ENERGY AUDIT REPORT

GOGAMUKH COLLEGE

Gogamukh College (NAAC Accredited with Grade 'B')
P.0.- Gogamukh, Dist.- Dhemaji, Pin-787034 (Assam)
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Gogamukh College, Dhemaji

A report on Energy Audit

- Internal Audit Team:
  - Ms Kanchan K Sharma, IQAC Coordinator, Gogamukh College
  - Mr Pitambar Pegu, Coordinator, EnergyAudit Committee, Gogamukh College
  - Mr Humen Gogoi, Internal Expert, Energy Audit Committee, Gogamukh College
  - Mrs Bidisha Barthakur, Member, Energy Audit Committee, Gogamukh College
  - Mr. Gunabhiram Baruah Member, Energy Audit Committee, Gogamukh College.

- External Audit Team:
  - Dr. Lohit Kr Baishya, Scientist In-Charge, ICAR-IARI, Gogamukh, Assam
  - Raja Gopal Krishna Permey, SDO, APDCL, Gogamukh.

- Report Compiled By: Mr Humen Gogoi, Mrs Bidisha Barthakur and Mr. Gunabhiram Baruah.

Certificate of Energy Audit

This certifies that Gogamukh College has undergone a comprehensive Energy Audit conducted by Energy Audit Team of Gogamukh College led by Sh. Humen Gogoi under the guidance of the Principal, Gogamukh College, Dr. Dilip Kumar Jha and IQAC Co-Ordinator and her team The audit encompassed in-depth assessment of energy consumption patterns, systems efficiency, and potential areas for optimization within the premises of Gogamukh College.

The diligent efforts of the team involved meticulous examination of various aspects including but not limited to:

- Energy consumption data analysis
- Building envelope inspection
- HVAC (Heating, Ventilation, and Air Conditioning) systems evaluation
- Lighting systems assessment
- Renewable energy feasibility analysis

Recommendations for energy conservation

Based on the findings and analysis, actionable recommendations have been provided to Gogamukh College aimed at enhancing energy efficiency, reducing environmental impact, and achieving cost saving.

This certificate attests to the commitment of Gogamukh College towards sustainability and responsible energy management practices. By engaging in this Energy Audit, Gogamukh College demonstrates its dedication to fostering a greener and more sustainable future.

Raja Gopal Krishna Permey,
Sub Divisional Engineer
Ghilamara, Electrical Sub-Division.

Sub-Divisional Engineer
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9/5/2024

Dr. Lohit Kr. Baishya
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Dirpai Chapori, Gogamukh-787035 (Assam)

Recommendations by External Energy Audit Team:

Here are some recommendations based on common findings from energy audits that could apply to Gogamukh College campus:

- Upgrade Lighting System: Replace traditional incandescent bulbs with energy-efficient LED lights throughout the campus. Implement occupancy sensors and daylight harvesting systems to optimize lighting usage in classrooms, corridors, and common areas.
- HVAC System Optimization: Conduct regular maintenance of heating, ventilation, and air conditioning (HVAC) systems to ensure they operate efficiently. Upgrade to programmable thermostats and zone control to regulate temperatures more effectively in different areas of buildings.
- Insulation Improvements: Enhance insulation in buildings to minimize heat loss during winter and reduce the load on HVAC systems. Insulate roofs, walls, and pipes to improve energy efficiency and indoor comfort.
- Renewable Energy Integration: Explore opportunities for integrating renewable energy sources such as solar panels or wind turbines on campus buildings. Invest in renewable energy technologies to supplement electricity from the grid and reduce reliance on fossil fuel.
- Energy Management System:(EMS): Implement an EMS to monitor and control energy usage in real-time. Utilize data analytics to identify energy waste, set energy-saving targets, and track progress over time. Integrate EMS with building automation systems for centralized control and optimization.
- Behavioral Changes and awareness: Launch energy conservation awareness campaigns to educate students, faculty, and staff about the importance of energy efficiency. Encourage simple actions like turning off lights and electronics when not in use, and promoting a culture of sustainability across the campus community.
- Water Conservation Measures: Implement water-saving technologies such as low-flow faucets, toilets, and showerheads in campus facilities. Fix leaks promptly and implement irrigation systems with moisture sensors to optimize outdoor water usage for landscaping.
- Transportation Initiatives: Promote alternative transportation options such as biking, walking, carpooling, and public transit to reduce the carbon footprint associated with commuting to and from campus. Provide incentives for using eco-friendly transportation methods and invest in bike racks and pedestrian infrastructure.
- Continuous Monitoring and Improvement and Establish a regular schedule for conducting energy audits and performance assessments to track progress and identify further opportunities for energy savings. Continuously evaluate and refine energy management strategies based on evolving technology best practices.

2. Govt of Ashani such PM Surya for solar energy is to be used to lessen the burden of fund

Raja Gopal Krishna Permey,
Sub Divisional Engineer
Ghilamara, Electrical Sub- Division

Sub-Divisional Engineer
Ghilamara Electrical Sub-Division
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19/5/2024

Dr. Lohit Kr. Baishya
Scientist In-Charge (ICAR-IARI,
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CONTENT

1. Background:

Energy is very important in the entire process of evaluation, growth and survival of the world. Energy conservation is reducing the energy by using less of an energy service. One of the important ways of to improve the energy conservation is energy audit. Energy conservation without compromising the usage is a great task. In today's world, every nation realizes that energy conservation is one of the great necessities for them. As a result, the Parliament of India passed the Bill on Energy Conservation in 2001, enlisting different rules for the conservation of energy. Now, the industries and other institution are the part of those rules for energy conservation. Even the educational institution also the important followers of energy conservation. Gogamukh College, being a pioneer educational institution located at Gogamukh, Dhemaji, Assam also needs a good quality of energy conservation. It also needs to conduct an energy audit every year to improve its energy conservation.

2. Introduction:

An energy audit is a survey in which the study of energy flows for the purpose of conservation is examined at an organization. It refers to a technique or system that seeks to reduce the amount of energy used in the Organization without impacting the output. The audit includes suggestions of alternative means and methods for achieving energy savings to a greater extend. An energy audit is proposed and conducted to ensure that energy saving practices are implemented and followed in Educational Institutions and Industrial sectors in a sustainable way. Preparation and completion of a questionnaire, physical examination of the campus, observation and examination of documentation, key person interviews, data analysis, measurements and suggestions are all part of the audit process. Energy audit involves several facts including energy savings potential, energy management, finding alternatives, etc.

