

ENERGY AUDIT



DHING COLLEGE, DHING, NAGAON, ASSAM


Conducted and Prepared by
Department of Physics, Dhing College




ENERGY AUDIT REPORT
SUBMITTED TO
DHING COLLEGE, DHING, NAGAON, ASSAM

SUBMITTED BY
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Acknowledgement



The Principal,

Dhing College, Dhing, Nagaon, Assam

Principal
Dhing College

ACKNOWLEDGEMENT

Energy Audit of system is key instrument in knowing the present level of efficiency of various components and establishing the areas of shortfall for improvement.


We are very thankful to Hon. Principal Dr Biman Hazarika, Dhing College, Nagaon for giving opportunity to conduct Energy audit of various facilities in college campus. We are also thankful to Vice Principal Mr. S.K. Sarma, Coordinator IQAC, Dhing College, various respected HOD, Lecturers, Hostel Rectors & their respective subordinate staffs who have given their valuable contribution for guiding & supporting us during campus round for data collection, network study & measurement for accomplishing successful Energy audit.

This report made with sincere effort gives details of the relevant data collected during energy audit study, observation, analysis & recommendations made pertaining to different facilities in campus.

Several Energy Conservation Opportunities(Measures) have been identified & proposed in course of our study & these options when implemented , are expected to bring in lasting benefits(saving) in term of energy as well as cost saving to the management.

We are pleased to submit this Detailed Energy Audit Report to Hon. Principal Dr. Biman Hazarika with energy conservation opportunity as well as recommendations after sincere study & observations.

For Audit Team


(Debabrata Debnath)

**Head of the Department
Physics, Dhing College
Dhing, Nagaon**

ENERGY AUDIT TEAM

NAME	DEPARTMENT	DESIGNATION
Debabrata Debnath	Physics, Dhing College	HOD & Associate Professor
R.S. Baruah	Physics, Dhing College	Associate Professor
Dr N K Barthakur	Physics, Dhing College	Associate Professor
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PREFACE

In the contemporary scenario, Energy has been identified as a crucial and balancing factor in the indices for sustainable development. The heavy and unbalanced energy consumption adversely affects energy price and economic growth.

The Energy Conservation Act, 2001, defines Energy auditing as “the verification, monitoring and analysis of use of energy including submission of technical report containing recommendations for improving energy efficiency with cost benefit analysis .It facilitates a systematic approach to the energy management in a system, trying to balance the total energy input with its use. It identifies all the energy streams in a system and quantifies the use of energy according to its discrete functions. It is a study to determine how and where energy is used, and to identify methods for energy savings. The Energy Auditing for a day is the index of the consumption which normalizes the situation of Energy crisis by providing the schemes for conservation of energy. The opportunities lie in the use of existing renewable energy technologies, greater efforts at energy efficiency and the dissemination of latest technologies

This report is our mite in contributing to the larger picture of effective energy management and conservation. As is known, energy auditing is an on-going process, a part of a larger procedure to ensure long- term sustainable development.

We have enlisted credible solutions based on the outcome of our analysis of data, and our recommendations, which can be implemented totally in the campus in order to ensure minimizing energy waste and maximizing energy potential. We hope in all earnest that these will be given its due and that the audit will be fruitful in terms of energy conservation.

Any suggestions to further enhance the quality of this work are always welcome.
Energy audit of College (PDF) is available from: www.dhingcollege.in

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INTRODUCTION

Dhing College, Dhing Nagaon Assam, established in 1965, an institution devoted to meet the needs of higher education, has attained great heights during past years. The mission of the college is to spread education among the People of this socially and economically challenged area. This college, having the status of the "biggest ' college in the division", has an important role to play in spreading higher education. Keeping this fact in mind, every effort is being made to establish this college as a 'Role Model College'.

Dhing College was established in 1965. The college is affiliated to Gauhati University, Guwahati, Assam. The college is offering Graduate Courses in 14 subjects in three faculties i.e. Arts, Science and Commerce with various Diploma and Certificate Courses. The total students' strength of the college is more than 2000.

