

ENERGY AUDIT REPORT (2021-22)



OF

NAHARKATIYA COLLEGE

Address: Alichiga Gaon, Naharkatiya

PIN - 786610

Assam

Submitted By

JKM Consultancy Service, Jorhat

INDEX

Sr. No.	Particulars	Page No.
1	Preface	3
2	Acknowledgement	4
3	Energy Audit Certificate	5
4	Abbreviations	7
5	Introduction to energy audit	8
6	Pre audit phase	9
7	Audit phase	11
8	Energy consumption profile	12
9	Study of variation of monthly unit consumption and power factor	13
10	Actual measurement and its analysis	15
11	Observation and suggestion	16
12	Study of air conditioner	17
13	Carbon di-oxide emission	18
14	Energy conservation proposal	20
15	Post Audit Phase	22
16	Photograph	23

Preface

Data collection for energy audit of the Naharkatiya College , Naharkatiya was conceded by team for the period of April 2021 to March 2022.

This audit was over sighted to inquire about convenience to progress the energy competence of the campus. All data collected from each classroom, laboratory, every room. The work is completed by considering how many tubes, fan, A.C, electronic instruments, etc. in each room. How much was participation of each component in total electricity consumption.

We really appreciate the effort put by college management for creating awareness of Energy Audit, use renewable energy such as solar energy and their significance use for efficient energy saving and our nature among the all of us. We really appreciate Hon. Management of the college for encouraging us by providing this wonderful opportunity to do the energy audit. Through this, we have been cleared the vision of Institution towards the Green campus and save our green nature. We really appreciate to develop good quality weather station in house of the college.



MAIN BUILDING

Acknowledgement

We are sincerely thankful to the Naharkatiya College , Naharkatiya management for giving us the opportunity to conduct energy audit in the college campus.

We are also grateful to Dr. Jyoti Prasad Konwar , Principal, Naharkatiya College , Naharkatiya Assam whose valuable comment / feedback , during various reviews have helped us to bring the report in the present format.

We express our sincere gratitude to IQAC Coordinator and all other concerned officials for their support and guidance during the conduct of this exercise.

JKM/EA/05-22/10

Energy Audit Certificate

is awarded for 2021-22 to the esteemed institute

Naharkatiya College

Naharkatiya
Assam-786610

*As a part of the institution's initiatives for a healthy & sustainable college the energy audit was conducted .
we appreciate the immense efforts taken by staff and students towards the energy management and conservation.*

This certificate is valid till 30th June 2022


Dr. Dulen Saikia
Chairperson, E-Audit
JKM Consultancy Service



JKM Consultancy Service
Kenduguri, Jorhat-785010






Mr. Arup Saikia
Co-ordinator, E-Audit
JKM Consultancy Service



JKM Consultancy Service
Kenduguri, Jorhat-785010

Energy Audit Assessment Team

(Internal)

- Dr Dulen Saikia, Principal, M.Sc, M.Phil. Ph.d 
- Mr Rajib Bordoloi, Associate Prof. M.Sc 
- Mr Arup Saikia, Assistant Prof. M.Sc, M.Phil 
- Mr Amrit Dutta, Assistant Prof. M.Sc 

(External)

- Mr. Sabikur Rahman, Assistant Prof. 
- Dr. Dandeswar Dutta, Sr. Scientist 

Abbreviations

AHU	Air handling unit
APFC	Automatic Power Factor Controller
DG	Diesel generator
ECP	Energy Conservation Proposal
GCV	Gross Calorific Value
HVAC	Heating, Ventilation and Air Conditioning
HSDG	High speed diesel Generator
PF	Power Factor
SEC	Specific Energy Consumption
TR	Tons of Refrigeration
UOM	Unit of Measurement
APDCL	Assam Power Distribution Company Limited

Introduction to Energy Audit

- **General:**

Naharkatiya College , Naharkatiya, Assam entrusted the work of conducting a detailed Energy Audit of campus with the main objectives are as bellows:

- To study the present pattern of energy consumption
- To identify potential areas for energy optimization
- To recommend energy conservation proposals with cost benefit analysis.