Energy auditing is a routine procedure of monitoring power consumption of the institute performed on annual basis. As per the Energy Conservation Act, 2001, Energy Audit is defined 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 and an action plant reduce energy consumption". For the successful implementation of an energy efficient campus, Gogamukh College has focused a lot on the enhancement and awareness among the students, teachers, and other members of the institution.

Gogamukh College has also considered it extremely essential to work sincerely in the matter of environment consciousness parallel with green energy initiatives. In it strive for a clean, green and energy efficient campus, every possible step is taken by every member or cell of the institution to create a sense of responsibility among the students pertinent to the sustenance of healthy environment in the form of various programmes and project works.

2 .1 Need for an Energy Audit:

Energy Audit will help to understand more about the ways energy and fuel are used in any industry, and help in identifying the areas where waste can occur and where scope for improvement exists. The Energy Audit would give a positive orientation

to the energy cost reduction, preventive maintenance and quality control programmed which are vital for production and utility activities. Such an audit programmed will help to keep focus on variations which occur in the energy costs, availability and reliability of supply of energy, decide on appropriate energy mix, and identify energy conservation technologies, retrofit for energy conservation equipment etc.

Auditing for Energy Management may be studied in terms of energy savings and opportunities. In general, energy cannot be seen, but we know it is there in wire, pipes and other non-living materials because we can see its effects in the forms of heat, light and power. This indicator addresses energy consumption, energy sources, energy monitoring, lighting, vehicle movement, electrical and electronics appliances, and transportation. Energy use is clearly an important aspect of campus sustainability and thus requires no explanation for its inclusion in the assessment. However, energy saving and opportunities may be taken into consideration while energy is extensively used.

3. Aims and Objectives of an Energy Audit:

The energy auditing is very much useful for developing and implementing comprehensive energy management plans of an Institution. The aim of an energy audit is to identify the energy efficiency, conservation and savings opportunities at the premises of the audits in a systematic manner. The audit process is carried out as per the following.

- Review of energy saving opportunities and measures implemented in the audit sites.
- Identification of additional various energy conservation measures and saving opportunities.
- Detailed analysis on the calculation of energy consumption, analysis of latest electricity bill of the campus, understanding the tariff plan provided by the State Electricity Board.
- List ways that the use of energy in terms of electricity, kettle, LPG, firewood, diesel and others.
- Analysis of electricity bill amount, paid for LPG cylinders, amount paid for water consumption for human beings and watering to the plants for last five years.
- Use of incandescent (tungsten) bulb and CFL bulbs, fans, air conditioners, cooling apparatus, computers, printers, inverter, generators and laboratory equipment and instruments installed in the organization.
- Creating awareness among the stakeholders on energy conservation and utilization.

4. Methodology for energy audit:

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

Step 1: At the request of IQAC, the college administration decides to conduct an energy audit for all academic and administrative buildings on campus.

Audit Team Formation: A team is assembled consisting of SDO (APDCL) Gogamukh, Principal of Gogamukh College, IARI-ICAR Gogamukh, Ms Kanchan K Sharma, Coordinator IQAC, Gogamukh College, Mr Pitambar Pegu, Associate Prof, Mrs Bidisha Barthakur, Assistant Prof, Dept of Zoology and Mr Humen Gogoi, Assistant Prof, Dept of Physics of this college.

Step 2: Data collection:

- Different sites are observed thoroughly by the audit team.
- Data collection and observation was done in large scale.
- Data collected from the college was analyzed properly.
- Recommendations for further improvement.

Step 3: Verification of the Data and Equipment:

- Physical verification of lighting, fans/ac machines.
- Verification of installed energy efficient systems.
- Generators, Uninterrupted power supply machines.
- Inspect and verify the maintenance aspects of installed Generators and additional backup power sources.
- Various documents like energy bills, agreements with utility are verified, log sheets of DG set are looked into to ascertain if the pattern of energy consumption are tallying.
- Analyze the electricity consumption through the supply utility company (Assam Power Distribution Company limited)
- Review the potential usage of alternative energy resources.
- Reviewtheenergyconservationawarenessamongthestakeholdersforoptimum use of electricity and its savings.

Step 4: Evaluation and Outcome:

The outcome of energy audit will be beneficial after the implementation of the recommendation regarding energy efficiency improvement. Gogamukh College will take necessary action for conservation of energy and use of renewable energy resource. Gogamukh College is going to install a solar panel as a renewable energy resource soon.

Audit Details:

5. Sources of Energy:

The source of electrical energy of the college depend on-

A. Assam Power Distribution Company Limited (APDCL), Gogamukh

B. Diesel Generator of the College (During the power cut)

6. Audit Details:

6.1. The Energy Audit team visited during the Energy Audit:

Date	Section where Energy Audit is conducted
	Canteen of the College
	Administrative Block
	DG Power House

08-05-2024	Teachers Common room
	All the Teaching Departments
	Seminar Halls
08-05-2024	Digital Classroom
	Auditorium
	Laboratories
	Computer Centers
	Hostel warden Quarter
	Hostel
	Library
	Classrooms

6.2. Observations of the Energy Audit:

The Gogamukh College Campus consisting of multiple buildings (both RCC multi stored and Assam type building). The following tables show the basic information about the building and the utilities.

