ENERGY AUDIT

Assam Science and Technology University

2023-2024

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ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

2023-2024

Under the consultation of
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EXECUTIVE SUMMARY

This executive summary presents the findings, analysis, and recommendations from the Energy Audit conducted at Assam Science and Technology University (ASTU). The audit assessed current energy consumption, identified inefficiencies, and proposed strategies to enhance energy efficiency and reduce operational costs. The first objective is to evaluate current energy usage, quantify energy consumption across various facilities and identify key areas of high usage. The second objective is to identify inefficiencies and detect systems and processes contributing to energy wastage. The third objective includes recommendations for improvements and actionable measures for improving energy efficiency and reducing costs. The audit included three steps. Gathering historical energy consumption data and conducting on-site inspections. Assessing energy usage patterns in lighting, HVAC systems (Heating, Ventilation, and Air Conditioning), electrical equipment, and other critical infrastructure. Evaluating the financial implications of proposed energy-saving measures. The energy audit of Assam Science and Technology University reveals significant opportunities for improving energy efficiency and reducing operational costs. By implementing the recommended measures, the university can achieve substantial energy savings, enhance environmental sustainability, and set a precedent for responsible energy management. Immediate action is encouraged to capitalize on these benefits and to foster a culture of energy consciousness within the institution.

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CHAPTER 1

INTRODUCTION

The Government of Assam established the Assam Science and Technology University (ASTU) under the Assam Science and Technology University Act, 2009. The university aims to promote education and research in the fields of science, technology, and other professional disciplines in Assam. ASTU is the premier technical university in the northeastern region of India. It is responsible for the academic regulation of all undergraduate and postgraduate programs in engineering, pharmaceutical sciences, and selected professional courses in science and management. Additionally, ASTU offers an in-house postgraduate program in Energy Engineering.

An energy audit of Assam Science and Technology University (ASTU) involves a systematic evaluation of the university's energy consumption to identify opportunities for energy conservation and efficiency improvement. The audit includes assessing energy usage patterns across academic buildings, laboratories, administrative offices, and other facilities, along with the performance of installed systems such as lighting, HVAC, and renewable energy installations. Key aspects of the audit include analyzing electricity bills, identifying energy wastage, and recommending cost-effective measures such as retrofitting with energy-efficient appliances, optimizing power usage, and integrating smart energy management systems. Conducting an energy audit will help ASTU minimize energy wastage, reduce operational costs, and align with sustainable energy practices, contributing to the university's commitment to environmental stewardship.

1.1 TOTAL CAMPUS AREA & UNIVERSITY BUILDING SPREAD AREA

Total Campus Area	14125.08 m^2.
University Buildings Area	3217.92 m^2.
Open Space Area	10907.16 m^2.

1.2 CAMPUS INFRASTRUCTURE

SOLAR POWER PLANT

A 15-kW hybrid Solar Photovoltaic (SPV) power plant has been installed on the rooftop of the Academic Building at Assam Science and Technology University under the AICTE GAINER initiative. The plant is designed to generate electricity using bifacial monocrystalline solar modules with a power rating of 580W or higher. It is equipped with a 20-kW hybrid inverter to enhance flexibility, energy management, and overall sustainability. The rooftop provides

approximately 226.60 m^2 of surface area, sufficient for installing the required number of solar panels. This initiative aims to address the campus's energy shortage, reduce dependency on conventional electricity, and contribute to significant savings on the university's monthly electricity bill. The project reduces the reliance on diesel generator (DG) sets and uninterruptible power supply (UPS) systems, which are currently used during grid power outages. The Solar PV power system supplies electricity to classrooms, research laboratories, lecture halls, computer center, and selected departmental devices. These initiatives contribute to enriching the teaching-learning process, fostering a more sustainable and practical approach in the technical institution.

Figure 1: Rooftop hybrid Solar Photovoltaic (SPV) power plant.

CHAPTER 2

PRE-AUDIT STAGE

The pre-audit meeting, held on January 5, 2024, at Assam Science and Technology University, served as a vital step in the Energy Audit process. It provided an opportunity to define the audit's scope and objectives while addressing practical considerations. This meeting marked the first interaction between the audit team and the auditee, enabling the resolution of any initial concerns. During the meeting, the audit protocol and plan were shared and discussed in detail to ensure clarity and alignment before the audit began. It also allowed the audit team to gather essential information and documents directly from the University for preliminary analysis. The planning of audit processes was finalized, and the audit team was selected collaboratively with input from the University's staff and management. Under the leadership of the lead auditor, the team committed to ensuring the audit's timely and thorough completion within its defined scope.

2.1 COMMITMENT OF THE UNIVERSITY MANAGEMENT

During the pre-audit meeting, the University management demonstrated a strong commitment to energy auditing and expressed their readiness to support green initiatives. They agreed to promote activities such as energy conservation awareness programs following the completion of the audit. Additionally, the management showed a willingness to develop and implement policies based on the findings and recommendations outlined in the Energy Audit report.