- **Scope of Work, Methodology and Approach:**

Scope of work and methodology were as per the proposal While undertaking data collection, field trials and their analysis, due care was always taken to avoid abnormal situations so as to generate normal/representative pattern of energy consumption at the facility

- **Approach to Energy Audit:**

We focused our attention on energy management and optimization of energy efficiency of the systems, sub systems and equipment. The key to such performance evaluation lies in the sound knowledge of performance of equipment and system as a whole.

- **Energy Audit:**

The objective of Energy Audit is to balance the total energy inputs with its use and to identify the energy conservation opportunities in the stream. Energy Audit also gives focused attention to energy cost and cost involved in achieving higher performance with technical and financial analysis. The best alternative is selected on financial analysis basis.

There are three phases of energy audit

1. Pre audit phase
2. Audit phase
3. Post audit phase

Above phase include following stages

1. Data collection- In preliminary data collection phase, exhaustive data collection was performed using different tools such as observation , survey communicating with responsible persons and measurements.

Following steps were taken for data collection:

- a) The team went to each department , centers, library, canteen etc.
- b) Data about the general information was collected by observation and interview.
- c) The power consumption of appliances was recorded by taking an average value in some cases

2. **Data analysis** – Detailed analysis of data collected include: calculation of energy consumption , analysis of latest electricity bill of campus .

3. **Recommendation** - On the basis of results of data analysis and observations , some steps For reducing power and water consumption were recommended. Proper treatments for waste were also suggested. Used of fossil fuels has to be reduced for the sake of community health The above target areas particular to the college was evaluated through questionnaire circulated among the students for data collection. Five categories of questionnaires' were distributed. The format of this are given below :

Preaudit phase

Survey form for data collection :

1. List ways that you use energy in your college .(Electricity , Electric stove , Kettle, Microwave , LPG , Petrol , Diesel and others).
2. Electricity bill amount for the last five year
3. Amount paid for LPG cylinders for last one year
4. Weight of firewood used per month and amount of money spent ? Also mention the amount spend for petrol/diesel/others for generators?
5. Are there any energy saving methods employed in your college? If yes , please specify . If no , suggest some.
6. How much money does your college spend on energy such as electricity , gas , etc. In a month . (Record monthly for the year 2016).
7. How many CFL bulbs has your college installed ? Mention use (Hours used/ Daily for how many days in a month)
8. Energy used by each bulb per month? (For example- 60 watt bulb x 4 hour x No of bulbs= kwh).
9. How many LED bulbs are used in your college ? Mention the use (Hours used / day for how many days in a month)

10. Energy used by each bulb per month? (kwh) .
11. How many incandescent(tungsten)bulbs have your college installed? 12.Mentions used (Hours used/day for how many days in a month)
13. Energy used by each bulb per month? (kwh).
14. How many fans are installed in your college ? Mention use(Hours used /day for how many days in a month
15. Energy used by each fan per month ? (kwh)
16. How many air conditioners are installed in your college? Mention use(Hours used /day for how many days in a month)
17. Energy used by each air conditioners per month? (kwh)
18. How many electrical equipment including weighing balance are installed in your college ?
19. Mention the use (Hours used /day for how many days in a month)
20. Energy used by electrical equipments per month? (kwh)
21. How many computers are there in your college? Mention the use (Hours used /day for how many days in a month)
22. Energy used by each computer per month? (kwh)
23. How many photocopiers are installed by your college ? Mention use(Hours used /day for how many days in a month)
24. How many cooling apparatus per month are installed in your college ? Mention use(Hours used /day for how many days in a month)
25. Energy used by cooling apparatus per month? (kwh) Mention use(Hours used /day for how many days in a month)
26. Energy used by each photocopier per month? (kwh) Mention use(Hours used /day for how many days in a month)how many inverters your college installed ? Mention use(Hours used /day for how many days in a month)
27. Energy used by each inverter per month? (kwh)
28. How many electrical equipment are used in different labs of your college? Mention use(Hours used /day for how many days in a month)
29. Energy used by each equipment per month? (kwh)

