Kallabor College of Education
Kuwaritol · Nagaon (Assam)

A Report on Energy Audit at Kaliabor College of Education, Assam

KALIABOR COLLEGE OF EDUCATION
विद्यया साध्यते
ESTD - 1992

SUBMITTED TO

THE PRINCIPAL,

KALIABOR COLLEGE OF EDUCATION

SUBMITTED BY

K. TALUKDAR

BEE Certified Energy Auditor

EA-5846

10/08/2024
IQAC Co-ordinator
Kaliabor College of Education
Kuwaritol : Nagaon (Assam)
Pin : 782137

12/8/24
Principal
Kaliabor College of Education
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ENERGY AUDIT REPORT OF KALIABOR COLLEGE OF EDUCATION		
Table of Contents		
Serial no	Topic	Page
1	Acknowledgement	3
2	Certification by Bureau of Energy Efficiency	4
3	Energy Conservation Committee	5
4	Executive Summary	6
5	Energy Scenario of Kaliabor College of Education	7
6	Energy Audit and its objectives	8
7	Layout of Kaliabor College of Education	9
8	Methodology of Energy Audit	10
9	Scope of Works	12
10	Load study of the Institution	13
11	Load Calculation	15
12	Assessed Load	16
13	Component of Electrical Load	17
14	Analysis of Electricity Bill	18
15	Pay back calculation	20
16	Recommendations	21
17	Standard Operating Procedure	22s

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Acknowledgement

We express our thanks and gratitude to the management of Kaliabor College for giving us the opportunity to conduct energy audit of the institution.

We are also grateful to Dr. Tileswar Kumbang, principal of Kaliabor College of Education for guiding us in completing the report on Energy Audit of Kaliabor College of Education.

We also thank Miss Lipika Kalita, assistant professor and in charge IQAC and entire team of teachers and staff for helping us in carrying out the energy audit of Kaliabor College.

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Regn. No. EA-5846

Certificate No. 4039

National Productivity Council

National Productivity Council

(National Certifying Agency)

PROVISIONAL CERTIFICATE

This is to certify that Mr. / Ms. ....Khanindra Talukdar

son / daughter of Mr.......... D.D.Talukdar

has passed the National Certification Examination for Energy Auditors held in November - 2008, conducted on behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India.

He / She is qualified as Certified Energy Manager as well as Certified Energy Auditor.

He / She shall be entitled to practice as Energy Auditor under the Energy Conservation Act 2001, subject to the fulfillment of qualifications for the Accredited Energy Auditor and issue of certificate of Accreditation by the Bureau of Energy Efficiency under the said Act.

This certificate is valid till the issuance of an official certificate by the Bureau of Energy Efficiency.