Dhing College campus consists of buildings named as Science Block, Arts Block, Commerce Block, with administrative office, various HOD cabins, staff rooms, classrooms, various laboratory like Physics, chemistry, botany, Zoology, Bio-Tech Hub as well as various faculty departments are functioning with basic motto to impart quality, employment, entrepreneur and Agro oriented higher education to mostly rural as well as marginal urban student. Besides this there are multistoried hostel building (Boys and Girls) for facilitating student accommodation to many rural boys & girl students. This college also provides field for outdoor games, indoor, gymkhana NCC and NSS facility to student undergoing through various type of physical education. There is also beautiful Digital Library building where student studying in various branches have facility to refer books.

The solar power plant was setup in August 2012 in the college and power supply of the college meet up by this plant completely till July 2020. But unfortunately, the power plant malfunctioned and further communication was made with the concerned organization to reactivate it. During this period the power is taken from ASEB, Dhing.

This audit was undertaken in order to verify how effective these steps were, and also to identify loop holes, if any, in the existing practices, along with outlining measures for enhancing energy utilization.

Objectives

The task of energy audit undertaken by Department of Physics, Dhing College has objective to identify energy saving & conservation opportunity with electrical network & equipment load study with measurement & to recommend action plan with saving & financial calculation for implementation to materialize energy saving & conservation opportunity to save input energy cost. The energy audit was conducted during summer and winter season which was reviewed for implementation of energy saving & conservation opportunity already identified as well as quantified it.

- 1) Inventory of various electrical load
- 2) APDCL bill study & working out average cost of power.
- 3) Identification of various energy conservation measures & saving opportunity.
- 4) Review of Awareness program if any for optimum use of electricity as well as its saving.
- 5) Review of implemented non-conventional energy installation & applications in college campus & its quantification.

The Energy Audit Manual of the Energy Management Centre, Government of Assam, defines the primary objective of any energy audit as determining “ways to reduce energy consumption per unit of product output or to lower operates costs” .The recommendations of the study will become a basis for future schemes of better energy consumption and preservation throughout the organization.

Specific objectives of the study are:

- Verify the steps adopted for energy management in the campus
- Spot the inefficient or inadequate practices, if any
- Improve the energy preserving measures and methods
- Identify potential energy saving opportunities
- Formulate Possible steps and measures to be adopted in the campus

SYSTEMS STUDIED DURING ENERGY AUDIT

- 1) Lighting fixtures have been physically in various campuses verified & recorded.
- 2) Reviewed implemented non-conventional energy installation & applications in college for use.
- 3) Electricity bills served by APDCL are verified & worked out cost of power.
- 4) It is reviewed about awareness program if any for optimum use of electricity as well as its saving undertaken at college level. There is tremendous scope to create awareness among user about efficient & optimum use of energy to save. Instruction cum Request Sign board shall be displayed near each switch-board & toilet block, bathrooms to influence & guide to user to arrest misuse & wastage of power.

Methodology

An energy audit is an inspection, survey and analysis of energy flows, for energy conservation in a building, process or system to reduce the amount of energy input into the system without negatively affecting the output.

Method use for Energy audit is a Preliminary Audit. Preliminary audit uses existing data to look extensively at the existing energy consumption patterns and identifies the areas for improvement.

Data collection

For the purpose of this audit, audit groups for specific areas were formed. Data was collected through

- ✓ Inspection and observation
- ✓ Identification of energy consumption
- ✓ Calculations, analysis
- ✓ Validation

Data analysis

The gathered data was then quantified and separated according to the following criteria:

- ✓ Energy consumption by end use
- ✓ Estimated energy use block-wise
- ✓ Consumption equipment-wise

Table 1: Department wise electrical/electronic appliances and equipments

Sl. No	Department	Tube light	CFL/LED	Fan	AC/air Cooler	Freeze	Xerox Printer+ Computer+	Lcd TV	Aqua guard	Inverter/ Motor	Others
1	Physics	12	2/2	13+3(Wal l fan)	-	-	1+1	-	1	-/1	
2	Chemistry	6	1/-	12+05 (exhaust fan)	-	1	1+1	1	1	-	
3	Mathematics	2	1/3	7	-	-	1+0	-	1	-	
4	Botany	5	2/3	7	-	1	1+0	-	1	-	
5	Zoology	8	-/1	13	-	1	-	-	1	-	
6	Biotech Hub	3	-/3	4+1(wall fan)	2	1	3+2	-	1	1	
7	Geography	2	-/1	5	-	-	2+0	-	1	-/1	
8	Political Science	1	1/-	1	-	-	-	-	-	-	
9	Economics	1	1/1	1+1(wall fan)	-	-	1+1	-	1	-	
10	History	1	-/2	2+1(wall fan)	-	-	1+0	-	1	-	
11	Bengali	1	-/2	4	-	-	-	-	-	-	
12	English	6		11	-	-	10+0	-	1	-	
13	Education	2		5	-	-	-	-	1	-	
14	Assamese	2		4	-	-	-	-	1	-	
15	Commerce	1	-/1	1	-	-	1+0	-	1	-/1	
16	Central Library	19	1/1	29+1(wall fan)	-	-	21+2+1	1	1	1/1	