30. How many heaters are used in the canteen of your college? Mention use (Hours used /day for how many days in a month)
31. Energy used by each heater per month (kwh)
32. Number of street lights in your college?
33. Energy used by each street light per month? (kwh)
34. Any other item that uses energy (Please write the energy used per month) Mention use (Hours used/day for how many days in a month)
35. Are any alternative energy sources /Known conventional energy sources employed / installed in your college? (Photovoltaic cell for solar energy, windmill ,energy efficient stoves etc.,)Specify.
36. Do you run “switch off” drills at college?
37. Are your computers and other equipment put on power saving mode?
38. Does your machinery (TV, AC, Computer , weighing balance , printers, etc.)run on standby mode most of the time? If yes , how many hours?
39. What are the energy conservation methods adopted by your college?
40. How many boards displayed for saving energy awareness?
41. How much ash is collected after burning firewood per day in the canteen?
42. Write a note on the methods/ practice / adaptation by which you can reduce the energy used in college campus in future.

2. Audit Phase

In Naharkatiya College , Naharkatiya, Assam, energy auditing was done with the help of team teaching staff and students. The energy audit began with the teams walking through all the different facilities at the college, determining the different types of appliances and utilities (lights, taps, toilets, fridges, etc.) as well as measuring usage per item (watts indicated on appliances) and identifying the relevant consumption patterns (such as how often an applicant is used) and there impacts. The staff and learners were interviewed to get details of usage, frequency or general characteristics of certain appliances.

Data collection

Data collection was done in the sector such as sources of energy and energy consumption pattern, college records and documents were verified several times to clarify the data received through survey and discussions. Although whole process was completed from April 2021 to march 2022 , previous energy patterns were also observed.

Site Tour

Site inspection was done along with students and staff.

Review of Documents and Records

Documents such as electricity bill registers of electricity fuel consumption were collected .

Energy Consumption Profile

A. Source of Energy:

- a. Electricity from Assam Power Distribution Company Limited
- b. High Speed Diesel Generator (HSDG):

HSD is used as a fuel for Diesel Generator which is run whenever power supply from APDCL is not available.

Study of Variation of Monthly Units consumption & Power Factor:

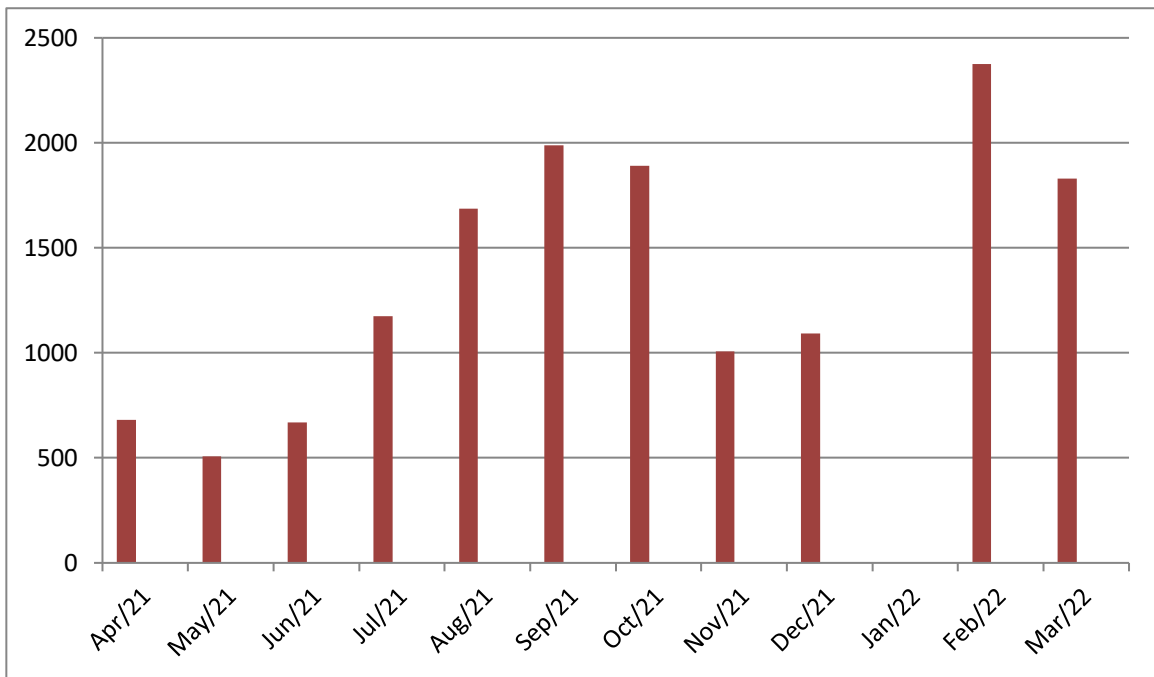
In this Chapter, we study the details of the 12 months Electricity Bills.