Energy consumption of equipment for 8 hours per day for 30 days per month				
Sl. No	**Name**	**Quantity**	$Kw = \frac{w}{1000}$	**Kwh=Kw**X **240**
1	LED bulb (12 Watt)	**142**	**1.704**	**408.96**
2	Tube light (12 Watt)	**74**	**0.888**	**213.12**
3	Fans (75 Watt)	127	9.525	2286
4	AC (1 kW)	07	7	1680
4	AC (1.5 kW)	05	7.5	1800
5	Water Pumps (746 Watt)	06	4.476	1074.24
6	R.O Filter(25 Watt)	08	0.2	4.8
7	Inverter (700 watt)	03	2.1	504
8	Computer (70 watt)	37	2.59	621.6
9	Biometric cum face reorganization Machine	01	0.0015	0.36
10	Refrigerator (800 Watt)	01	0.8	192

11	Digital Board (200 watt)	02	0.4	96
12	Printer (50 Watt)	10	0.5	120
13	CC Camera (10 Watt)	10	0.1	24
14	Photo state machine (70 Watt)	01	0.7	168
Total Power			38.4845	9193.08

6.3. Present Energy Scenario of Gogamukh College:

- Connected Load: 12KW
- Contract demand: 12KVA
- Installed capacity of DG set: 30 KVA (1 No)
  Make: Kirloskar Oil Engines Limited.
  A Kirloskar Group Company
  DGS Translogistics India Pvt Ltd.
  Model: KGI-30AS1/30(1Ph) KVA
  Product Code: PSI-A030.500.020.100
  MFG Date/SR NO: 06/04/2017/454
- Total numbers of building covered: 15
- Working hours (Academic and Administration building) : 8 Hours(9AM to 5PM)
- Working hours (Hostel Building): 24 Hr X 7days
- Working days/week: 6 Days
- Whether sub metering of electricity consumption for each building: No

Table for Annual electricity consumption and Cost:

Sl. No	Session	Annual electricity consumption	Annual electricity cost (INR)
1	April'2018 to March' 2019	14254 KWH	1,26,825.00
2	April'2019 to March' 2020	14156 KWH	1,24,480.00
3	April'2020 to March' 2021	7401KWH	61,057.00
4	April'2021 to March' 2022	7312KWH	69,961.00
5	April'2022 to March' 2023	16621KWH	1,20,200.00

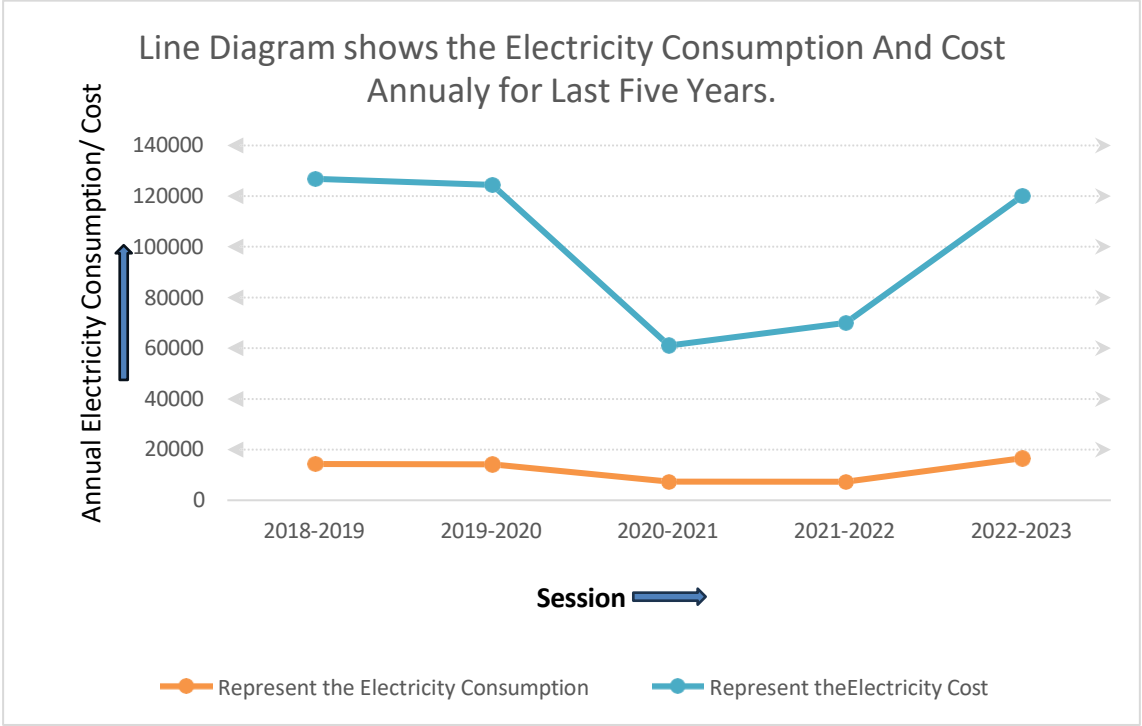
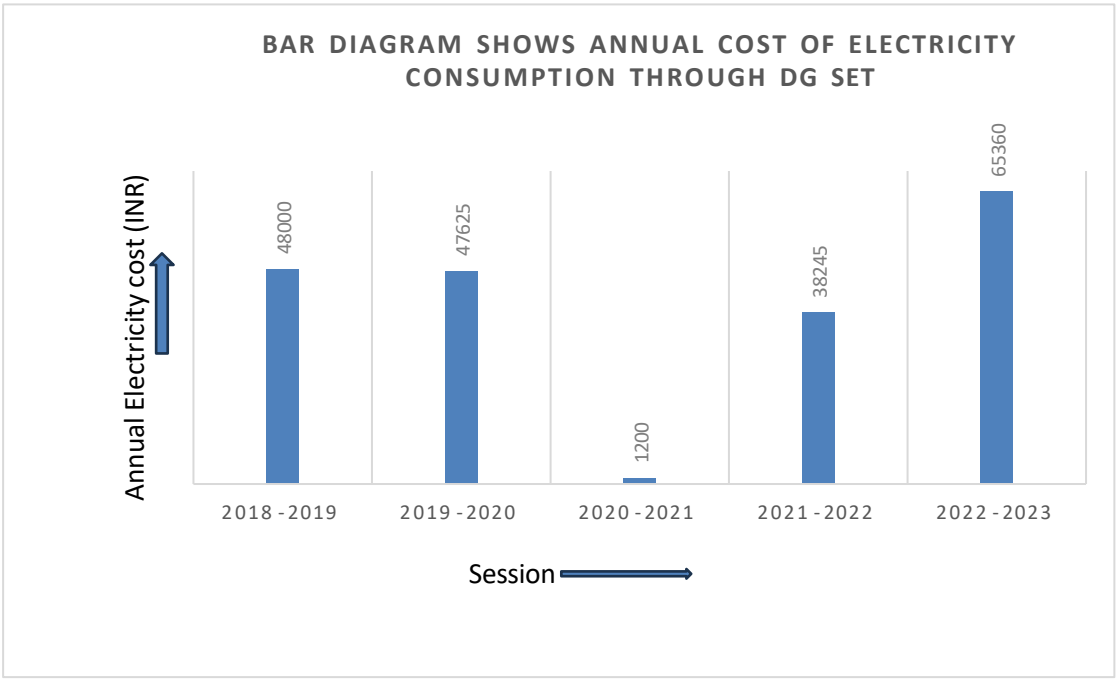


