A REPORT
ON
ENERGY AUDIT,
NANDA NATH SAIKIA COLLEGE,
TITABAR, JORHAT

Prepared by,
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STUDY TEAM

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   Department of Physics, N. N. Saikia College, Titabar

DECLARATION BY THE STUDY TEAM

We, hereby declare that we have formed, completed and written the report on "**ENERGY AUDIT OF NANDA NATH SAIKIA COLLEGE, TITABAR**". It has not been previously published in any other format for the fulfillment of any degree and professional conduct.

Rajanish Saikia

Place: Titabar

(Dr. Rajanish Saikia)

Date: 21-12-2022

Prathana Borah

(Dr. Prathana Borah)

ACKNOWLEDGEMENT

Department of Physics, N. N. Saikia College, Titabar, takes immense pleasure in expressing deepest gratitude and appreciation to all those people who in a way or another have contributed in making this possible.

First and foremost, we would like to convey our utmost thanks to Dr. Litool Baruah, Principal, N. N. Saikia College for his proactive support in conducting the energy audit.

A sincere thanks to IQAC coordinate and Associated Professor: Dr. J. P. Oza and IQAC member and Assistant Professor: Dr. Partha P. Saikia for initiating energy audit as an environmental and safety initiative.

It is a great pleasure to thank ***"Assam Power Distribution Company Limited"(APDCL)****, for their guidance which has been immensely monumental in framing the report on energy audit. We would be sincerely obliged for the constant support and feedbacks.*

We would also like to thank Kashmiri, Hemant, Monu, Bikram and Uttam for their help during the survey.

~ *Rajanish Saikia*

Prathana Borah

CONTENT

1 INTRODUCTION:

1.1 WHAT IS ENERGY AUDIT?

Energy audit 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 its use, and serves to identify all the energy streams in a facility. It quantifies energy usage according its discrete functions. According to Energy Conservation Act 2001:

"Energy audit means the verification, monitoring and analysis of the use of energy including submission of technical report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption".

1.2 NEED FOR ENERGY AUDIT

Energy audit will help to identify the savings potential and cost reducing methods, understand the ways in which fuel is used, where; the waste occurs and find the scope for improvement. An energy audit is proposed and conducted to ensure that energy saving practices and implanted and followed in educational institutes in a sustainable way. Such programme provide aid in maintaining a focus on energy price variations, energy supply availability and efficiency, determining an appropriate energy mix, identifying energy-saving technology, retrofitting for energy-saving equipment and so on.

1.3 OBJECTIVE OF THE ENERGY AUDIT

The prime goal of the energy audit is to obtain a detailed idea about the various end use energy consumption activities and identifying, enumerating and evaluating the possible energy saving opportunities. The target is to achieve savings in the energy consumption. Being an educational organization, this audit also aims to promote awareness in energy efficiency.

1.4 SCOPE OF THE ENERGY AUDIT

i. Review of electricity consumption pattern.
ii. Assessment of building wise electrical load based on electrical fitting.
iii. Lux level study at various building rooms as per standard and comparison with recommended standard level.
iv. Energy consumption profile by DG set.

1.5 METHODOLOGY

- Step 1: Physical verification of Lighting, Ceiling, Table and Exhaust Fans, A/C machines, Solar panels, Heaters, Generators, Uninterrupted power supply machines

and ventilators load fixtures and verification of installed energy efficient system's capacities are carried out.

- Step 2: Inspection of when the cost or prospective cost savings in each of the above components are considered, energy always wins, and the energy management task becomes a key cost reduction area. The energy audit assisted in better understanding how energy and fuel are used in the Organization as well as identifying waste factors and development potential towards energy savings opportunities.
- Step 3: Finally after the audit process, the energy audit included suggestions for energy cost reduction, preventive maintenance and quality control activities, all of which are critical for the utility operations in the Organization.