Table No 4.1 Variation in Units Consumption & Power Factor (PF)

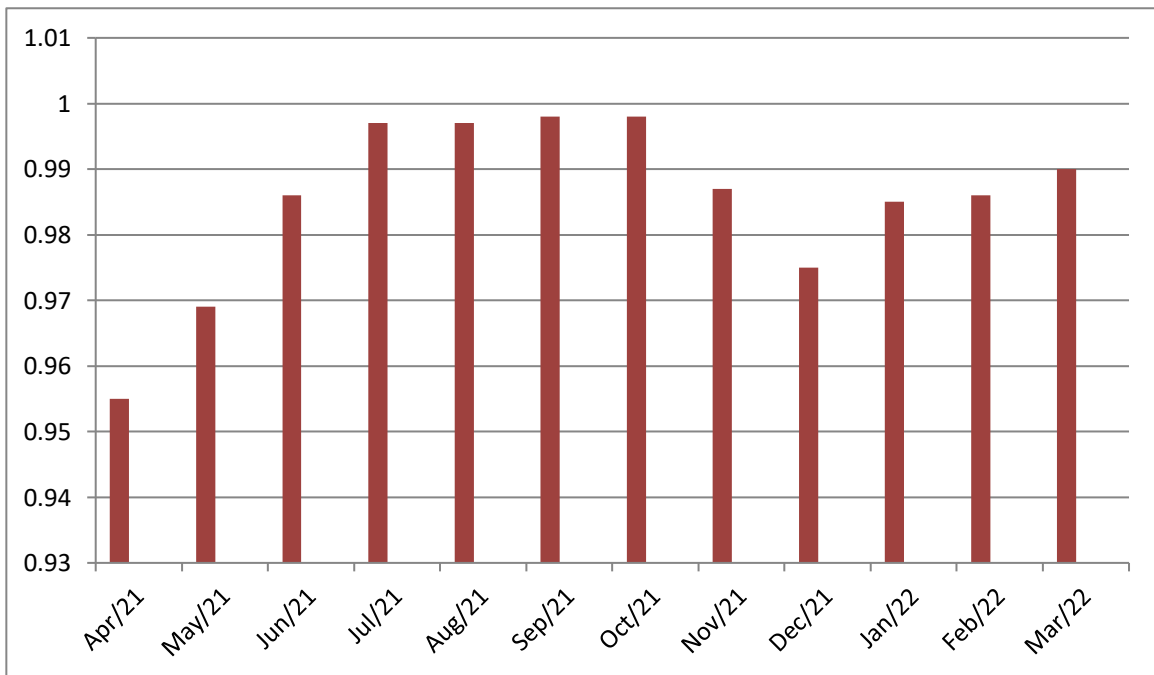
I. Naharkatiya College , Naharkatiya , Meter no X0457672