17	IQAC	1	-/1	3	-	-	1+0	-	-		
18	Computer lab	1	-	3	-	-	12+0	-	-		
19	seminar hall	4	-	10+2 (exhaust fan)	3/-	-	-	-	-		
20	Office	3	-/3	8	-	-	6+2+2	-	-	1/1	
21	Principal Room	3	-/2	6+1 (wall fan)	1/-	-	3+2	1	1		
22	Examination Control	3	-/2	7+1 (exhaust fan)	-	-	7+1	-	-	1/-	
23	Zone	3	-	4	-	-	-	-	-		
24	Hall and Classroom	19	35/2	75	-	-	1		-	-/1	3 amplifier
25	Common Room	5	3/-	7	-	-	-	-	3		
26	NCC	2	-	3	-	-	-	-	-		
27	Vice principal room	1	-	1+1(wall fan)	-	-	-	-	1		
28	Medical Room	2	3/-	2	-	-	-	-	-		
29	Old library			4							
30	Girls Hostel	25	-/30	26	-/1	1	-	1	1	1/2	
21	Boys Hostel				-	-	-	-	-	-/1	
32	Indoor	5	-/6	4	-	-	-	-	-	-/1	
33	J House		-/4	2	-	-	-	-	-	-/1	
34	Canteen & Security Room			4+1(wall fan)	-	-	-	-	-	-/1	
35	Bearer Campus	4	-/7	4	-	-	-	2	-	-	
36	Street light/sign board/ campus	13	-/7		-	-	-	-	-	-	23 CCTV, 3 halogen

Table 2: Estimated energy consumption in KWH during summer (per month)

Block	Items	Number	Power in W/item	TIME consumed (In hours)	Days	TOTAL Power consumption in KWH
SCIENCE	Ceiling Fan	56	60W	5	24	403.2
	Wall Fan	04	100W	1	24	9.6
	Exhaust Fan	05	35W	1	24	4.2
	Tube light	31+5(used)	20W	1	24	30
	LED Bulb	10+2(used)	9W	1	24	0.432
	CFL	06	35W	1	24	5.040
	Aquaguard	06	100W	0.5	24	7.2
	Motor	01	746	0.5	24	8.952
	Desktop	07	200	2	24	67.2
	Printer	04	30W	0.5	24	1.44
	Refrigerator	04	250	6	24	144
	Indicator	34	1W	24	24	19.584
	AC	02	1000	6	24	288
	Inverter	01	1500W	1	24	36
	LED TV	01	40W	1	24	0.96
Lab Equipments						64
Total						1025.808
ARTS	Ceiling Fan	13	60W	5	24	93.6
	Wall Fan	02	100W	3	24	14.4
	Tube light	06	20W	1	24	2.88
	LED Bulb	2+4(used)	9W	5	24	4.32
	CFL	01+01(used)	60W	5	24	7.2
	Aquaguard	03	100W	0.5	24	3.6
	Motor	01	746	0.5	24	8.952
	Desktop	04	200	2	24	38.4
	Printer	01	30W	0.5	24	0.36
	Indicator	12	1W	24	24	6.912
Total						180.624
ARTS/COMMERCE	Ceiling Fan	21	60W	5	24	151.2
	Tube light	7+4(used)	20W	10	24	24
	LED Bulb	01	9W	1	24	0.216
	Aquaguard	04	100W	0.5	24	4.8
	Motor	01	746	0.5	24	8.952
	Desktop	11	200	2	24	105.6
	Indicator	23	1W	24	24	13.248
Total						308.016
CENTRAL LIBRARY	Ceiling Fan	19+10(used)	60W	5	24	72
	Wall Fan	01	100W	5	24	12
	Tube light	19	20W	5	24	45.6
	LED Bulb	01	9W	5	24	1.08
	CFL	01	35W	1	24	0.840
	Aquaguard	01	100W	0.5	24	0.012
	Motor	01	746	0.5	24	8.952
	Desktop	21	200	4	24	40.32
	Printer	02	30W	0.5	24	0.72
	Xerox Machine	01	2000W	0.5	24	24
	Indicator	44	1W	24	24	25.344
	Inverter	01	1500W	5	24	180
LED TV	01	40W	1	24	1.92	