Place : Chennai, India

Date : 24th February, 2009

Controller of Examination

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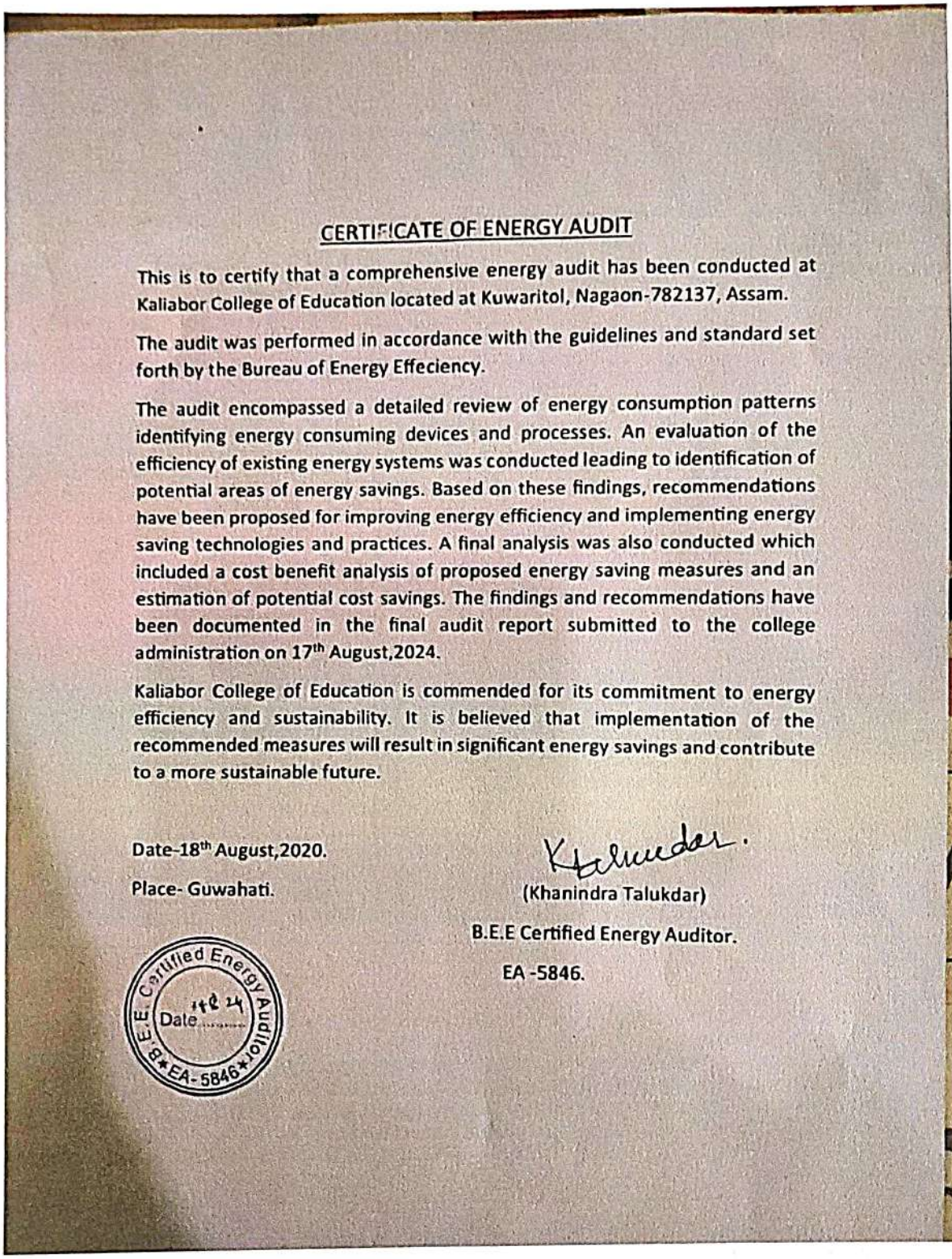
CERTIFICATE OF ENERGY AUDIT



CERTIFICATE OF ENERGY AUDIT

This is to certify that a comprehensive energy audit has been conducted at Kaliabor College of Education located at Kuwaritol, Nagaon-782137, Assam.

The audit was performed in accordance with the guidelines and standard set forth by the Bureau of Energy Effeciency.

The audit encompassed a detailed review of energy consumption patterns identifying energy consuming devices and processes. An evaluation of the efficiency of existing energy systems was conducted leading to identification of potential areas of energy savings. Based on these findings, recommendations have been proposed for improving energy efficiency and implementing energy saving technologies and practices. A final analysis was also conducted which included a cost benefit analysis of proposed energy saving measures and an estimation of potential cost savings. The findings and recommendations have been documented in the final audit report submitted to the college administration on 17th August,2024.

Kaliabor College of Education is commended for its commitment to energy efficiency and sustainability. It is believed that implementation of the recommended measures will result in significant energy savings and contribute to a more sustainable future.

Date-18th August,2020.

Place- Guwahati.

Khanindra Talukdar.

(Khanindra Talukdar)

B.E.E Certified Energy Auditor.

EA -5846.

B.E.E. Certified Energy Auditor ★EA-5846★ Date 18/8/24

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Energy Conservation Committee (ECC)

It was gratifying to note that during the visit to Kaliabor College of Education on 12th August, 2024 and subsequent discussion with authorities of College, Principal as the head of the institution was enthusiastic enough to form Energy Conservation Committee (ECC) and lead the team as team leader.

The purpose was to have firsthand information on sources of power and network of electrical loads of Kaliabor College of Education, consumption pattern and prospect of saving energy. Conservation of energy is a collective work and collaborative effort. The management of Kaliabor College of Education was aware of the need to save energy and was committed to carry on energy audit.

Energy Conservation Committee was formed to ensure participation of all stake holders including teachers, staff and students. The energy conservation committee was formed with principal of Kaliabor College of Education as the team leader and members of team as follows.