2 GENERAL OVERVIEW OF ENERGY CONSUMPTION

2.1 ELECTRICITY CONSUMPTION:

The basic information of Nanda Nath Saikia College is shown in the following tables:

Table 1

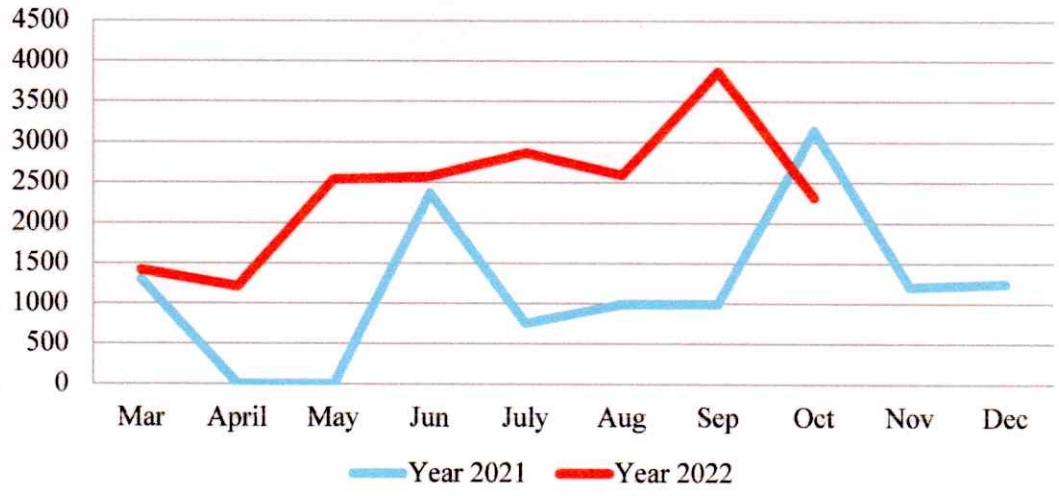
Sl. No.	Basic Data		Value
1	Connected load		60kW
	Contract Demand		71kVA
2	Installed DG capacity		25 kVA (1No.s) 15 kVA (1 No.s)
3	Annual electricity consumption (July' 2021-June 2022)		15855.6kWh
	Comparison of electricity consumption (March' 2021- September' 2022)		Depicted in Fig 1
4	Annual Cost of	Electricity @7.35/unit	Rs 3,38,129.00
		Diesel consumption	Rs 30,000.00
	Total Cost		Rs.3,68,129.00
5	Working hours	Academic + Administrative	8hrs (9AM -5PM) (6 days)
		Hostel	24hrs (7 days)

The month wise electricity consumption data is collected and plotted for both of the year 2021 and 2022.

Table 2

Electricity Consumption pattern in Kwh for the last two years		
Month of the year	**2021**	**2022**
Mar	1298.09	1415.34
April	0	1209.36
May	0	2533.72
Jun	2368.05	2573.68
July	751.32	2863.42
Aug	989.11	2587.67
Sep	988.8	3866.52
Oct	3143.27	2313.92
Nov	1205	----
Dec	1246	----

Fig 1: Consumption Vs Month of the Year



While going through the plot, it has been observed that,

1. For the Year 2022, there is uniformity in the consumption pattern and it is observed that the consumption actually followed the seasonal pattern, i.e. started to rise with the summer days and then decline as winter season is approaching. So, the consumption is strongly related to cooling load i.e. the cooling devices (fan, AC, etc) are the major consumers of electricity of the college.

2. In other hand, for the year 2021, there is no such uniform pattern had been observed and so no definite resolution can be made. There is sudden spike in energy consumption during the Month June, but before that, in the month of May and April, the consumption is zero. Similar spike in consumption was observed during October 2021 which even crosses this year October Month's consumption. But as evident from the curve above, absolute consumption level for the year 2022 is higher than Year 2021.Perhaps there may be utilization of some temporary load in June 2021 and then addition of permanent load by the mid September 2021, this will require further study on the matter, considering factor like Lockdown due to pandemic etc.

