

A Report
On
Energy Audit at
Jhanji Hemnath Sarma College



Submitted To
The Principal
Jhanji Hemnath Sarma College
Sivsagar

Submitted By
E-Audit
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Solution For Energy Audit

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Preface

Data collection for energy audit of the Jhanji Hemnath Sarmah College, Sivsagar was conceded by team for the period of March 2021 to February2022

This audit was oversighted to inquire about convenience to progress the energy competence of the campus.. All data collected from each classroom, laboratory, everyroom. 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.

Acknowledgement

We are sincerely thankful to the Jhanji Hemnath Sarmah College , Sivsagar management for giving us the opportunity to conduct energy audit in Jhanji Hemnath Sarmah College campus.

We are also grateful to Dr. Manjit Gogoi, principal, Jhanji Hemnath Sarmah College , Sivsagar , Assam whose valuable comments/feedback, during various reviews have helped us to bring the report in the present format.

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

Summary

The objective of the audit was to study the energy consumption pattern of the facility, identify the areas where potential for energy/cost saving exists and prepare proposals for energy/cost saving along with investment and payback periods.

The salient observations and recommendations are given below.

1. Energy sources of Jhanji Hemnath Sarmah College are in the following forms:

- a. **From APDCL**
- b. **High Speed Diesel Generator (HSDG)**
- c. **Solar panel**

Electrical energy is used for various applications, like: Computers, Lighting, Air-Conditioning, Fans Other Laboratory Equipment, Printers, Xerox machines, CCTV, UPS, LCD Projector, Router system, Floodlight, Pumping motor etc.

2. The average cost of energy is around **Rs. 6662.33** per month
3. After the measurement and analysis, we propose here with following Energy Efficiency Improvement measures.

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

Energy Audit Certificate

This is to certify that an Energy Audit for, Jhanji Hemnath Sarmah College sivsagar, Assam has been conducted from March-21 to February-22 to assess energy costs, availability and reliability of supply of energy, energy conservations technologies and ways to reduce energy consumption.


16/11/2022

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Introduction to energy audit

Jhanji Hemnath Sarmah College sivsagar, 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 somecases

2. **Data analysis** – Detailed analysis of data collected include:

calculation of energy consumption , analysis of latest electricity bill of campus .

Recommendation - On the basis of results of data analysis and observations , some stepsFor 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

1. Pre audit 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 generator.
- 5 . How much money does your college spend on energy such as electricity , gas , etc. In a month (Record monthly for the year 2016).
6. How many CFL bulbs has your college installed ? Mention use (Hours used/ Daily for how manydays in a month)
- 7 . Energy used by each bulb per month? (For example- 60 watt bulb x 4 hour x No of bulbs= kwh).
8. How many LED bulbs are used in your college ? Mention the use (Hours used / day for how manydays in a month)
- 9 . Energy used by each bulb per month?(kwh) .
- 10 . How many incandescent(tungsten)bulbs have your college installed?
Mentions used (Hours your college installed?12.Mentions used (Hours used/day for how many days in a month)
11. Energy used by each bulb per month?(kwh).
12. How many fans are installed in your college ? Mention use (Hours used /day for how many days in a month . Energy used by each fan per month ? (kwh)
13. How many air conditioners are installed in your college? Mention use(Hours used /day for howmany days in a month)

14. Energy used by each air conditioners per month?(kwh)
15. How many electrical equipment including weighing balance are installed in your college ?
16. Mention the use (Hours used /day for how many days in a month)
17. Energy used by electrical equipments per month?(kwh)
18. How many computers are there in your college? Mention Hours used / day for how manydays in a month)
19. Energy used by each computer per month?(kwh)
20. How many photocopiers are installed by your college ?Mention use(Hour used /day for howmany days in a month)

21. How many cooling apparatus per month are installed in your college ?
Mention use(Hours used/day for how many days in a month)
22. Energy used by cooling apparatus per month?(kwh) Mention use(Hours used /day for how many days in a month)
23. 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)
24. How many inverters your college installed ? Energy used by each inverter per month?(kwh)
25. How many electrical equipment are used in different labs of your college?
Mention use(Hours used /day for how many days in a month)
Energy used by each equipment per month?(kwh)
26. How many heaters are used in the canteen of your college? Mention use (Hours used /day for how many days in a month)
Energy used by each heater per month (kwh)
27. Number of street lights in your college?
Energy used by each street light per month?(kwh)
28. 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)
- 29 Are any alternative energy sources /Known conventional energy sources employed / installed in your college? (Photovoltaic cell for solar energy, windmill energy installed in your college?(Photovoltaic cell for solar energy, windmill efficient stoves etc.,)Specify.
30. Do you run "switch off" drills at college?
31. Are your computers and other equipment put on power saving mode?
Does your machinery(TV, AC, Computer , weighing balance , printers, etc.)run on standby mode most of the time? If yes , how many hours?
- 32 . What are the energy conservation methods adopted by your college?
.How many boards displayed for saving energy awareness?
- 33 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 Jhanji Hemnath Sarmah College, 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 appliance is used) and their 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 the whole process was completed from 2021 March to February, 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