	Total					412.788
ADMINISTRATIVE BLOCK	Ceiling Fan	25+16(used)	60W	6	24	138.24
	Wall Fan	01	100W	6	24	14.4
	Exhaust Fan	03	35W	2	24	5.04
	Tube light	16+02(used)	40W	6	24	11.52
	LED Bulb	4+4	9W	6	24	5.184
	Aquaguard	01	100W	0.5	24	1.2
	Motor	01	746	0.5	24	8.952
	Desktop	27+2(used)	200	6	24	57.6
	Printer	05	30W	2	24	1.44
	Xerox Machine	02	2000W	1	24	96
	Indicator	43	1W	24	24	24.768
	AC	04	1000	8	24	768
	Inverter	01/01	1500W/ 10000W	8/1	24	288+240
LED TV	01	80W	2	24	3.84	
	Total					1664.184
HALLS AND CLASSROOMS/COMMON ROOM/NCC ROOM	Ceiling Fan	92	60W	4	24	529.92
	Wall Fan	01	100W	0.5	24	1.2
	Tube light	29	20W	1	24	13.920
	LED Bulb	02	9W	4	24	1.728
	CFL	41	35W	1	24	17.220
	Aquaguard	04	100W	0.5	24	4.8
	Motor	01	746	0.5	24	8.952
	Desktop	01	200	1	24	4.8
	Indicator	17	1W	24	24	9.792
	AMPLIFIER	03	40W	4	24	11.52
	Total					603.852
OLD CAMPUS	Ceiling Fan	32	60W	6	30	345.6
	Tube light	30	20W	5	30	90
	LED Bulb	36+4(used)	9W	6	30	6.48
	Aquaguard	01	100W	0.5	30	1.5
	Motor	05	746	1	30	111.9
	Refrigerator	01	250	8	30	60
	Indicator	35	1W	24	30	25.2
	Air Cooler	01	300W	0.5	30	4.5
	Inverter	01	1500W	2	30	96
	LED TV	01	40W	2	30	2.4
	Total					743.58
CANTEEN/ SECURITY ROOM	Ceiling Fan	04	60W	6	24	34.56
	Wall Fan	01	100W	6	24	14.4
	Motor	01	746	1	24	17.904
	Indicator	04	1W	24	24	2.304
	Total					69.168
BEARER CAMPUS	Ceiling Fan	04	60W	8	30	57.6
	Tube light	04	20W	10	30	24
	LED Bulb	07	9W	10	30	18.9
	LED TV	01	40W	2	30	4.8
	Total					105.3
STREET LIGHT/SIGN BOARD/CCTV	Tubelight	13	60W	10	30	234
	LED Bulb	07	9W	10	30	18.9
	Halogen	03	500W	10	30	450
	CCTV	23	50W	24	30	828
	Total					1530.9