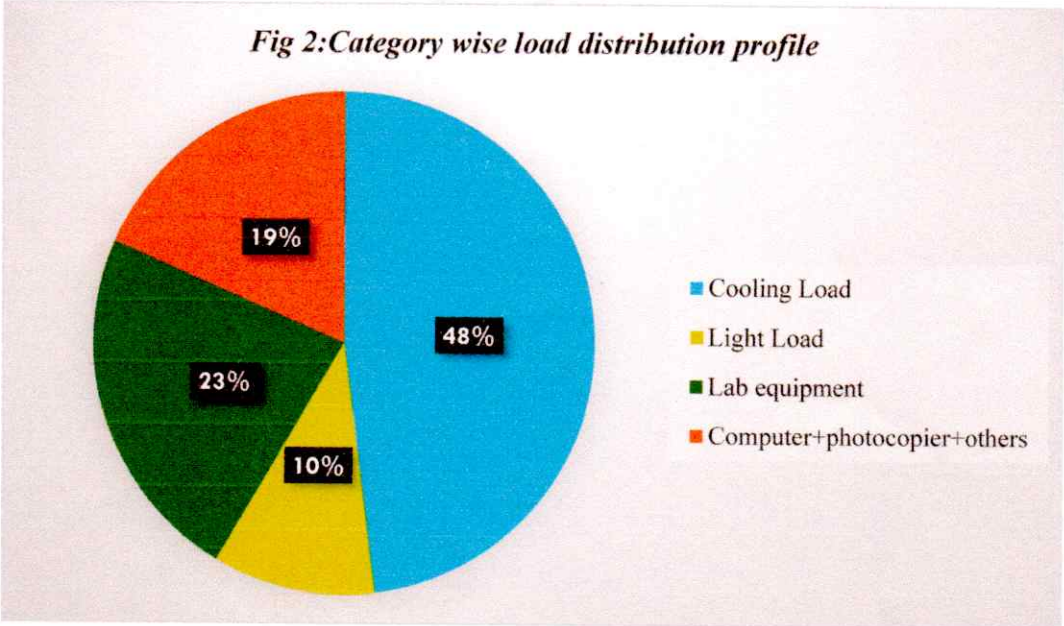
2.2 ASSESSMENT OF CONNECTED LOAD:

The total connected load has been assessed with details survey of all the building section of the college and it is found that following categories of load are mainly responsible for significant energy consumption by the institute.

1) Cooling load i.e. Ceiling Fan and AC.
2) Computers and accessories.
3) Laboratory equipment.
4) Light Load.

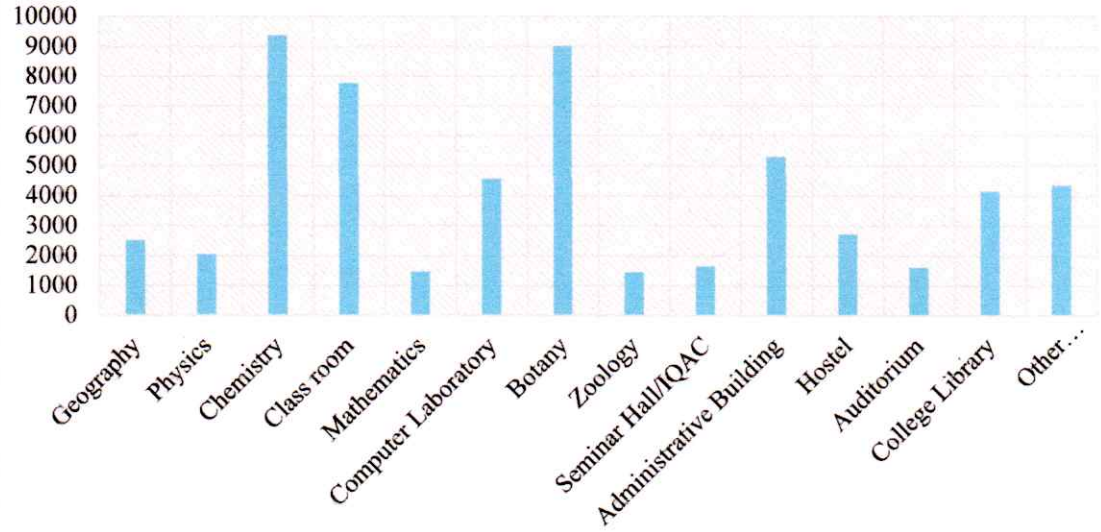
The contribution of various category of load is fractionized as below through a simple pie chart.

Fig 2:Category wise load distribution profile



It was observed during this analysis is that light load contribute the least ,which is quite obvious due to the fact that, there is a good amount of daylight penetration throughout various rooms of all the building of the Institute during normal working hours, which reduces the necessities of artificial lighting.