1. Dr. T. Kumbang, Principal, Kaliabor College of Education- Team Leader
2. Ms. Lipika Kalita, Assistant Professor - Member
3. Sri. Dwijendra Chetri - Member.
4. Sri. Naba Pachani - Member.
5. Sri. Pradip Pachani - Member.
6. Sri. Himangshu Bora - Member.
7. Sri. Hemanta Bora - Member

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Executive Summary:

The Executive summary gives an overview of the conservation measures taken by the management of the college. An initiative to carry out energy audit was in itself an appropriate step to assess use of energy by the institution. The steps involve action taken to initiate measures to save energy on various front like illumination, replacement of fans which consume substantial amount of power, air conditioners and other energy consuming devices.

During auditing it was objective of all stake holders to optimize use of power in such a manner that the institution saves power in every possible manner.

Measures have been mentioned on optimum use of power by replacement of fans which are almost 32 years old.

Further proposal to install roof top solar power is also mentioned so that college can generate its own power by mean of proposed roof top solar system.

All such energy conservation measures have been supplemented by analysis of electricity consumed by the institution. As construction of new building was going on consumption of electricity will be based on degree of completion of the project. A pattern of consumption of electricity would emerge after the building is complete and all the devices are functional. In such a backdrop the bills served by APDCL are analyzed and pattern is sought to be framed on the basis of data available.

Table-4. Power saving, Investment & Payback period chart

SLno	Item to be replaced	Replaced by	Power saved (Kwh)	Capital invested (Rs)	Payback period (Years)
1	48 numbers of fans in Assam Type building	BLDC FAN	3654.72	1,68,000	5.6
2	Installation of 20 kwp roof top solar power	Roof Top Solar system on Assam Type Building	14699	1000000	8.3

The larger aim of saving energy by replacing existing devices with efficient equipment is to ensure lesser carbon footprint at micro level.

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ENERGY SCENERIO OF KOLIABOR COLLEGE OF EDUCATION:

Kaliabor College is located at a picturesque location of Nagaon District at Kuoritol by the side of the river Kolong. It is equipped with administrative block, Academic blocks, a central library, Science blocks with laboratories, various departments including English, Economics, Political science, Sociology, Assamese, smart class room, canteen, girls' hostels so on along with auditorium. Entire campus of college is supplied with power by a 40Kwp off grid solar power, A DG set and grid power from APDCL. There is no distribution transformer to supply electricity as entire college is dependent on solar power and low-tension grid power. The college authorities justify that since most of the teaching hours are conducted in day hours solar power caters to the need of power supply. However, the load of air conditioners is met by electricity from grid supply. In the event of power failure DG set remains in standby mode and supplies power during emergency.

Sl. No.	Data on power supply	Values
1	Capacity of Solar Generation in Kwp	40
1	Contract load demand from grid power in Kw	6
2	Assessed Connected Load in Kw	86.88
3	Units of Energy on consumed as per bills for 16 months (April,2023-July,2024) in kwh	21264
4	Annual consumption of Diesel in Liters	218
5	Maximum dependance as power source	grid power

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ENERGY AUDIT AND ITS OBJECTIVES:

Introduction to Energy Audit

Energy Audit is a better way to increase energy efficiency and reduce energy bills. An energy audit is an assessment of energy consumed within a time frame in a given location and to explore means to reduce consumption of energy by replacement with efficient device or an efficient process in the system or both.

As per Energy Conservation Act, 2001, Energy Audit is defined as "the verification, monitoring and analysis of use of energy including submission of technical report containing recommendation for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption".

In the provision of the Energy Conservation Act, 2001 the Bureau of Energy Efficiency has been set up under the ministry of power. The parliament of India passed the bill on conservation of energy bill in 2001 there by enlisting a set of rules to make efficient use of energy.

Conservation of energy has to become a part of our habit in our daily lives so as to save energy. Reducing use of fossil fuels will reduce carbon foot print and will help to build a sustainable future.

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LAYOUT OF KALIABOR COLLEGE OF EDUCATION:

Photo 1: Location of Kaliabor College of Education (*Source: Google Earth*).

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Methodology of Energy Audit:

The methodology for energy audit consists of preliminary audit, audit and post audit stages.

Step 1- Building a team for Energy conservation (ECC).

During the preliminary audit, an Energy Conservation Committee (ECC) is formed with the principal of college as the team leader. Energy Audit is a collective effort. It is essential that an energy conservation team is formed to carry forward the objectives of energy audit. During the discussion on energy conservation measures issues related to objectives, scope of works, standard operating procedures, awareness building among stake holders, roles and responsibilities of ECC team, importance of saving electricity and safety measures are raised. The members adopt resolutions relating to various issues on energy conservation measures. The energy auditor underlines the role of bureau of energy efficiency in tackling energy conservation measures.

Step-2. Walk in Audit

After formation of ECC, designated members of the team walk with energy auditor to have a general idea about the college and goes around the college campus to take a stock of various sources of electrical power and power consuming devices including illumination arrangement in class rooms and offices, lighting system, fan, air conditioners, pumps and various other equipment in premise of college.

Step-3. Documents verification

In this phase various documents like energy bills, agreements with utility, log book of DG set are looked into to ascertain the pattern of energy consumption for the year 23-24 for the purpose of energy audit.

Step-4. Identification of energy consuming devices

After a study of the facilities, energy consuming devices are identified and where appropriate field measurements are collected to supplement findings.

Step-5. Bills by utility for analysis

This is one of the steps where bills served by utilities have to be verified to ascertain if cost incurred on electricity charges are reasonable. It also seeks to verify balance between energy actually required and energy consumed.

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Step-6. Evaluation and feasibility of Energy Conservation Measures.

After walk in audit, scrutiny of relevant data, information based on available documents, measurements where required, feasibility of conservation measures is studied with pay back method. This may be segregated to short-, medium- and long-term period.

Step-7. Preparation of Audit finding report

The findings and recommendations of audit are documented in the audit report. This report includes description of existing power network within the campus and focuses on areas of major energy consuming locations. A discussion with Energy conservation Committee highlights the need for saving energy. This will lead to saving on cost of electricity consumption followed by recommendations on short, medium and long-term measures. These Energy saving measures try to rationalize the use of electricity and estimates payback period after implementation of the recommendations.

Step -8. Post audit period

The energy conservation measures (ECM) will bring benefits of energy and costs saving only after the recommendations are implemented. The onus is on the user and stake holders of the institution to implement the ECM. The energy auditor has to highlight the importance of implementing ECM so as to achieve broader goal of efficient use of energy as stated in the Energy Conservation Act 2001.

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Scope of Works:

3.1 Assessment of actual operating load and scope for optimizing load

- Review of existing electrical load in the campus
- Review of electrical load based on actual requirement

3.2 Study of individual units and means to conserve electrical power

- Study of existing use of power
- Review of unit wise electrical load based on requirement
- Recommendation for saving electricity

3.3 Energy conservation in Air-conditioning and water pumping system

- Observation in use of power and water
- Methods to save power and water

3.4 Diesel Generator (DG) set

- Existing standard of operation
- Performance of DG set in terms of specific fuel consumption
- Recommendation for optimum use of DG set

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Load Survey of Kaliabor College of Education, Kuwaritol, Kaliabor **TABLE-1**

S No	Location	LED	LED Tube	Fan	40w Tube	Plug 16 A	Plug 6 A	AC 1.5T	Others	Remarks
1st Floor										
1	Principals Room	6	0	4	0	5	10	1	Inverter, xerox machine	1 A Light 2 pcs
2	Visitor's Room	4	0	1	0	0	1	0	16 Nos CCTV Camera	Control from Principals Office
3	Office Room	7	0	6	0	1	20	1		
4	Store Room	2	0	1	0	0	1	0		
5	Corridor 1st Floor	12	0	0	0	0	7	0		1st Floor Corr
6	Female Bathroom	4	0	0	0	0	0	0		
7	Female Staff Room	7	0	6	0	2	20	1	.	
8	Male Staff Room	7	0	6	0	1	22	0		
9	Toilet	5	0	2	0	0	1	0	1 Exhaust Fan	
10	Smart Class Room	16	0	4	0	2	2	0		
11	IQAC	10	0	8	0	2	10	0		Conference
12	Governing Body	8	0	6	0	3	4	0		
2nd Floor										
13	Multipurpose Hall	37	0	22	0	6	7	0	9 Speakers	
14	Waiting Hall	4	0	2	0	0	1	0		
15	Seminar Hall	16	0	4	0	2	6	0		2 T AC 2 Nos (Provision)
16	Bathroom	5	0	2	0	0	1	0		Exhaust Fan
17	Steps	3	0	0	0	0	0	0	Fire pump 2 HP	
Ground Floor										
18	Class Room	10	0	8	0	2	2	0		
19	Smart Class Room1	0	6	4	0	0	6	0		
20	Smart Class Room2	0	6	4	0	0	6	0		
21	Class Room General	5	2	6	0	0	2	0		
22	do	5	2	6	0	0	2	0		
23	do	5	2	6	0	0	2	0		
24	do	5	2	6	0	0	2	0		
25	Corridor	10		10	0	0	10	0		
26	Outdoor	0	0	0	0	0	0	0	25 W LED 4 Nos	
Canteen Building										
27	Canteen General	25	0	14	0	0	10	0		
28	Canteen AC	25	5	4	0	0	10	5		
29	Gymnasium	25	5	5	0	5	20	5		
30	Night Chowkidar Quarter	14	0	7	0	0	5	0		