Source of Energy:

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

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

There is one number of DG set which is dedicated to supply power to entire campus.

The salient technical specifications are as follows:

Company	Jakson
Model no	JSP-25
Machine no	CJGS18061305
KVA	25
KW	20
Voltage	415v
Current	87amp
Power factor	0.8

Following are the major consumers of electricity in the facility:

- Computers
- Lighting
- Air-Conditioning
- Fans
- Other Lab Equipment
- Printers
- Xerox machines
- CCTV
- UPS
- LCD Projector
- Router system
- Pumping motor

Conclusion: Variation of PF

The Power Factor to reduce the utility power bill. Most utility bills are influenced by KVAR usage. A good Power Factor provides a better voltage. Reducing the pressure on electrical distribution network. Reducing cable heating, cable overloading and cable losses. Reducing overloadings of control gear sands witch-gears etc.

Whenever the average power factor over a billing cycle or a month, whichever is lower, of a higher tension consumer is below 90%, Penal charges shall be levied to the consumer at the rate of 2 % (two %) of the amount of monthly energy bill (excluding of Demand Charges, FOCA, Electricity Duty and Regulatory Liability Charge etc.)

For power factor of 0.99, the effective incentive will amount to 5% (five percent) reduction in the energy bill and for unity power factor; the effective incentive will amount to 7% (seven percent) reduction in the energy bill .

Electricity Bill of Jhanji Hemnath Sarmah COLLEGE for the period from 1st Feb,2021 to 31st March,2022

Sl. No.	Month		Electricity Bill Amount (Rs.)
1	29/04/2020		9630.00
2	18/5/2020		1620.00
3	11/6/2020		3463.00
4	13/7/2020		1374.00
5	05/8/2020		10165.00
6	10/11/2020		16160.00
7	11/01/2021		7577.00
8	12/02/2021		4052.00
9	18/03/2021		5920.00
		Total	59,961.00
		Average	6662.33

Monthwise Load Factor Variation

Conclusion: Variation in monthly Load Factor

If your load factor ratio is above 0.75 electrical usage is reasonably efficient. If the load factor is below 0.5, you have periods of very high usage (demand) and low utilization rate. Low load factor customers would benefit from a peak demand control system or from a Battery Energy Storage System to distribute electrical usage out over longer intervals of time and smooth peaks.

Low load factors, such as below 0.4, contribute significantly to the overall monthly electric bill in the form of demand charges. These demand charges are listed on the bill as coincident demand, facilities demand, and summer time related demand.

SL. NO	Basic Building Data	Value
1	Connected Load	8kW
	Contract Demand	8KVA
2	Installed capacity of DG set	25KVA(1Nos)
3	Annual cost of electricity consumption @6.45/ unit	59,961.00
4	Working hours (Academic and administrative building)	8hrs (9am to 5pm)
5	Working hours (Hostel building)	24hrs X 7days
6	Working days/week	6 Days

Actual measurement and its analysis :

List of Electrical and Electronic Equipment's used in Jhanji Hemnath Sarmah College

Room	Sl. No.	Name of the equipment	Power Rating (Watt)	Qty.	Power consumption In Watt/hr	Used Per Day (hr)	Power Consumption Per day (watt)
Administrative Block	1	Fan	80	41	3280	6hrs	19680
	2	Tube light	40	5	200	4hrs	800
	3	Desktop	170	61	10370	2hrs	20740
	4	Printer	100	4	400	2hrs	800
	5	Xerox	1200	1	1200	2hrs	2400
	6	LED light	12	56	672	2hrs	1344
	7	Projector	100	2	200	2hrs	400
	8	CCTV	50	3	150	24 hrs	3600
	9	AC	2000	1	2000	6hrs	12000
New Extension Block	1	AC	2000	1	2000	6hrs	12000
	2	Fan	80	3	240	6hrs	1440
	3	Tube light	40	1	40	4hrs	160
	4	LED Bulb	12	3	36	2hrs	72
New digital Conference Block	1	LED Bulb	12	23	276	2hrs	552
	2	Fan	80	26	2080	6hrs	12480
	3	Tube light	40	8	320	4hrs	1280
	4	CCTV	50	1	50	24hrs	1200
	5	AC	2000	2	4000	6hrs	24000
	6	Projector	100	1	100	2hrs	200
Commerce Block	1	LED Bulb	12	21	252	2hrs	504
	2	Fan	80	26	2080	6hrs	12480
	3	CCTV	50	1	50	24hrs	1200
	4	Tube light	40	6	240	4hrs	960
	5	Projector	100	3	300	2hrs	600