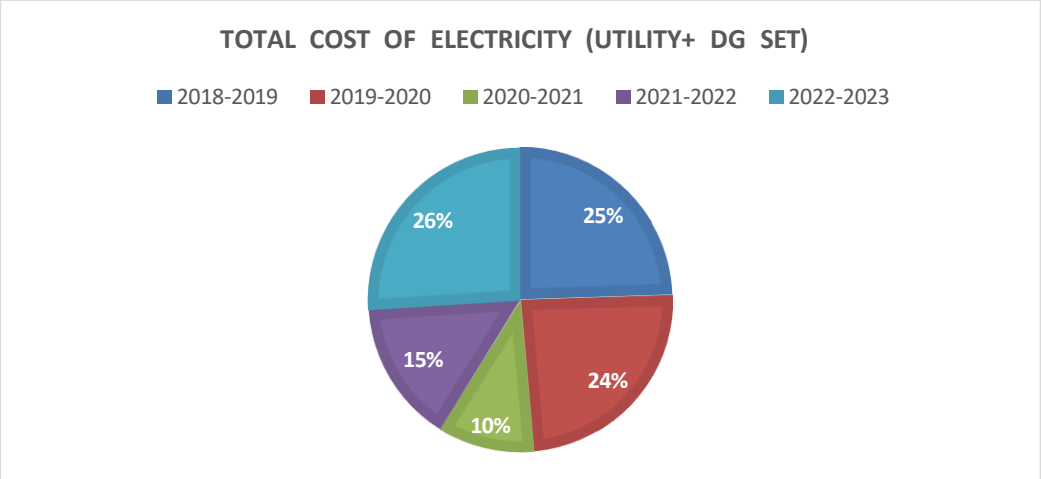
Table for Annual cost of electricity consumption through DG set

Sl. No	Session	Annual electricity cost (INR)
1	April'2018 to March' 2019	48,000.00
2	April'2019 to March' 2020	47,625.00
3	April'2020 to March' 2021	12,000.00
4	April'2021 to March' 2022	38,245.00
5	April'2022 to March' 2023	65,360.00



Total cost of electricity (Utility + DG set):

Sl. No	Session	Annual electricity cost (INR)
1	April'2018 to March' 2019	174825.00
2	April'2019 to March' 2020	172105.00
3	April'2020 to March' 2021	73057.00
4	April'2021 to March' 2022	108206.00
5	April'2022 to March' 2023	185560.00



7. Energy Conservation:

To reduce the amount of end-use energy consumption, the college has adopted the following ways for saving electricity.

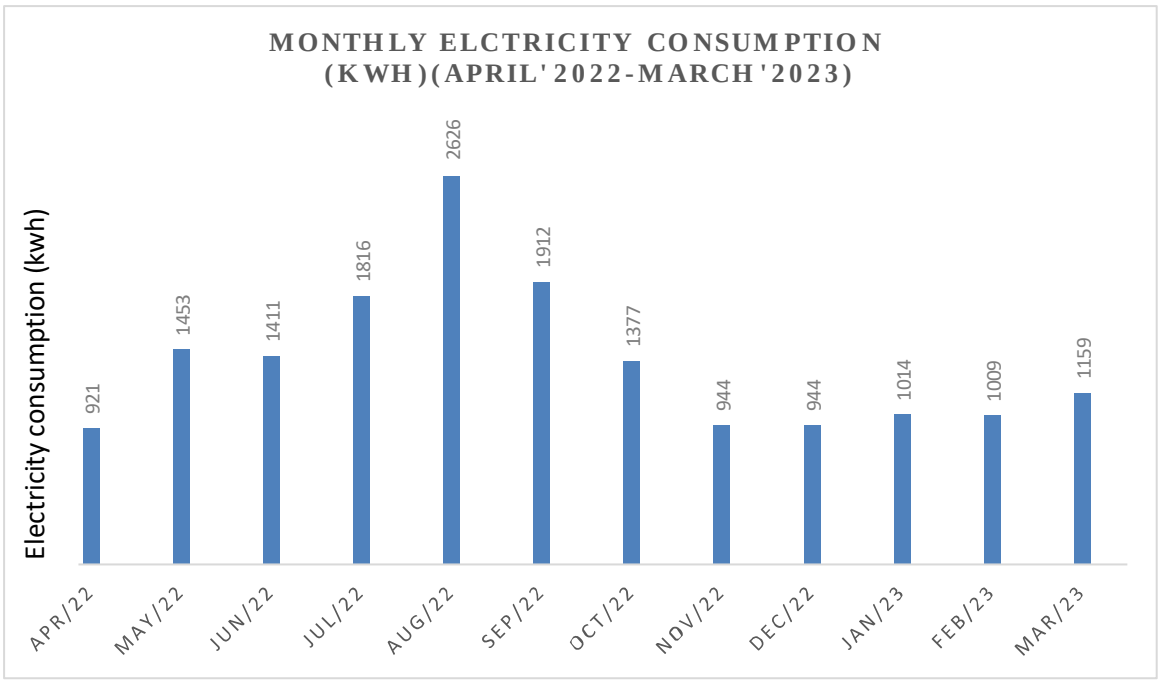
- The classrooms as well as the laboratories are constructed in such manner that they allow sufficient light and air during class hours and as a result, much electricity is saved.

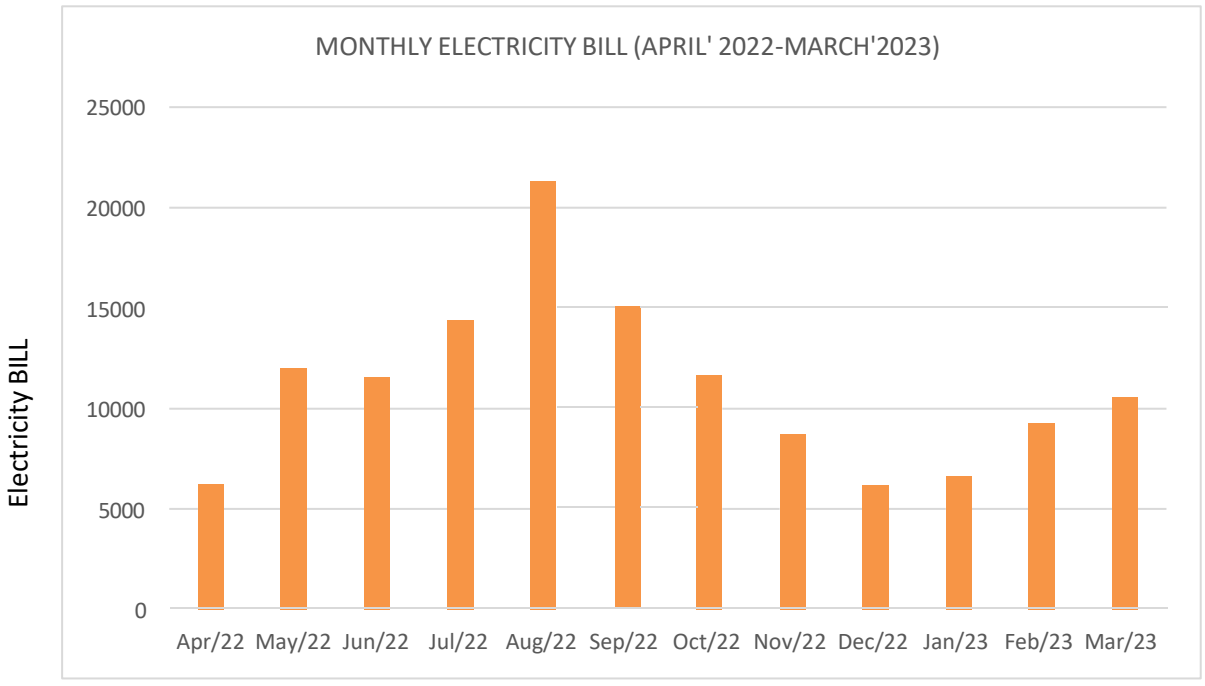
- Gogamukh College has taken steps to replace all existing bulbs and lights with LED lights phase wise. In fact, all newly constructed buildings by RUSA have been equipped with LED lights and 5-star rating ceiling fans with a view to reducing the consumption of energy.

- All the students and teachers of Gogamukh college maintain a good habit to switch off lights and fans of the classroom and other place when it is not in used to proper utility of electricity.

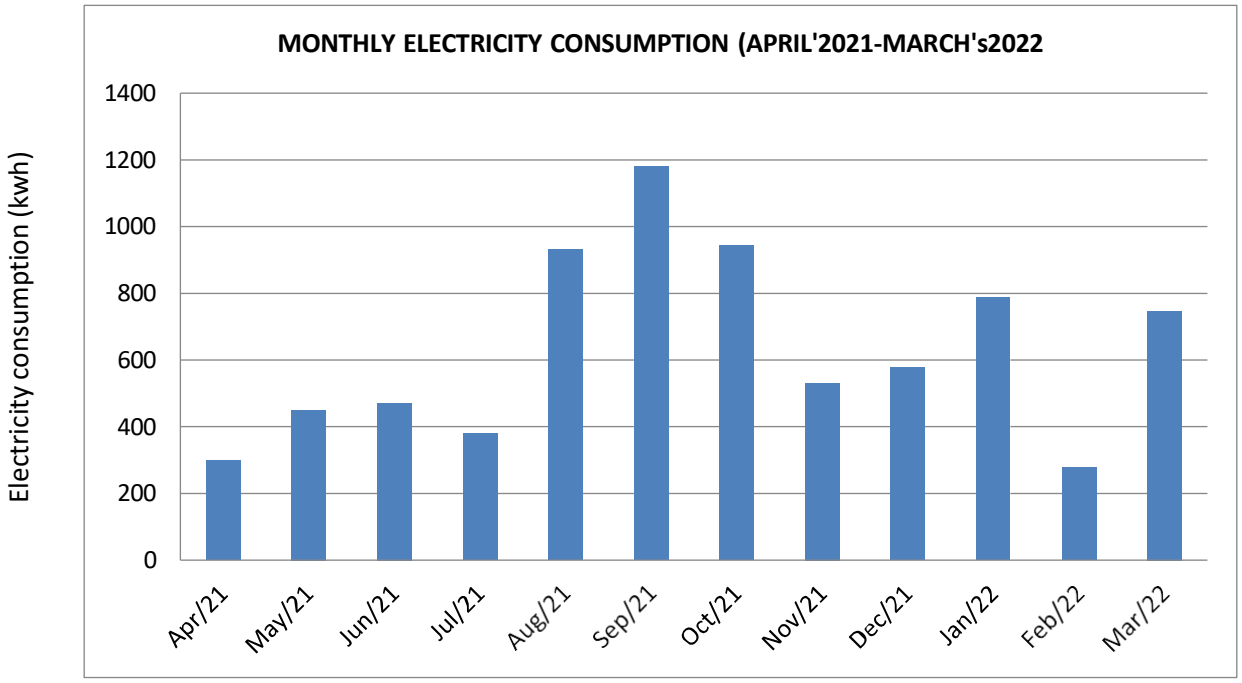
7.1. Energy Consumption and Cost Profile:

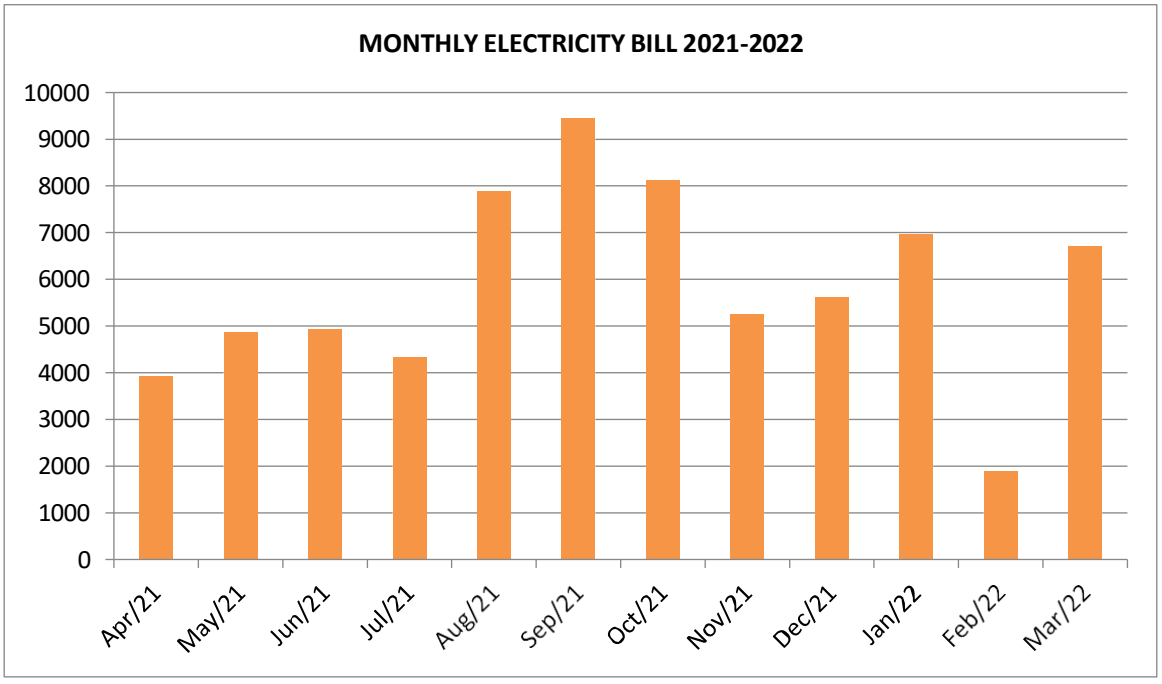
Monthly Electricity Consumption (kwh) and electricity bill (Rs) paid during the financial year 2022-2023.



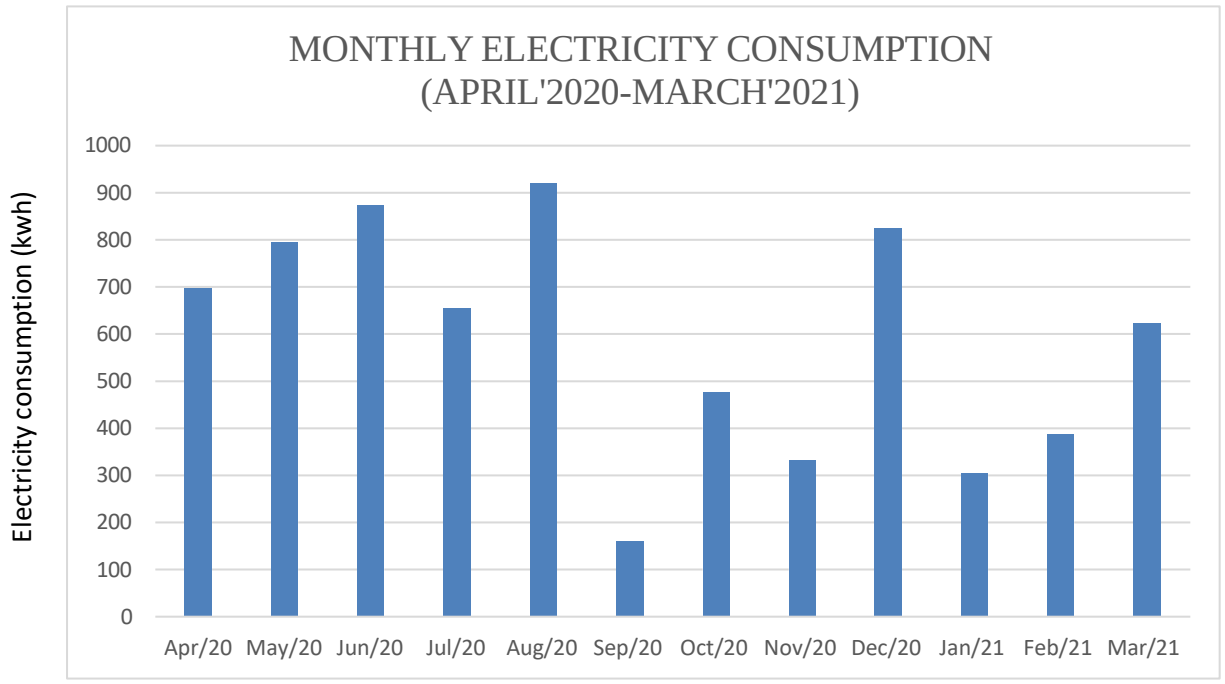


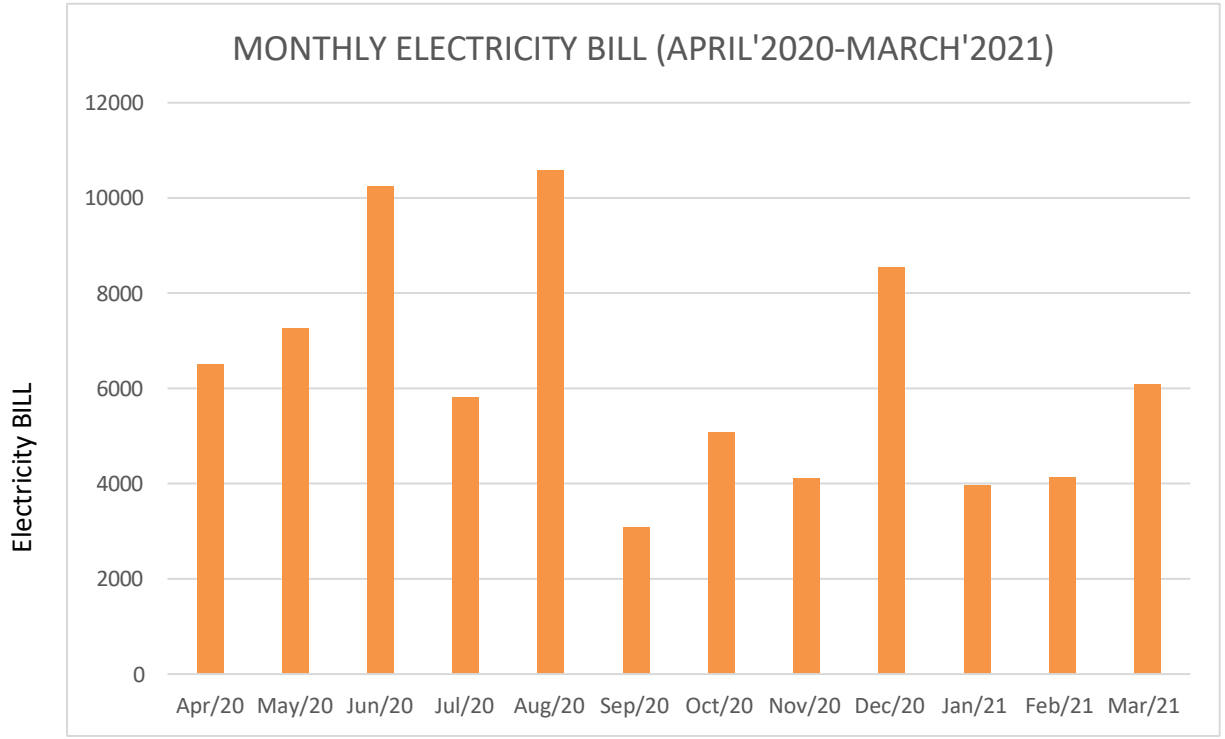
Monthly Electricity Consumption (kwh) and electricity bill (Rs) paid during the financial year 2021-2022.



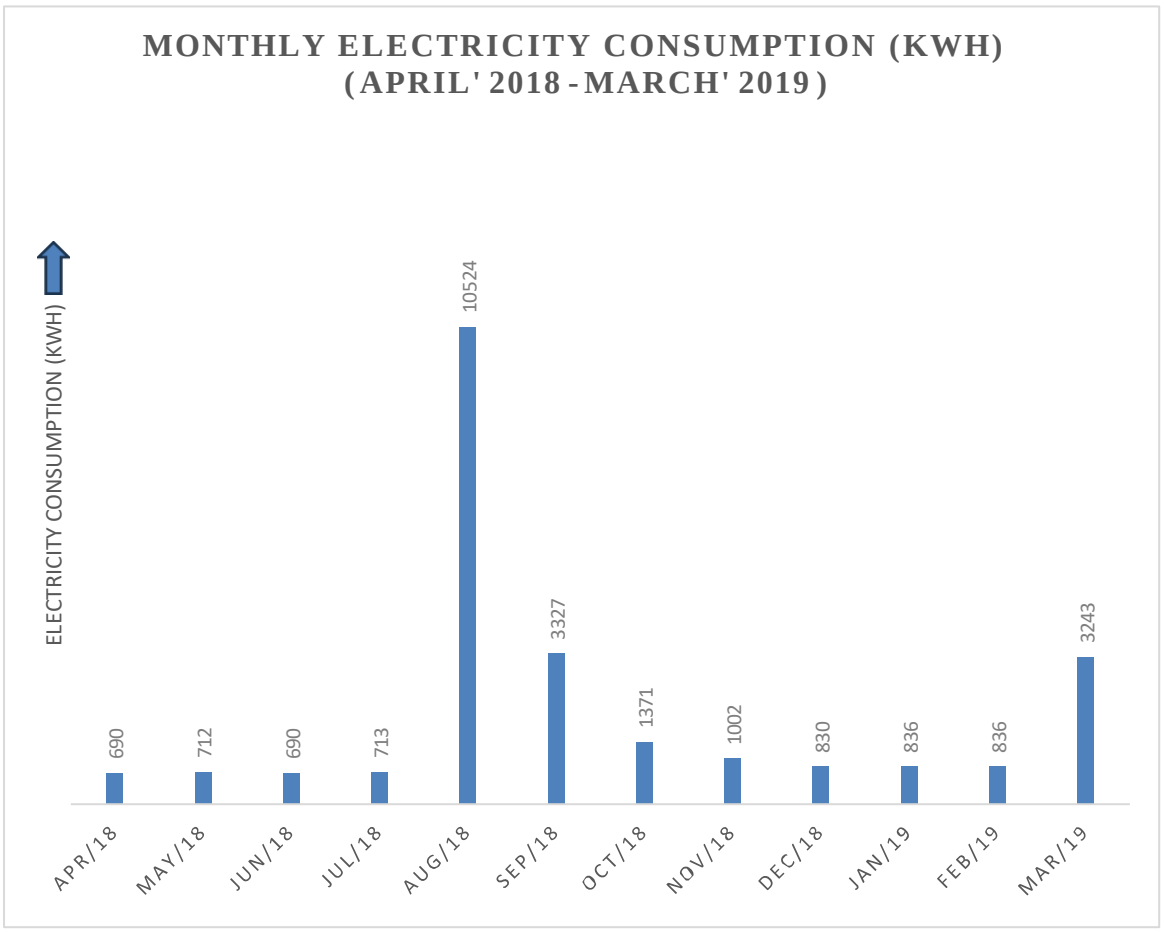


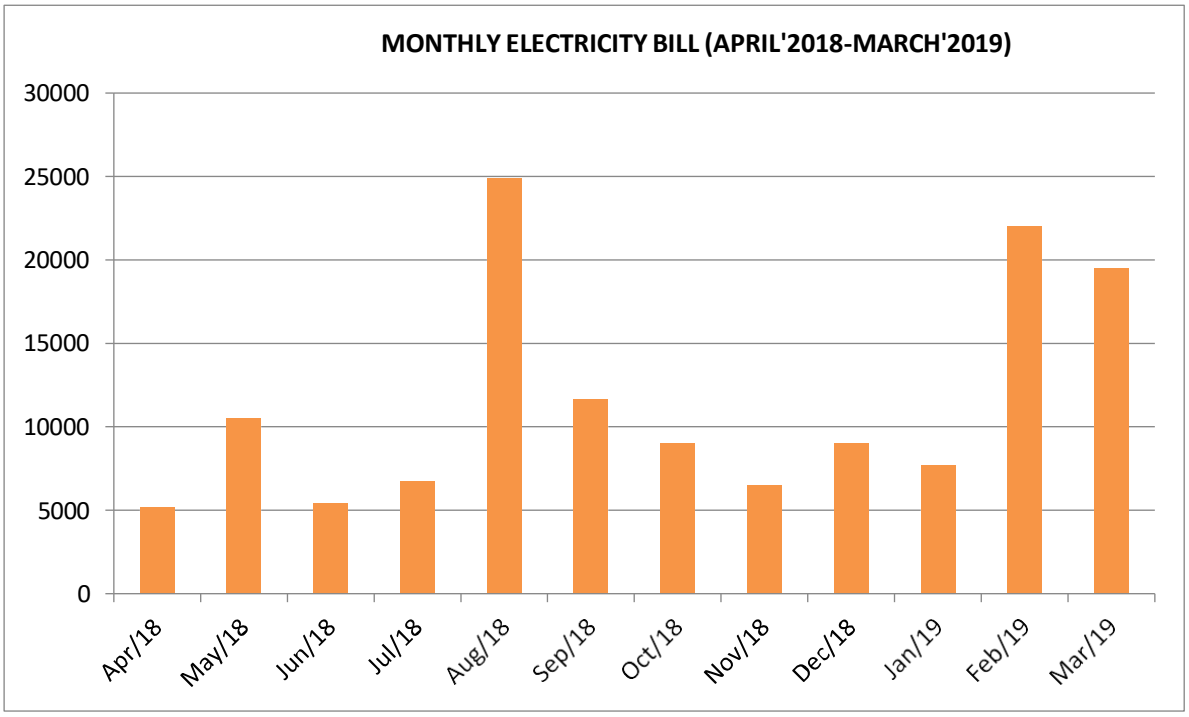
Monthly Electricity Consumption (kwh) and electricity bill (Rs) paid during the financial year 2020-2021.





Monthly Electricity Consumption (kwh) and electricity bill (Rs) paid during the financial year 2018-2019.





8. Conclusion:

Since 1981 Gogamukh College has Establised good reputation so there is significant scope for conserving energy and make the campus self sustained in it. The energy conservation initiatives taken up by the institution are substantial. A few recomdendations are required for further improvement in energy saving by the college, which may lead to prosperous future. Energy efficient lighting schems, awarness created among stakeholders and necessary power backups are being practiced by the institution. Gogamukh College is trying to make the campus as an energy efficient campus for sustainable development practices.

The Energy Audit highlights significant opportunities for Gogamukh College to Improve energy efficiency, reduce operating costs and minimize environmental impact. By implementing the recommended measures, the College can enhance its sustainability efforts and create a more comfortable and environmentally friendly campus environment.

9. Recommendations:

- Procurement of equipment with energy efficiency (4-5star rated equipment) during replacement may be considered.
- Sub meters in all the buildings for energy monitoring are recommended so that energy load required and energy consumption in each building may be noted.
- Continuous monitoring and analysis of energy consumption by dedicated team may be planned within the campus.
- Turn off electrical equipment when not in use.
- Maintain appliances and replace old appliances in all laboratories.
- Use computers and electronic equipment in power saving mode.
- Installation of Bio gas plant for hostel kitchen as well as canteen.
- Automatic switches with occupancy sensors in common areas.
- There are fans of older generation and non-energy efficient which can be phase out by replacing with new energy efficient fans.
- Regular monitoring of equipment in all laboratories and immediate rectification of any problems.
- Value added /Certificate / Diploma course on ‘Energy and Green Management Audits’ may be conducted for the benefit of students.
- Suggested to protect all Transformer, Generators and UPS with fencing and keep the awareness boards and safety signs on ‘Dangers’ and ‘Warnings, etc.
- Advised to cover Electrical wires, switch boxes, inverters, and stabilizers not to cause any problem to the staff and student members
- Advised to replace old generation computers and TVs with LED monitors and old incandescent (tungsten) bulbs with LED lights and install automatic street solar lights.
- Instructed to replace Overhead Projectors with LCD projectors to reduce the power consumption.

- Suggested to install Roof top solar power plants.

10. References:

- Backlund, S. and Thollander, P. 2015. Impact after three years of the Swedish energy audit programme. *Energy*, **82**: 54-60.
- Bae, S.H. and Seol, I. 2006. An exploratory empirical investigation of environmental audit programs in S&P 500 companies. *Management Research News* **29** (9): 573-579.
- Buckman, A.H.,Mayfield,M.andBeck,S.B.M.2014.What is as mart building?. *Smart Sustainable Built Environment* **3** (2): 92-109.
- 350-1000 ppm: Typical level found in occupied spaces with good air exchange along with pure air.
- 1000-2000ppm: Moderate level associated with complaints of drows in sand poor air quality.

Some Photographs of Electrical Equipment:

Figure 01: Disel Generator

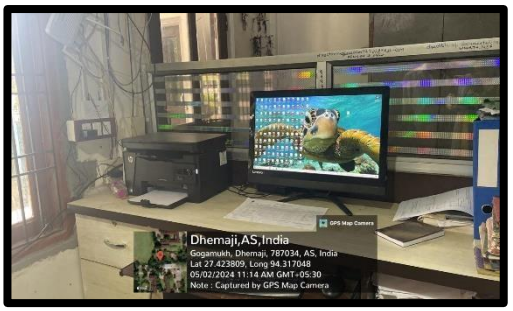


Figure 02: Equipment on STANDBY MODE wasting power.

Figure 03: Computer Room.

Figure 04: Energy Efficient Lighting

Figure 05:. AC (1 kW)

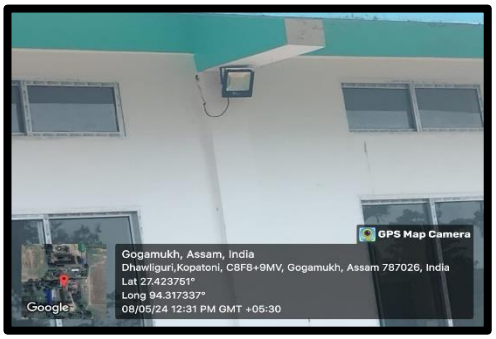


Figure 06: Street Light