Assam Type Old Building										
28	Outdoor	0	0	0	0	0	0	0	25 W LED 5 Nos	
29	Library	10	0	10	0	0	16	0	Inverter 1100 VA, Tube 40 W	
30	Demo Bridal Makeup	2	0	0	0	0	0	0		
31	Corridor	7	2	0	0	0	3	0		
32	Boys Common Room	2	1	2	0	1	4	0		1 Wall Fan
33	Principals Old Office	2	0	1	0	0	2	0		
34	Girls Common Room & Toilet	6	0	4	0	1	6	0	Inverter 1100 VA	
35	Kitchen	3	0	1	0	0	2	0		1 Wall Fan
36	ICT Computer & Resource Centre	9	0	2	0	22	3	2		
37	Dining Hall	8	0	2	0	2	1	0		
Assam Type Ground Floor										
38	Psychological Resource Centre	2	1	2		0	1	0		
39	Science & Maths Resource Centre	1	0	1	1	0	1	0	Tube 40 W	
40	Lobby Ground Floor	0	0	1	0	0		0		
41	Social Science Lab	1	1	1	0	0	1	0		
42	Store Room 2	2	1	1	0	0	1	0		
43	Corridor	4	1		0	0	1	0		
44	Toilet	1	0		0	0		0		
45	Class Room Bed 2nd yr	0	5	6	4	0	4	0	4 Nos 40 W Tube	
46	Store Room	0	0		0	0		0	1 HP Pump	pressure pump
47	Store Room 3	1	0		0	0	1	0		
48	BEd 1st yr Multipurpose Hall	12	1	10	0	2	5	0	7 Nos 40 W Tube	
49	Submersible pump	0	0		0	0		0	1.5 HP	
50	SUPW Room	1	0	1	0	0	1	0		
51	Music Room	1	0	1	0	0	1	0		
52	Health & Physical Resource Room	1	0	1	0	0	1	0		
53	Language	2	0	1	0	0	1	0		
54	Toilet Boys	3	0	0	0	0	0	0	1 No Exhaust Fan	
55	Toilet Girls	3	0	0	0	0	0	0	1 No Exhaust Fan	
Total		**366**	**43**	**202**	**5**	**59**	**246**	**15**		

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LOAD CALCULATION:

S No	Electrical Load	watt per unit	Quantity	Total Load in (watts)	Load in KW	Remark
1	LED 9w	9	366	3294	3.294	After the load study It is noted that calculated load is 414 KW. However entire load is not used for all the time. The utility (APDCL) has to maintain power supply to each load point so that power is available every time. As per discussion with authorities working hours of college is considered as 6 hours on each working day and 25 working days a month.
2	LED Tube	20	43	860	0.86	
3	Fan	75	202	15150	15.15	
4	AC 1.5 T	1500	14	21000	21	
6	16 A Socket	2000	59	118000	118	
7	6 A Socket	1000	246	246000	246	
8	Exhaust Fan	250	3	750	0.75	
9	Inverter	1000	3	3000	3	
10	Pump 4.5 HP(2+1+1.5)	746	4.5	3357	3.357	
11	40 W Tube	13	40	520	0.52	
12	25 W LED	9	25	225	0.225	
13	Speaker	9	60	540	0.54	
14	CCTV Camera	16	12	192	0.192	
15	Photostat m/c	1600	1	1600	1.6	
			Total connected load		414.488	

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ASSESSED LOAD ON BASIS OF 6 HOURS /DAY AND 25 DAYS/ MONTH

Sl no	Load	watt/ unit	Quantity	Total watts	Kilowatts	Assessed KW	Remark
1	LED 9w	9	366	3294	3.294	3.294	1. Monthly Energy consumption is assessed assuming that average use of each load is 6 hrs. per day for 25 days.
2	LED Tube	20	43	860	0.86	0.86	
3	Fan	75	202	15150	15.15	15.15	
4	AC 1.5 T	1500	14	21000	21	21	
6	16 A Socket	2000	59	118000	118	11.8	
7	6 A Socket	1000	246	246000	246	24.6	
8	Exhaust Fan	250	3	750	0.75	0.75	
9	Inverter	1000	3	3000	3	3	2.Total number of 16A & 6A plugs are 59 and 246 numbers in rows 6 & 7 respectively. Assessed Kw is calculated by assuming that 1/10th of plugs will be used for 6 hrs. for 25 days.
10	Pump 4.5 HP (2+1+1.5)	746	4.5	3357	3.357	3.357	
11	40 W Tube	13	40	520	0.52	0.52	
12	25 W LED	25	9	225	0.225	0.225	
13	Speaker	60	9	540	0.54	0.54	
14	CCTV Camera	16	12	192	0.192	0.192	
15	Photostat m/c	1600	1	1600	1.6	1.6	
			Total load		414.488	86.888	

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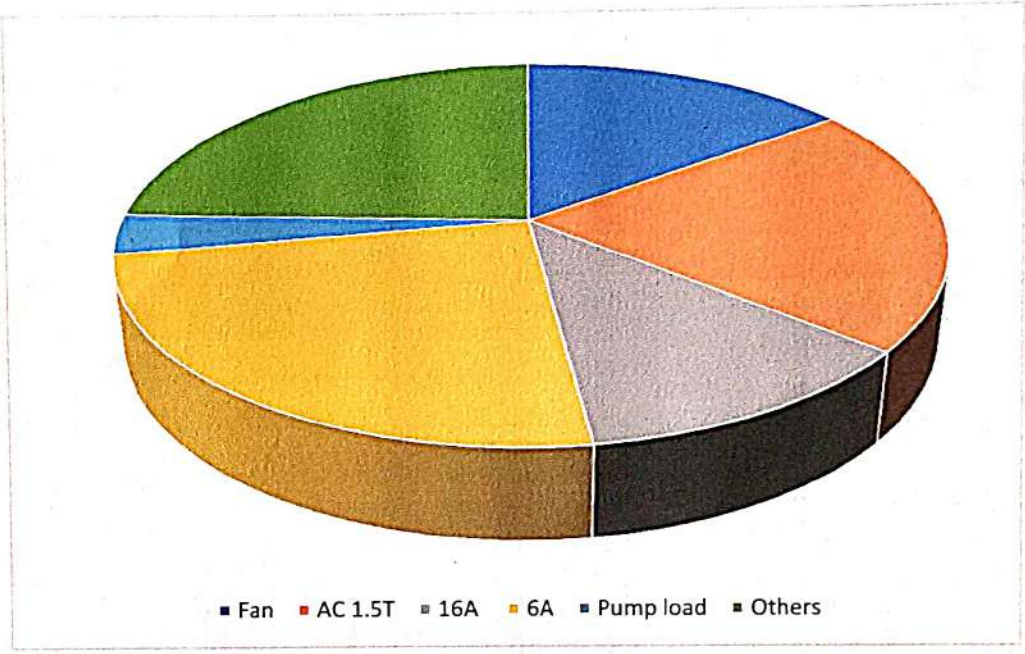
PIE CHART WITH COMPONENETS OF ASSEDDED LOADS					
Fan	AC 1.5T	16A	6A	Pump load	Others
15.15	21	11.8	24.6	3.357	24.093



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ANALYSIS OF ELECTRICITY BILL:

Combined units of both buildings Assam Type and New bldg. (Kwh)				Remark
Month	AT Bldg.	New Bldg.	Total	In year 2023 unit consumed by AT Bldg. are available for 7 months (April to Sept,23 and Dec,23). For 2024 unit consumed are available for 5 months (Jan to March, June and July of 24) for new building. As the new bldg. is under construction estimated total unit consumed is assessed by average of 7 months for AT Bldg. and July,24 for new Bldg. Average for 7 months is 219 units (rounded). It is expected that unit consumed will increase when new bldg. is fully functional. For audit purpose total unit consumed by both units (219 and 1100) is 1329 units per month. Total units for both bldgs. per year is (12*1329) 15948 units. Months from Dec to March showing less consumption is indicative. Real consumption data will emerge after both bldgs. are functional. The graphics represents 13 months only.
April,23	132	0	132	
May'23	174	0	174	
June,23	160	0	160	
July,23	165	0	165	
August,23	372	0	372	
Sept'23	360	0	360	
Oct'23	nil	0		
Nov'23	nil	0		
Dec'23	169	0	169	
January'24	nil	140	0	
February'24	nil	165	0	
March'24	nil	399	0	
April'24	nil	nil	0	
May'24	nil	nil	0	
June'24	nil	50	50	
July'24	nil	1100	1100	
Total (16 months)			21264	

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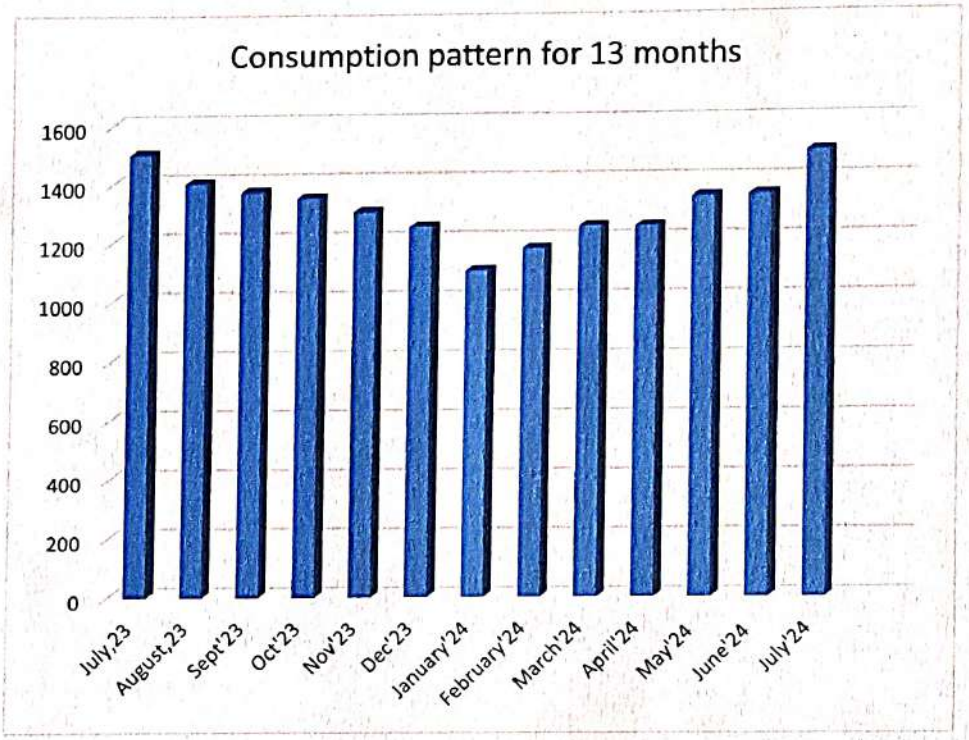
CHART INDICATING CONSUMPTION OF ELECTRICITY FOR 13 months (July,23-July,24) in KWH.

Month	Total units
April,23	1300
May'23	1329
June,23	1485
July,23	1500
August,23	1400
Sept'23	1370
Oct'23	1350
Nov'23	1300
Dec'23	1250
January'24	1100
February'24	1175
March'24	1250
April'24	1250
May'24	1350
June'24	1355
July'24	1500



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Cost Analysis and Payback period by replacement with efficient devices.

A. Payback period for replacement of fans in AT bldg.: The institution of KCE was established in year 1992 August and all 48 fans are 32 years old. Each fan consumes 75w of power which can be replaced by 28w BLDC fan. Each of BLDC fans will save 47w of power.