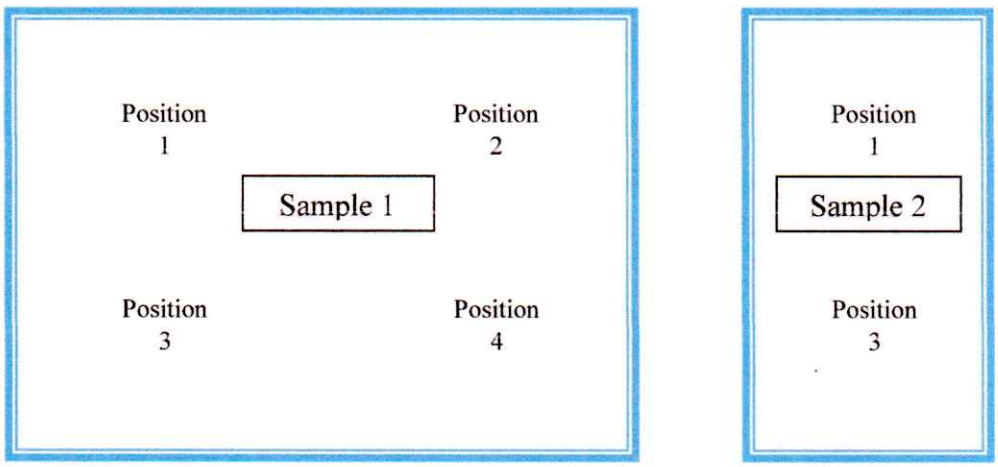
Fig 3: Connected Load(watt)

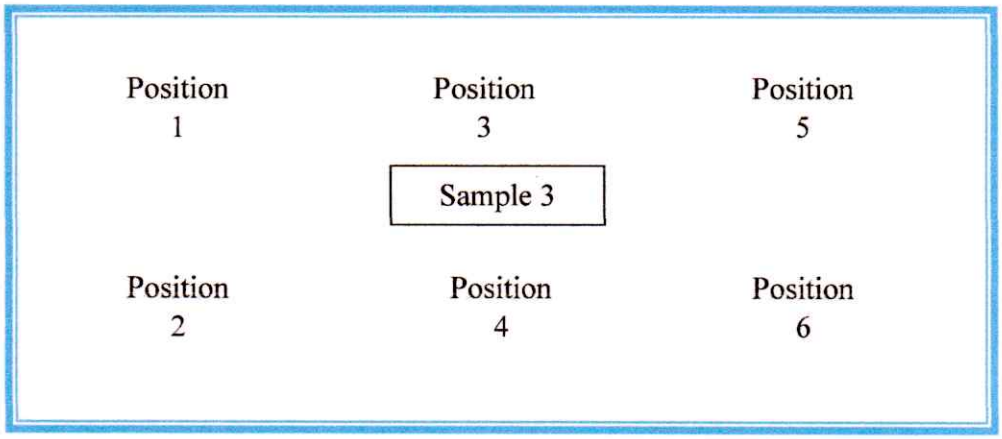


2.3 ILLUMINATION STUDY:

Light contributes about 10% of energy consumption of various buildings of the college campus out of connected load 60kW. Mainly the light load comprises of 18W LED light and 30W tube lights.

The building wise illumination survey is performed by using portable Lux Meter. Sample of measuring positions are shown below:





The following table shows the building wise Lux level for sample 1 and 2:

Table 3

Sl. No.	Category	Room	Lux Level Measuring point				Average Lux Level
			Position 1	Position 2	Position 3	Position 4	
1	Administrative building	Principal Room	295	291	250	284	280
		Office Room 1	290	243	282	197	253
		Office Room 2	211	-	188	-	199.5
		Vice Principal Room	223	195	171	185	193.25
		Teachers' Common Room	284	277	262	295	279.5
2	IQAC Building	IQAC Room	278	-	352	-	315
		Sick Bed Room	212	-	293	-	252.5
		Seminar Room	195	188	231	202	204
		Examination Room	354	-	291	-	322.5
3	Class Rooms	1	142	-	152	-	147
		2	155	-	161	-	158
		3	391	365	298	312	341.5
		4	257	245	132	112	186.5

		5	247	251	142	133	193.25
		6	249	251	135	143	194.5
		7	234	241	148	135	189.5
		8	234	211	184	159	197
		9	196	191	142	136	166.25
		10	201	213	151	139	176
		11	192	213	145	140	172.5
		12	199	232	139	150	180
		13	213	222	171	174	195
		14	178	189	198	201	191.5
		15	169	179	214	197	189.75
		16	178	191	142	136	161.75
		17	156	177	134	137	151
		18	155	-	131	-	143
		19	145	156	267	271	209.75
		20	135	130	205	221	172.75
		21	149	143	247	234	193.25
		22	132	145	255	234	191.5
		23	178	189	278	295	235
		24	167	179	226	239	202.75
		25	250	197	289	187	230.75
		26	211	252	234	269	241.5
4	Departments	Geography	217	212	234	222	221.25
		Physics	112	109	201	197	154.75
		Chemistry	115	121	167	154	139.25
		Education	235	245	177	178	208.75
		Botany	157	161	189	109	154
		Zoology	165	142	168	155	157.5
		Assamese	123	124	189	201	159.25
		English	134		178		156
		Economics	140		179		159.5
		History	145	138	213	231	181.75
		Political Science	149	143	165	131	147
5	Gymnasium		137	123	201	198	164.75