SI. NO.	Month	No. of unit(KWh)	Amount	Power factor
1	APRIL-2021	681.71	5847	0.955
2	MAY-2021	506.77	10058	0.969
3	JUNE-2021	670.05	10866	0.986
4	JULY-2021	1174.49	14493	0.997
5	AUGUST-2021	1686.88	18180	0.997
6	SEPTEMBER-2021	1989.16	19799	0.998
7	OCTOBER-2021	1889.35	19334	0.998
8	NOVEMBER- 2021	1006.04	13141	0.987
9	DECEMBER-2021	1090.87	13926	0.975
10	JANUARY-2022	0	1343	0.985
11	FEBRUARY-2022	2374.31	20643	0.986
12	MARCH- 2022	1830.9	18938	0.99
Total unit		14907.75	166568	

Month wise power consumption



Month wise power factor



Actual Measurements and its Analysis

SI. NO.	ITEMS	Power rating (watt)	Quantity	Power consumption (watt per hr)
1	Bulb (CFL)	30	5	150
2	Bulb (LED)	9	305	2745
3	Ceiling Fan	70	235	16450
4	Computer	100	70	7000
5	Printer	150	06	900
6	Projector	100	05	500
7	Router	70	1	70
8	Inverter	1000	1	1000
9	Air Conditioner	2250	7	15750
10	Water Purifier	60	7	420
11	Water Pump	375	2	750
12	Water Pump	750	1	750
13	XEROX Machine	1000	5	5000
14	Television	90	1	90
15	C.C.T.V	40	50	2000
16	Spare Plug Point 5 Amps	100	95	4750
17	Spare Plug Point 15 Amps	1000	30	15000
	Total			72575

Lighting System

Observations and suggestions:

- It is found that FTL, Bulbs, CFLs is installed in the facility.
- It is recommended that some tube lights in this area be switched off when sufficient daylight is available.
- Presently there are no reflectors installed for tube lights.
- Every light or electric gadget left on when not needed is wasting energy and money and is causing pollution that is totally unnecessary.
- Stand-by power can use up to 8% of a household's total electricity.

For most homes a 10% reduction in electricity consumption can save \$200 a more a year off our electricity bill and nearly $\frac{3}{4}$ of a tone of CO₂ pollution. A 20% reduction on average consumption will save over \$400 and over 1.5 tons of CO₂.

Don't forget to power down these things when not in use:

- Lights
- Heaters and fans (or air-conditioning)
- Printers and scanners
- Battery and phone chargers
- Computers
- Gaming consoles
- TVs, DVD players
- Stereos
- Kitchen gadgets such as blenders, kettles, toasters etc.

Study of Air Conditioners

In the facility for air conditioning there is no centralized system with AHU.

(air handling unit), but mostly split air conditioners are installed.

a. Load of ACs was as follows:

Item	Rated Power (kW)	Qty	Voltage	Current Amp	Actual Power (kW)
ACs	2	7	240	8.3	1.9

Observations and suggestions:

1. Normal air conditioning temperature should be kept as high as possible (i.e., 24 d.cel.). By thumb rule, increase in 3 degrees in indoor air temperatures can save 1% of electricity.
2. The ventilation in area can be provided with installation of natural ventilation. Natural ventilation will also minimize the requirement of exhaust fans.