Old Seminar Hall Block	1	Fan	80	12	960	6hrs	5760
	2	LED Bulb	12	20	240	2 hrs	480
	3	Projector	100	1	100	2hrs	200
	4	AC	2000	2	4000	6hrs	24000
Library Block	1	Fan	80	28	2240	6hrs	13440
	2	LED Bulb	12	17	204	2 hrs	408
	3	Tube light	40	8	320	4hrs	1280
	4	Projector	100	1	100	2hrs	200
	5	Computer	170	22	3740	2hrs	7480
	6	CCTV	50	1	50	24hrs	1200
Canteen Block	1	Fan	80	16	1280	6hrs	7680
	2	LED Bulb	12	11	132	2 hrs	264
	3	Tube light	40	16	640	4hrs	2560
Auditorium	1	Fan	80	14	1120	6hrs	6720
	2	LED bulb	12	26	312	2 hrs	624
New Toilet Block	1	LED Bulb	12	8	96	2 hrs	192

Store Room	1	LED Bulb	12	2	24	2 hrs	48
RCC Hostel	1	Fan	80	38	3040	6hrs	18240
	2	LED Bulb	12	42	504	2 hrs	1008
	3	Tube Light	40	2	80	4hrs	320
	4	Inverter	900	1	900	2hrs	1800
	5	Water pump	750	1	750	1hrs	750
AT Hostel	1	Fan	80	26	2080	6hrs	12480
	2	LED Bulb	12	50	600	2 hrs	1200
	3	Computer	170	1	170	2hrs	340
	4	Water Pump	750	1	750	1hrs	750
	5	Inverter	900	1	900	2hrs	1800
	6	AC	2000	1	2000	6hrs	12000
Total energy consume per hour=57,368 watt/hr							

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 house hold'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 the settings 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.

Load of ACs was as follows:

Item	Rated Power (kW)	Qty	Voltage	Current Amp	Actual Power (kW)
ACs	2	6	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.

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 noontime when Billing Rate in normal.
12. Walls are painted with off white colour to have sufficient brightness.
13. LED flashlight 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 295 W FTLs can be replaced with the LED tube lights 16 W. 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. (15years considering 8 hours per day running)

Following calculations are done for 8 hours working:

- Power consumption by 36WFTL with conventional choke=40W/Tube Light
- Equivalent LED tube light= 16W/Tube Light
- Savings in power =24W/Tube Light
- Operating hours= 8h/dayx300=2400h/year
- Tube Light Yearly savings=2400x24W=57.6kWh/year/Tube Light
- Average Cost of electricity=Rs.6.80/kWh
- Saving=57.6kWhx6.80=Rs.391.68/year/Tube light
- Approximate investment on single LED Tube lights=Rs.200
- Number of Tube Lights to be replaced =325

Summary:

- ✓ **Total Yearly Saving =325x391.16=Rs.127127.00 /year**
- ✓ **Total Investment=325 xRs.200 =Rs. 65000.00**

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 after10minutes/30minutes.
- The comfort/Default air conditioning temperature to be set between 24°Cto26°C.
- Lights in toilet are a may be kept OFF during daytime
- Use AUTOMATIC POWERFACTOR CORRECTION (APFC) Panel for PF improvement.

- Need to focus on existing solar plant which is generating power below the rated power
- Need to use power saver circuits for AC.
- 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
- Recently govt. has declared the exemption on electricity duty charges for school and colleges trying to get the benefit of the same as soon as possible.

Executive Recommendations:

- 1. There has to be Institute level student community that keeps track of the energy consumption Parameters of the various departments, classrooms, 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.

3. Post audit phase

Follow up and action plans

Energy audits form a part of an on-going process. Innovative energy saving initiatives has tobe designed and implemented every year to make the college environmentally sustainable.

Follow of programs of energy auditing recommendations should be done meticulously beforethe next audit.

Photographs-









