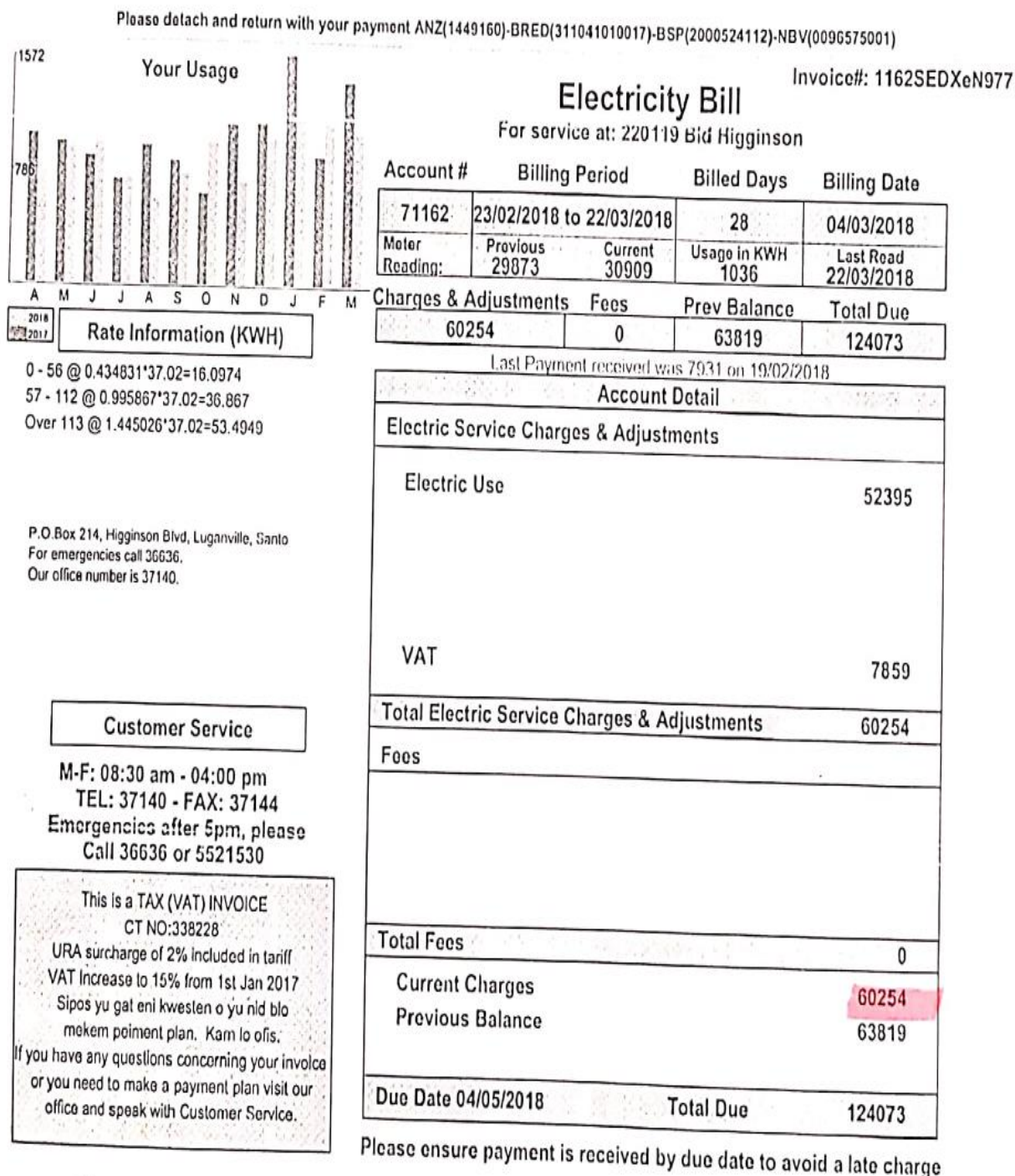


Analysis of the chart in Figure 3.

- Air conditioning is responsible for high significant proportion of the total energy consumption followed by lightings.
- There is variation among the appliance due to their arrangement within the building, the hours in which they operate and the rate at which they consume electricity.
- There is variation among the appliance due to their arrangement within the building, the hours in which they operate and the rate at which they consume electricity.
- It is evident that avenues need to be utilised to better managed electricity consumption of such appliances.

Appendix A: Power Consumption Data

Power consumption data for the CUSTOMS DEPARTMENT building (2018/2019)



Appendix B – Energy saving for Air Conditioner within the CUSTOMS DEPARTMENT building.

Sample calculation of approximate energy savings for Air Conditioner Savings with proper management (Sealed door and window) of Millennium Building.

Assume that the power consumption of evaporator for all the 1,600 W unit is 200 W:

i. Cost of Power per year (unsealed doors and windows)

$$\begin{aligned} &= \left(\left(\left(\frac{1,600}{1000} \right) \times 8 \right) + \left(\left(\frac{200}{1000} \right) \times 8 \right) \right) \times 4 \text{ units} \times 5 \text{ days per week} \\ &\quad \times 52 \text{ weeks per year} \times 36.867 \text{ VT/kwh} \\ &= 184040.064 \text{ VT per year} \end{aligned}$$

ii. Cost of Power per year (sealed doors and windows)

$$\begin{aligned} &= \left(\left(\left(\frac{1,600}{1000} \right) \times 1 \right) + \left(\left(\frac{200}{1000} \right) \times 1 \right) \right) \times 4 \text{ units} \times 5 \text{ days per week} \\ &\quad \times 52 \text{ weeks per year} \times 36.867 \text{ VT/kwh} \\ &= 23,005.008 \text{ VT per year} \end{aligned}$$

iii. Savings per year when doors & windows are sealed.

$$\begin{aligned} &= 184040.064 \text{ VT} - 23005.008 \text{ VT} \\ &= 161,035.056 \text{ VT per year} \end{aligned}$$

iv. Payback time (assume cost of sealed doors & window is 150,000 VT)

$$\frac{150,000 \text{ VT}}{161,035.056 \text{ VT}} = 0.9315 \text{ years}$$

∴ payback period is less than a year, which suggests that investing in sealed door is worthwhile, i. e. cost effective.

Appendix C - Inventories for Lightings, Air conditioners and other appliances.

i. Lighting Inventory for the CUSTOMS DEPARTMENT building

Appliance	Quantity	Power Consumption (W)
T8 Fluorescent Tube- linear(single/double)	23	36
T5 Fluorescent Tube	3	18
Compact Fluorescent	13	15

ii. Air conditioner and Fan inventory for CUSTOMS DEPARTMENT buildings

Brand	Type	Quantity	Rated Power Consumption (W)	Temp. Setting	Hours/Day
Air conditioner					
Sanyo	Split type	2	780	21	8
Hitachi	Split type	1	2050	24	8
Green Aircon	Split type	4	1600	23	8
Supercool	Split type	1	825	22	8
Fan					
Brand - Normal	Ceiling type	2	78	-	2

iii. Other Appliances inventory for the CUSTOMS DEPARTMENT building

Appliance	Quantity	Power Consumption (W)
Kambrook water boiler	1	700 W
Electric Kettle	1	1200 W
Rice Cooker	1	700 W

Appendix D – Additional photos