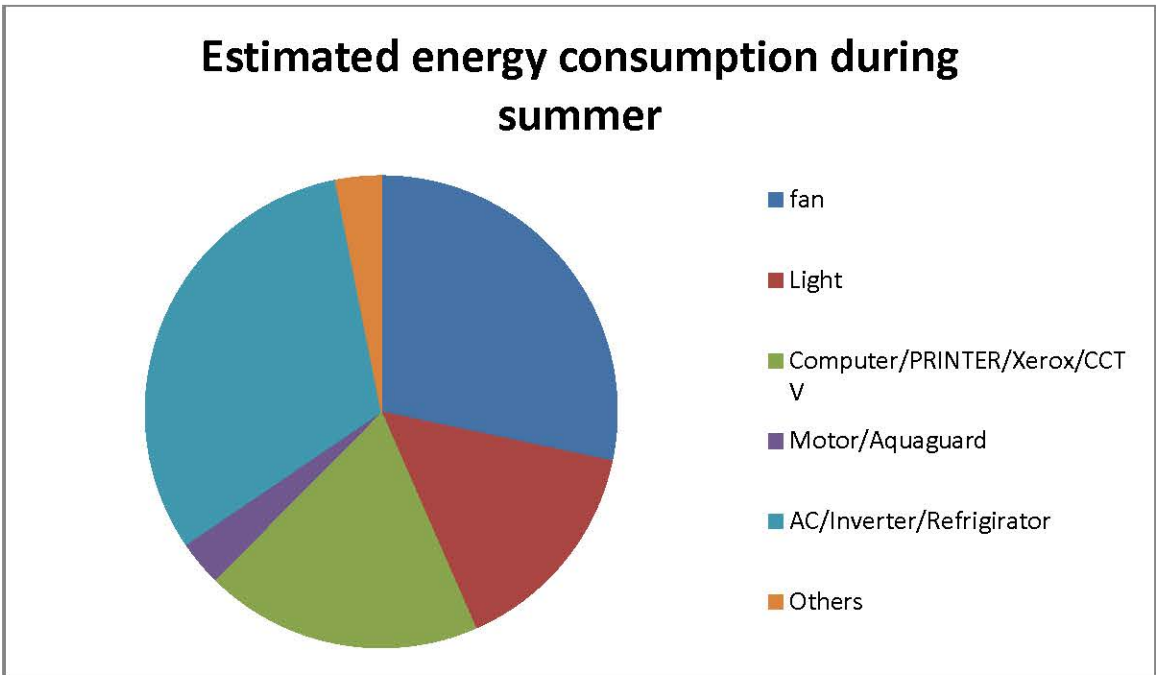


Fig 1: Energy consumption by and use (summer)

Table 3: Estimated energy consumption in KWH during winter (per month)

Block	Items	Number	Power in W/item	TIME consumed (In hours)	Days	TOTAL Power consumption in KWH
SCIENCE	Ceiling Fan	56	60W	0	24	0
	Wall Fan	04	100W	0	24	0
	Exhaust Fan	05	35W	1	24	4.2
	Tube light	31+5(used)	20W	1	24	30
	LED Bulb	10+2(used)	9W	1	24	0.432
	CFL	06	35W	1	24	5.040
	Aquaguard	06	100W	0.5	24	7.2
	Motor	01	746	0.5	24	8.952
	Desktop	07	200	2	24	67.2
	Printer	04	30W	0.5	24	1.44
	Refrigerator	04	250	4	24	96
	Indicator	34	1W	24	24	19.584
	AC	02	1000	0	24	0
	Inverter	01	1500W	1	24	36
	LED TV	01	40W	1	24	0.96
Lab equipments				24	64	
Total						341.008
ARTS	Ceiling Fan	13	60W	0	24	0
	Wall Fan	02	100W	0	24	0
	Tube light	06	20W	1	24	2.88
	LED Bulb	2+4(used)	9W	5	24	4.32
	CFL	01+01(used)	60W	5	24	7.2
	Aquaguard	03	100W	0.5	24	3.6
	Motor	01	746	0.5	24	8.952
	Desktop	04	200	2	24	38.4
	Printer	01	30W	0.5	24	0.36
	Indicator	12	1W	24	24	6.912
Total						72.624
ARTS/COMMERCE	Ceiling Fan	21	60W	0	24	0
	Tube light	7+4(used)	20W	10	24	24
	LED Bulb	01	9W	1	24	0.216
	Aquaguard	04	100W	0.5	24	4.8
	Motor	01	746	0.5	24	8.952
	Desktop	11	200	2	24	105.6
	Indicator	23	1W	24	24	13.248
Total						156.816
CENTRAL LIBRARY	Ceiling Fan	19+10(used)	60W	0	24	0
	Wall Fan	01	100W	0	24	0
	Tube light	19	20W	5	24	45.6
	LED Bulb	01	9W	5	24	1.08
	CFL	01	35W	1	24	0.840
	Aquaguard	01	100W	0.5	24	0.012
	Motor	01	746	0.5	24	8.952
	Desktop	21	200	4	24	40.32
	Printer	02	30W	0.5	24	0.72
	Xerox Machine	01	2000W	0.5	24	24
	Indicator	44	1W	24	24	25.344
	Inverter	01	1500W	5	24	180
LED TV	01	40W	1	24	1.92	