The following table shows the building wise Lux level for sample 3:

Table 4

Sl. No.	Room	Lux Level Measuring point						Average Lux Level
		Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	
1	Library	326	312	324	355	361	351	338.2
2	Auditorium	281	278	267	254	215	217	252
3	Conference Room	212	209	211	176	154	143	184.2
4	Computer Room	209	218	216	198	185	181	201.2

As an educational institute, the working hour's mainly on day time and hence the illumination study is carried out during the day time only (between 9AM to 5PM). It is observed that the classrooms have enough windows and ventilators which are adequate for illumination level for study. The illumination level of the library room is meeting up the standard illumination level. It is also observed that the computer laboratory and some part of administrative building do not have adequate day lighting which leads to depend on artificial lighting. Although most of the lights are converted to LED to save energy and to achieve the standard illumination level it is observed that there is still some higher energy consuming luminaries in the college campus.

2.4 DIESEL GENERATOR SET:

There are two DG sets with capacity of 25 kVA and 15 kVA respectively. The 25 kVA DG set is dedicated to supply power to Administrative building, IQAC building and Library building and 15 kVA DG set is dedicated to supply power to Departments (Laboratory specially). For the performance assessment of the DG sets its need to study specific fuel consumption [SFC= Total fuel consumed (litres)/ total power generated (kW)]. For which at least Twelve (12) months data of monthly fuel consumption and monthly energy generated by the DG set is required to analyze the specific fuel consumption. As monthly energy generation data is not available, therefore the performance assessment of DG sets is not able to conduct.

3 SUMMARY

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. Considering the fact that the college 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. There are some good practices followed in the college like Transformers and Generators (DG) are protected properly with fencing and kept awareness boards on 'Dangers'. Electrical wires, switch boxes and stabilizers are properly covered without any damage which will cause any problems to the staff and student members. The college campus has very less number of air conditioning units as cooling load. For the illumination purpose the college prefers the day light as it meets up the standard illumination level for study and office work.

Assam Power Distribution Company Limited
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Email ID: dgmjec_apdcl@rediffmail.com Phone No.: 0376-2320184

NO: CEO/JEC/APDCL/G-1/2022/1063 Date: 21.12.2022

To,

The Principal
N.N.Saikia College
Titabor, Jorhat

Sub: Energy Audit
Ref: Your letter no: **NNSC/EA/IQAC/2022/3994 Dated: 26.10.22**

Sir,

In reference to the subject cited above, I have the honour to inform you that, the energy audit report prepared and submitted by your organisation has been scrutinised, analysed and found satisfactory. Based on the audit, few observation and recommendation has been made from this end enclosed herewith as annexure A.

Thanking You

Very truly yours.

Jyotiska Barua
Assistant General Manager(Project)
Bidyut Bhawan, APDCL, Jorhat

Assistant General Manager(P)
O/o the CEO, JEC
APDCL, Jorhat

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Annexure-A

Observation and recommendation

1) The cooling load including fans and Air Conditioners contribute a major portion of total connected load and seems to significantly contribute to overall electricity consumption. Regular maintenance, cleaning of the devices helps to reduce energy losses from those devices. It is also recommended to replace any inefficient, old devices (fan, AC) by energy efficient devices which will contribute to achieve overall energy efficiency.

2) Department wise load segregation revealed that, Chemistry and Botany department has highest installed load due to different energy intensive devices like electric furnace, oven etc. Periodic inspection, cleaning are required for efficient operation of those devices which will contribute to reduce losses from those devices.

3) Illumination of most of the building rooms has been achieved through daylighting and having lux level within the range of recommended level of illumination for respective room's activity.

4) There is no separate energy sub meter installed. Sub meters can be installed to measure and compare category wise as well as department wise electricity consumption, which will helps in exploring energy conservation measures and achieving energy efficiency.

5) The college building has many vacant roof areas .which can be utilise to install solar panel for harnessing power through renewable energy. This will helps the organisation to reduce overall electricity consumption from Grid and carbon emission to the atmosphere.

Asstt. General Manager(P)
O/o The CEO, JEC
APDCL, Jorhat