Carbon Di-Oxide Emission

In this Chapter we compute the CO₂ emissions. For consumption of 1 Unit (1 kWh) of Electricity, the CO₂ emitted is 0.8 Kg. OR the Emission is 0.8 Kg/kWh. In the following Table we present the total units consumed and CO₂ emitted as under:

Table: CO₂ Emission:

SI. NO.	Month	No. of unit(KWh)	CO ₂ Emitted in MT
1	APRIL-2021	681.71	0.54
2	MAY-2021	506.77	0.4
3	JUNE-2021	670.05	0.54
4	JULY-2021	1174.49	0.94
5	AUGUST-2021	1686.88	1.34
6	SEPTEMBER-2021	1989.16	1.59
7	OCTOBER-2021	1889.35	1.5
8	NOVEMBER- 2021	1006.04	0.8
9	DECEMBER-2021	1090.87	0.87
10	JANUARY-2022	0	0
11	FEBRUARY-2022	2374.31	1.89
12	MARCH- 2022	1830.9	1.46
Total unit (Average)			0.99

Merits/Existing Features for Energy Savings.

1. Staff vigilance
2. Computers are connected in LAN.
3. Printers are shared in LAN.
4. Screen savers facility implemented for every computer.
5. AC's used are of three STARS.
6. Refrigerator's are of three STARS.
7. Incandescent Bulbs are nowhere used.
8. They are replaced by CFL tubes with electronic choke.
9. Maximum use of natural light.
10. Cross Ventilation is provided in laboratory & class rooms, which reduced number of fans.
11. Most of the practical's are scheduled in noon time when Billing Rate in normal.
12. Walls are painted with off white colour to have sufficient brightness.
13. LED flash light is used in Seminar hall.

Energy Conservation Proposals :

Providing Energy Saver Circuit to the Air Conditioners:

The energy saver circuits for the air conditioners, intelligently reduces the operating hours of the compressors either by timing or temperature difference logic without affecting the human comfort. This can save around 15% to 30% of the electricity depending on the weather conditions and temperature settings.

Replacing Fluorescent Tube Lights (FTL) with LED Tube Lights :

The FTLs can be replaced with the LED tube lights. These changes can be made at the places where the life is higher. Usually minimum of 3 years warranty is given and approximate burning hours is 40 000. (15 years considering 8 hours per day running).

General Recommendations

- All Class Rooms and labs to have Display Messages regarding optimum use of electrical appliances in the room like, lights, fans, computers and projectors. Save electricity.
- Display the stickers of save electricity, save nature everywhere in the campus. So that all stakeholders encouraged to save the electricity.
- Most of the time, all the tube lights in a class room are kept ON, even though, there is sufficient light level near the window opening. In such cases, the light row near the window may be kept OFF.
- All projectors to be kept OFF or in idle mode if there will be no presentation slides.
- All computers to have power saving settings to turn off monitors and hard discs, say after 10 minutes/30 minutes.
- The comfort/Default air conditioning temperature to be set between 24°C to 26°C.
- Lights in toilet area may be kept OFF during daytime
- Use AUTOMATIC POWER FACTOR CORRECTION (APFC) Panel FOR PF improvement.
- Need to focus on existing solar plant which is generating power below the rated power
- Need to replace FTL by smart LED Tube
- Need to replace ordinary bulb by LED bulb.
- Need to replace ordinary CRT monitor by LED.
- Need to replace ordinary refrigerator by BEE power saver refrigerator if possible.
- Out of total electricity bill paid, 53 percentage are actual energy utilized charges and remaining expense belongs to additional taxes on energy consumption.
- Need to use power saver circuits for AC.

Executive Recommendations:

1. There has to be Institute level student community that keeps track of the energy consumption Parameters of the various departments, class rooms, halls, areas, meters, etc.
2. Energy auditing inside the campus has to be done on a regular basis and report should be made public to generate awareness.
3. Need to Create energy efficiency/ renewable energy awareness among the college campus i.e. solar, wind, Biogas energy. College should take initiative to arrange seminars, lectures, paper presentation competition among students and staff for general awareness.

2.3 Post audit phase

Follow up and action plans

Energy audits form a part of an on-going process. Innovative energy saving initiatives has to be designed and implemented every year to make the college environmentally sustainable. Follow of programs of energy auditing recommendations should be done meticulously before the next audit.

Photograph:









