


**PAHALWAN GURUDEEN PRASIKSHAN MAHAVIDYALAYA
PANARI, LALITPUR**



ENERGY AUDIT

Page 1 of 17


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Contents

1. INTRODUCTION.....	
2. OBJECTIVE.....	
3. NEED OF ENERGY AUDIT.....	
4. INTERPRETATION.....	
5. SUMMARY OF RECOMMENDATIONS.....	
Description of building.....	
Findings.....	
6. HISTORICAL DATA ANALYSIS.....	
Energy Balance.....	
Appendix A: Power Consumption Data.....	
Appendix B – Energy saving for Air Conditioner.....	
Appendix C - Inventories for Lightings, Air conditioners and other appliances.....	
Appendix D – Additional photos.....	
7. CONCLUSION.....	

1. INTRODUCTION

- In energy audit is an assessment and analysis of energy flow in a process or system, aimed at reducing the amount the energy input in to the system without negatively affective the output.
- Energy audit is a systematic study or survey to identify how energy is been used in a building or plant and identifies energy saving opportunities.
- Using proper audits methods and equipments, energy audits provides the energy manager with essential information on how much, where and how energy is used within an organization.

2. 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 college building.
- Review and analyze 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.

3. Need of energy audit

- The three top operating expenses are energy (both electrical and thermal), labor and materials.
- Energy would emerge as a top ranker for cost reduction.
- Objective of Energy Audit is to determine ways to reduce energy consumption per unit of product output or to lower operating costs.
- Energy Audit provides a "bench-mark" (Reference point) for managing energy in the organization.
- Energy Audit will help to understand more about the ways energy and fuel are used in any industry, and help in identifying the areas where waste can occur and where scope for improvement exists.
- The Energy Audit would give a positive orientation to the energy cost reduction, preventive maintenance and quality control programmes which are vital for production and utility activities.
- Audit programme will help to keep focus on variations which occur in the energy costs, availability and reliability of supply of energy, decide on appropriate energy mix, identify energy conservation technologies, retrofit for energy conservation equipment etc.

4. 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, e.g. Replacing inefficient light bulbs with efficient ones.

Faulty means 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).

5. SUMMARY OF RECOMMENDATIONS

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

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 college building.	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 out- door air conditioner units with efficient ones (if funding is available).

Description of building

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 impaction monthly Bill.

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

Add few pictures of building



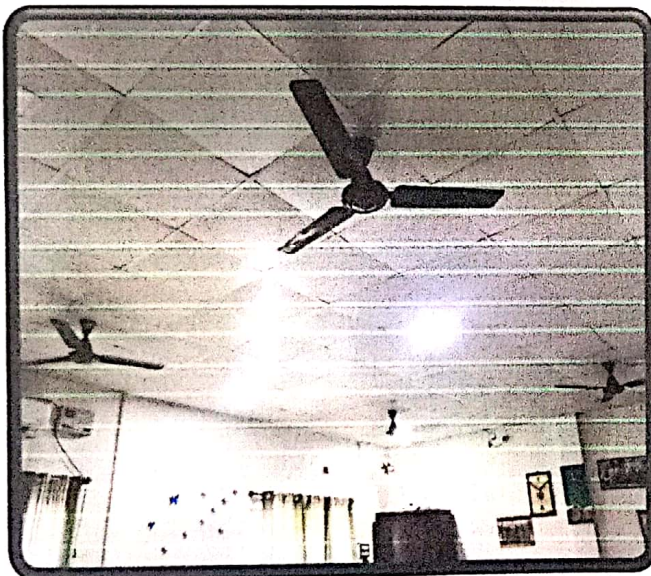
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SOLAR PENAL



BATTRIES



FANS



LIGHTS


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Findings

Vampire Loads Findings

I. Issue/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.
- Faulty light fittings which are left without bulb and faulty bulb which is intact are also vampire loads.

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.