	Total					328.788
ADMINISTRATIVE BLOCK	Ceiling Fan	25+16(used)	60W	0	24	0
	Wall Fan	01	100W	0	24	0
	Exhaust Fan	03	35W	2	24	5.04
	Tube light	16+02(used)	40W	6	24	11.52
	LED Bulb	4+4	9W	6	24	5.184
	Aquaguard	01	100W	0.5	24	1.2
	Motor	01	746	0.5	24	8.952
	Desktop	27+2(used)	200	6	24	57.6
	Printer	05	30W	2	24	1.44
	Xerox Machine	02	2000W	1	24	96
	Indicator	43	1W	24	24	24.768
	AC	04	1000	0	24	0
	Inverter	01/01	1500W/ 10000W	8/1	24	288+240
LED TV	01	80W	2	24	3.84	
	Total					743.544
HALLS AND CLASSROOMS/COMMON ROOM/NCC ROOM	Ceiling Fan	92	60W	0	24	0
	Wall Fan	01	100W	0	24	0
	Tube light	29	20W	1	24	13.920
	LED Bulb	02	9W	4	24	1.728
	CFL	41	35W	1	24	17.220
	Aquaguard	04	100W	0.5	24	4.8
	Motor	01	746	0.5	24	8.952
	Desktop	01	200	1	24	4.8
	Indicator	17	1W	24	24	9.792
	AMPLIFIER	03	40W	4	24	11.52
	Total					72.732
OLD CAMPUS	Ceiling Fan	32	60W	0	30	0
	Tube light	30	20W	5	30	90
	LED Bulb	36+4(used)	9W	6	30	6.48
	Aquaguard	01	100W	0.5	30	1.5
	Motor	05	746	1	30	111.9
	Refrigerator	01	250	4	30	30
	Indicator	35	1W	24	30	25.2
	Air Cooler	01	300W	0	30	0
	Inverter	01	1500W	2	30	96
	LED TV	01	40W	2	30	2.4
	Total					363.48
CANTEEN/ SECURITY ROOM	Ceiling Fan	04	60W	0	24	0
	Wall Fan	01	100W	0	24	0
	Motor	01	746	1	24	17.904
	Indicator	04	1W	24	24	2.304
		Total				
BEARER CAMPUS	Ceiling Fan	04	60W	0	30	0
	Tube light	04	20W	10	30	24
	LED Bulb	07	9W	10	30	18.9
	LED TV	01	40W	2	30	4.8
		Total				
STREET LIGHT/SIGN BOARD/CCTV	Tubelight	13	60W	10	30	234
	LED Bulb	07	9W	10	30	18.9
	Halogen	03	500W	10	30	450
	CCTV	23	50W	24	30	828
		Total				