1	No of fans in old bldg.	48	
2	Load of each fan in watts	75	
3	Load of each BLDC fan in watts	28	
4	Power saved by each fan in watts	47	
5	Power saved by 48 nos fan in watts	47*48	2256
6	Hours a fan runs in 270 days/year and 6 hrs./day	270*6	1620
7	Total energy saved by 48 fans per year in Kwh	(2256*1620) /1000	3654.72
8	Cost of energy saved per year @ Rs. 8.24/unit	3654.72*8.24	30114.8928
9	Cost of 48 BLDC fan @ Rs. 4000/fan	48*3500	168000
9	Payback period of capital cost	168000/30115	rounded
10	Payback period of capital cost	5.578615308	
11	Payback period in years	5.6	

Installation of 20KWp Solar roof top system		
B. Solar Unit (Energy) Generation Calculation		
Sl no	Parameter	Value
1	Expected Solar potential	20
2	Expected Solar generation @ 2units /day/kwp	40
3	Expected annual solar generation (40X365)	14600
4	Estimated annual unit consumption of college	15948
5	Potential solar energy share	91.54753
	Payback period Calculation	
1	Total annual solar generation of system	14600
2	Overall energy charges as per utility bill	8.24
3	Expected revenue generation per year	120304
4	Expected cost of 1 kw solar plant@ Rs.50/watt	50000
5	Expected total investment	1000000
6	Simple payback period of the project	8.312276
7	Payback in years	8.3

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RECOMMENDATIONS:

- There were a number of plug points (6 and 16 amps) which were rarely used.
- 40-watt Tube used for illumination can be replaced by LED lamps to save power.
- The DG set was used occasionally and there was a need to maintain a log book to record fuel consumption and other parameters.
- Water taps in toilets needed to be leak proof to prevent wastage of water.
- Air filters of air conditioners needed to be cleaned as a part of annual maintenance exercise to save power.
- There could be some hoarding in prominent places in the campus to highlight about need to save power.
- The illumination level of the class rooms and toilets need to be optimized.
- All stake holders can come to college with bicycles or by walking to save fuel.
- As of now a total connected load of 31 KW is available for use. Even without using maximum load the institute has to pay fixed charge for 31 KW load every month. Once a transformer is installed the contract load can be reduced by an agreement with utility. This will save fixed cost depending on agreed contract demand.
- Fans when replaced can be negotiated for bulk price which will have lesser capital cost.
- Solar power potential can be utilised by the college to generate power in day time.
- Some shade giving trees can be planted around the campus to reduce heat absorbed by building walls. This will reduce load on Acs in new building.

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Standard operating procedures:

9.1 Illumination:

Lux level is a measurement of illumination. For class rooms lux level is standardized at 300 lux. Natural light is the best and most important light to incorporate in the classrooms. Natural sun light provides physical and physiological benefits to both students and teachers. However, LED lights are best man-made lights for illumination of class rooms. Higher illumination if needed should be evaluated for the specific needs of class rooms.

9.2 Air- Conditioning system:

As mentioned, air conditioners should have regular cleaning of air filter. Depending on efficiency rating by BEE it is always better to opt for air conditioners with higher star rating (4-to-5-star rating) which are energy efficient.

9.3 Earthing system, preventive maintenance and safety:

The term Earthing means connection of the neutral points of the supply system or non-current carrying parts of electrical apparatus, such as metallic frame work, metallic covering of cables, stay wire etc. to the general mass of earth in such a manner that at all times immediate discharge of electricity takes place without danger. Safe handling of electricity is one of the most important aspects of dealing with electricity. It needs to be underlined that all electrical devices including power points need to be earthed to avoid any short circuit which may lead to electrical accidents.

Every electrical system should be earthed to ensure safety of the equipment and safety of person handling equipment. There should be scheduled inspection of electrical networks to take up preventive maintenance and ensure safety. It is better to go for a technological upgrade of protection system by installation of Earth Leakage Circuit Breaker (ELCB) in the circuit to prevent any accident due to earth leakage.
Solar panels need to be solidly earthed to prevent any accident.

9.4 Awareness on Energy conservation:

The need to save energy has to be understood by all stake holders as source of generating electricity by fossil fuel has become incompatible with global warming. Awareness on need for energy conservation has to percolate to every level of society by means of hoarding in prominent places, organizing discussion and popular talks, quiz and so on.

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ENTRANCE TO KALIABOR COLLEGE OF EDUCATION

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ASSAM TYPE ROOF FOR SOLAR POWER

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END OF REPORT

10/08/2024
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