Figure 2: Example of lack of proper lighting management

i) **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)

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

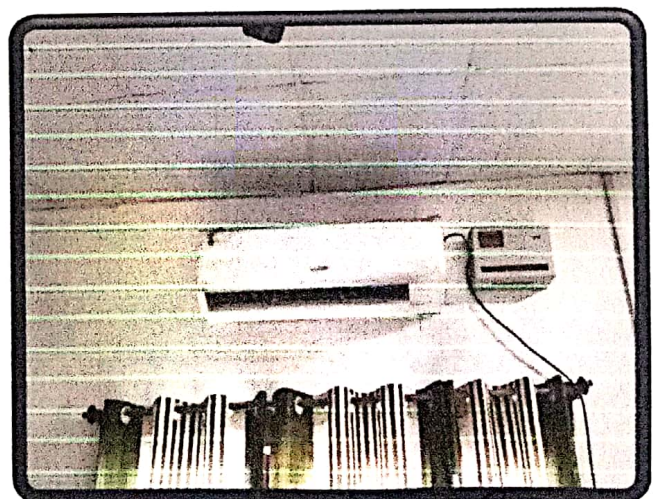
Use electric fan whenever possible.

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



Office Equipment (Computers, printers and network accessories)

i. Findings of Office Equipment

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

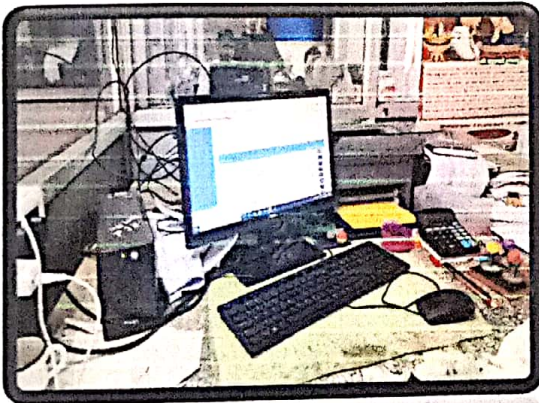
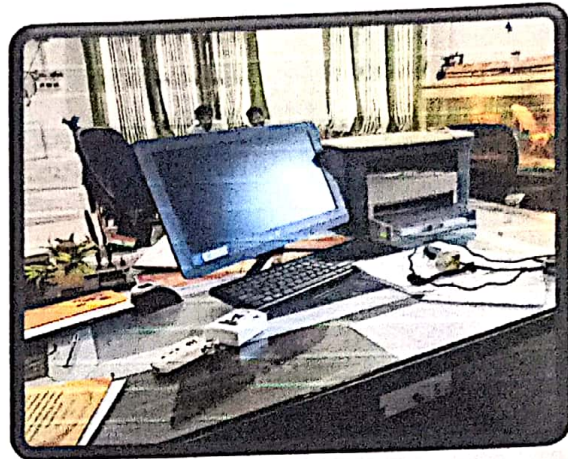
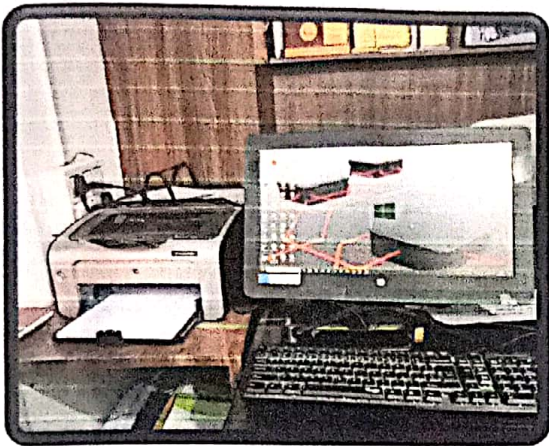
- Most of the office equipment is usually left without turning them off after working hours and are using electricity as Vampire loads.
- Electronics appliances (computer, printer, etc.) are still ON when connected to power
Point even though they are turned off.