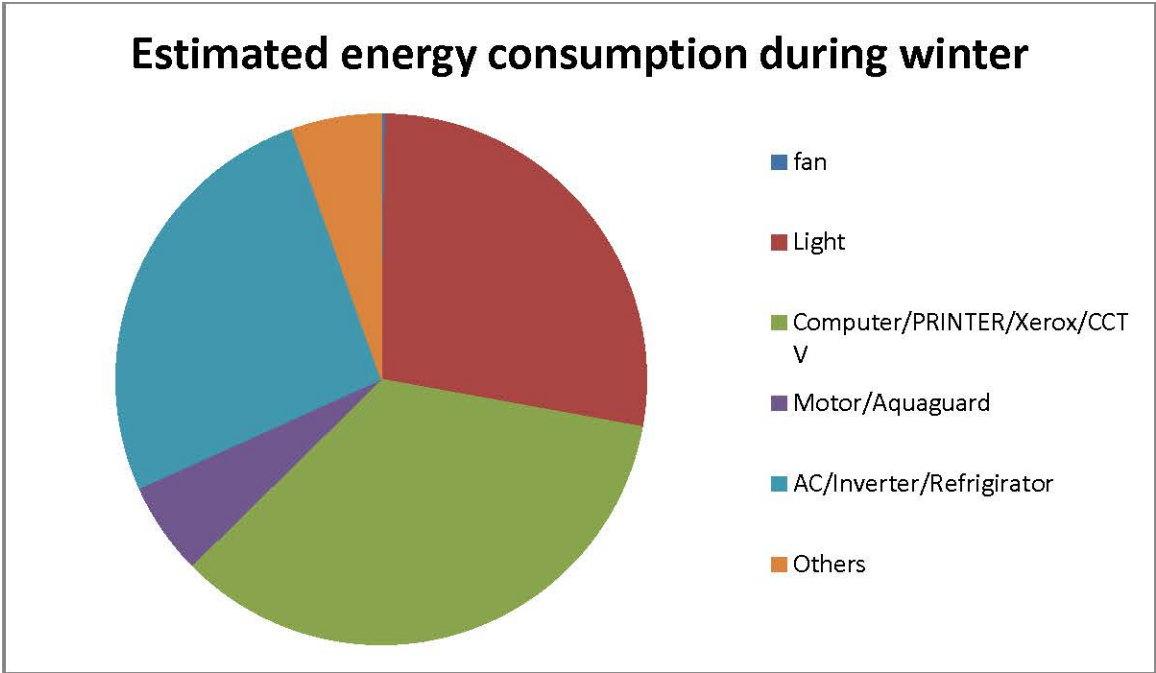


Fig 2: Energy consumption by and use (winter)

Table 4: The consumption of energy block-wise (per month)

S. No	Block	Estimated Energy Consume per month during summer (KWH)	Estimated Energy Consume per month during winter(KWH)
1	Science Block	1089.808	341.008
2	Arts/Commerce Block	308.016	156.816
3	Central Library	412.788	328.788
4	Arts Block	180.624	72.624
5	Administrative Block	1664.184	743.544
6	Hall and Classroom/NCC room/ Common Room	603.852	72.732
7	Old Campus	743.58	363.48
8	Canteen/Security Room	69.168	20.208
9	Bearer Campus	105.3	47.7
10	Street light/Campus/CCTV	1530.9	1530.9
TOTAL		6708.22	3677.8

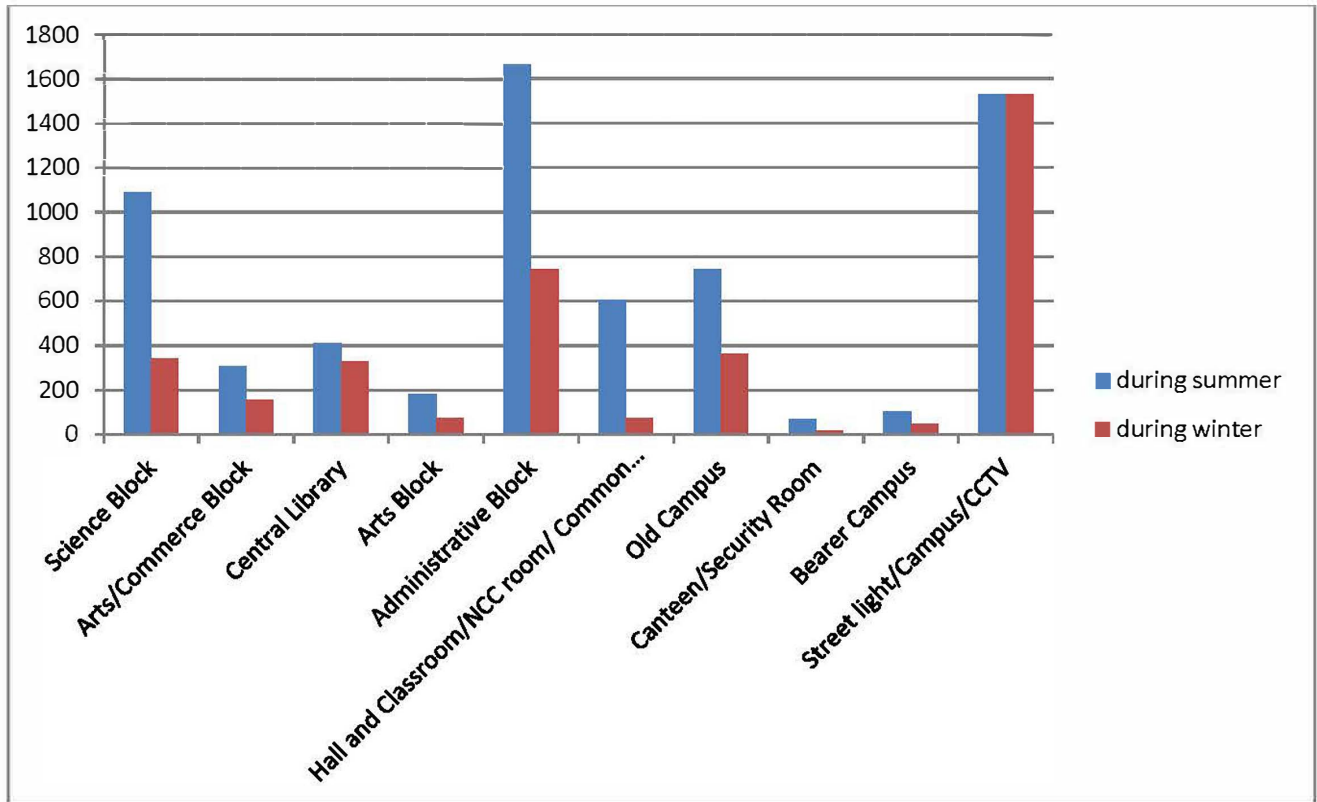


Fig 3: Block wise energy consumption

FINDING AND RECOMMENDATION OF THE AUDIT

Findings	Recommendation
The electrical wiring of many building was found to be old and inefficient	Replace old electrical cables with the new ones
There seem to be a lack of judicious use of power among students and staff. During the study, it was found that lights, fans and computers were kept on working mode in many rooms, without a single person present.	Students and staffs should be exhorted constantly to use energy judiciously. Posters and pamphlets should be distributed and notices about saving energy should be posted at major points of use.
Many departments still use bulbs causing heavy power loss	Filament bulbs and CFLs should be replaced with LEDs.
Solar panels are not in working condition.	Necessary action must be taken to activate solar panels as early as possible.
AC, refrigerators and freezers used in many departments use obsolete technology and hence cause power loss.	Gadgets and equipments should be repaired and/or replaced with latest ones to save energy(five star)
It is noticed that resistive regulators are used.	Resistive regulators should be replaced by electronic regulator.
It is noticed that maximum numbers of desktops are used.	Desktops must be replaced by laptops to save energy.

Identify easiest areas of attention

Based on the physical observation and the analysis of data collected, certain areas have been identified as areas of attention.

1. Old wiring cables in many parts of the campus leading to loss of energy.
2. Use of tubes in certain rooms.
3. There is no use of solar panels.
4. Use of old equipment in laboratories.
5. Use of large numbers of indicators on boards.
6. Lighting facilities in classrooms are available.
7. Awareness among students and bearers.

Estimate the Scope for Saving

The study could identify a large scope for saving energy in the campus, including

- Updating of technologies in laboratory equipment.
- Replacing old electrical cables.
- Replacing tubes with LEDs.
- Ensuring even lighting facilities in rooms.
- Turn off electrical equipments when not in use.

- False ceilings in classroom for maintaining optimum room temperature
- Use computers and electronic equipments in power saving mode.
- use of Solar panels which was functioning till July 2020 as a main source of lighting, especially common areas.

Identify immediate areas of improvement

Based on the study, certain areas were identified as requiring immediate improvement. These are

1. Replacing tubes with LEDs
2. Repairing and updating laboratory equipment
3. Encouraging students and staff to switch off electrical instrument.

CONCLUSION

- ✓ A master switch located at a prominent place which can be directly supervised by the HOD/supervising staff would help avoid power wastage in closed rooms.
- ✓ A well-prepared electrical wiring plan for the campus, which would help to identify unused points and re-wiring.
- ✓ A training /lecture for both students and staff to awareness for the need of energy conservation. If everyone ensures switching off lights, fans and electrical instrument that are not in use, roughly 10% of energy saving is possible.
- ✓ Instruction cum Request Sign board shall be displayed near each switch-board, toilet block & bathrooms to influence & guide to user to arrest misuse & wastage of power.
- ✓ The scope for non-conventional energy should be utilized.
- ✓ Power capacitors shall be provided to motor-pump set in campus as below for reducing electrical demand & improving power factor.