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

Electronics Appliances



6. HISTORICAL DATA ANALYSIS

a. Energy Balance

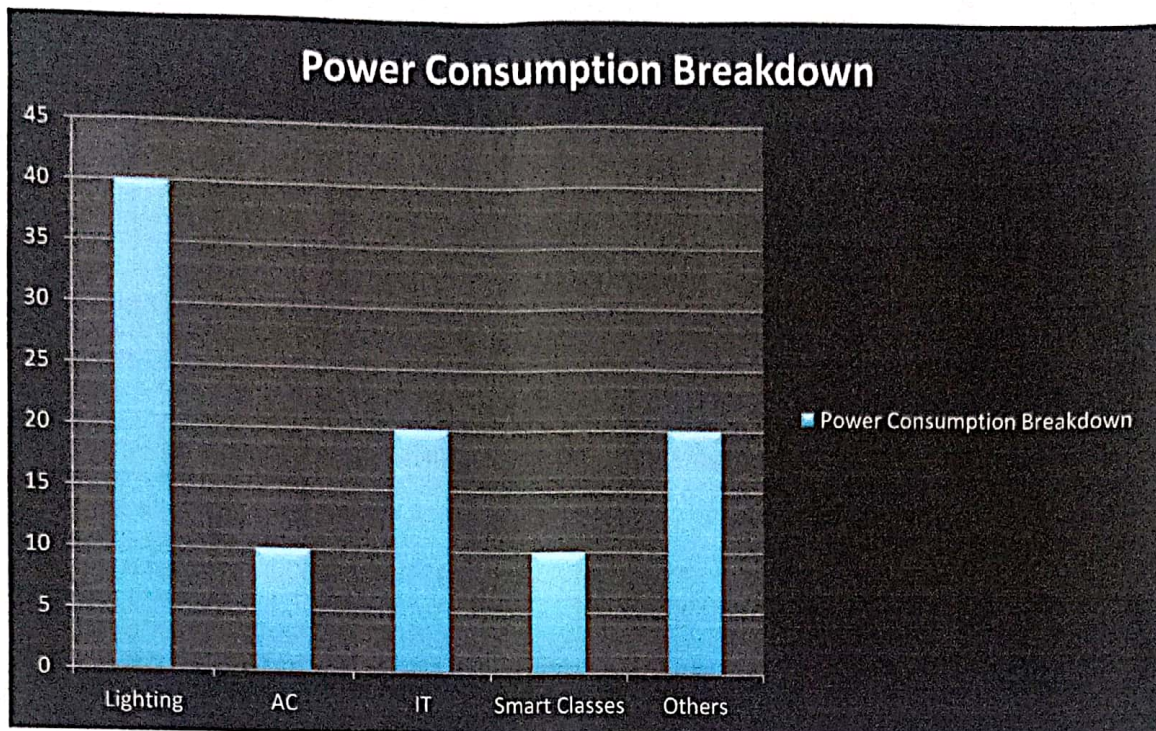
Table 2 shows the electricity consumption of Customs department (both offices combined) for a 1-year period. Raw data was not provided accordingly; hence an average estimated power consumption was calculated

Sr.No.	MONTH	YEAR	KWH	AMOUNT (RS.)	KVA	AMOUNT (RS.)	TOTAL (RS.)
1.	JANUARY	2021	43.266	519.192	51.91	-	519.192
2.	FEBRUARY	2021	55.8	669.6	66.96	-	669.6
3.	MARCH	2021	60.00	720.00	72	-	720.00
4.	APRIL	2021	62.8	753.6	75.36	-	753.6
5.	MAY	2021	69.3	831.6	83.16	-	831.6
6.	JUNE	2021	80.1	961.2	96.12	-	961.2
7.	JULY	2021	70.1	841.2	84.12	-	841.2

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 utilized to better managed electricity consumption of such appliances.

Appendix A: Power Consumption Data

Power consumption data for 2020-21

Appendix B – Energy saving for Air Conditioner within the College

Savings for Air Conditioner Savings with proper management
effective.

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

i. Air conditioner and Fan inventory for CUSTOMS DEPARTMENT buildings

Brand	Type	Quantity	Rated Power Consumption (W)	Temp.Setting	Hours/Day
Air conditioner					
Havells	Split type	2	780	21	8
Whirlpool	Window Type	1	2050	24	8
Fan					
Brand - Normal	Ceiling Type	2	78	-	2

7. CONCLUSION -

Considering the fact that the organization is a well-established, long time run establishment with good reputation, there is significant scope for conserving energy and make the campus as self-sustained in it. The energy conservation initiatives taken up by the institution are substantial.

Energy efficient lighting schemes, awareness created among stakeholders and necessary power backups are being practiced by the institution.

There are some best Practices followed on Energy Audit in the Organization like Transformers, Generators and UPS are protected properly with fencing and kept awareness boards on 'Dangers' and 'Warnings'. It is observed that the most of places, sign board of 'Switch ON' and 'Switch OFF' are kept towards saving energy measures to the stakeholders. Electrical wires, switch boxes and stabilizers are properly covered without any damage which will cause any problems to the staff and student members. Adaptations of sprinkler irrigation in the campus to minimize the energy potential are well appreciated. Few recommendations, in addition, can further improve the energy savings of the Organization.

This may lead to the prosperous future in context of Energy Efficiency Campus and thus sustainable environment and community development to the stakeholders in coming years to come.