2.2 SCOPE AND GOALS OF GREEN AUDITING

An energy audit is one of the most effective methods for addressing high energy consumption challenges. Conducting energy audits on university campuses is particularly important, as it raises awareness among students about energy conservation and its role in protecting the planet. As a result, energy audits have become a necessity at the university level. To facilitate this, a simple, indigenized system has been developed to monitor the University's energy consumption. This system includes a series of questions to be answered regularly, making it both user-friendly and entirely voluntary. The primary objective is to help the institution lead by example in energy conservation and to educate young learners, inspiring them to adopt sustainable practices within their communities.

2.3 BENEFITS OF THE ENERGY AUDITING

- ✓ To provide a basis for improved sustainability
- ✓ More efficient resource management
- ✓ Point out the prevailing and forthcoming complications
- ✓ Authenticate conformity with the implemented laws
- ✓ Empower organizations to frame better energy performance
- ✓ Impart energy conservation education through a systematic energy management approach and improve environmental standards
- ✓ Financial savings through a reduction in energy consumption
- ✓ Energy auditing should become a valuable tool in the management and monitoring of energy and sustainable development programs of the University.

2.4 TARGET AREAS OF ENERGY AUDITING

The University campus is committed to reducing emissions, securing a cost-effective and reliable energy supply, and promoting energy conservation. It emphasizes encouraging individual actions to conserve energy and minimizing the institution's overall energy consumption, thereby achieving significant environmental benefits.

2.4.1 AUDITING FOR ENERGY MANAGEMENT

Energy itself cannot be seen, but its effects are evident in the forms of heat, light, and power. This indicator focuses on key aspects such as energy consumption, sources, monitoring, lighting, appliances, and vehicles. As energy use is a critical component of campus sustainability, its inclusion in assessments is self-evident. For example, an old incandescent bulb consumes approximately 60W to 100W, whereas an energy-efficient LED uses less than 10W. Energy auditing focuses on conserving energy and identifying methods to reduce consumption, which directly addresses environmental degradation. Therefore, any environmentally responsible institution needs to evaluate and improve its energy use practices.

2.5 METHODOLOGY OF ENERGY AUDITING

The purpose of the audit was to ensure that the campus practices align with the institution's Energy Conservation Policy. The audit's criteria, methods, and recommendations were focused on identified areas of energy consumption. The methodology included several steps: preparing and completing a questionnaire, conducting a physical inspection of the campus, observing and reviewing relevant documents, interviewing responsible personnel, analyzing data, taking

measurements, and providing actionable recommendations. The methodology adopted for this audit was a three-step process comprising of:

2.5.1 DATA COLLECTION

During the preliminary data collection phase, comprehensive data was gathered using various methods, including observation, surveys, communication with responsible personnel, and measurements.

The data collection process involved the following steps:

- The audit team visited each department, center, section, library, canteen, and other facilities on campus.
- General information was collected through direct observation and interviews.
- Power consumption data for appliances was recorded, with average values used in certain cases.

2.5.2 DATA ANALYSIS

The detailed analysis of the collected data included the following: calculating energy consumption, reviewing the campus's latest electricity bill, and examining the tariff plan provided by Assam Power Distribution Company Limited (APDCL). Additionally, data related to water usage was analyzed using appropriate methodologies.

2.5.3 RECOMMENDATION

Based on data analysis and observations, some steps for reducing power consumption were recommended. The use of fossil fuels has to be reduced for community health.

The target areas specific to the University were evaluated using a questionnaire distributed among the students for data collection. The details and formats of the questionnaire are provided in the next page.

2.6 SURVEY FORMS

FORM I

Auditing for Energy Management

1. List ways that you use energy in your University. (Electricity, electric stove, kettle, microwave, LPG, firewood, Petrol, diesel and others).
2. Collect the monthly Electricity bill amount for the last year.
3. Collect the monthly amount paid for LPG cylinders for the last year.
4. Collect the monthly amount spent on petrol/diesel/others for generators.
5. Are there any energy-saving methods employed in your University? If yes, please specify. If not, suggest some.
6. How much money does your University spend on energy such as electricity, gas, firewood, etc. in a month? (Record monthly for the year 2023-24).
7. How many CFL bulbs has your University installed? Mention use (Hours used/day for how many days in a month)
8. How much energy is used by each bulb per month? (for example- 60-watt bulb x 4hours x number of bulbs = kwh).
9. How many LED bulbs are used in your University? Mention the use (Hours used/day for how many days in a month)
10. How much energy is used by each bulb per month? (kwh).
11. How many incandescent (tungsten) bulbs have your University installed? Mentions use (Hours used/day for how many days in a month)
12. How much energy is used by each bulb per month? (kwh).
13. How many fans are installed in your University? Mention use (Hours used/day for how many days in a month)
14. How much energy is used by each fan per month? (kwh)
15. How many air conditioners are installed in your University? Mention use (Hours used/day, for how many days in a month)
16. How much energy is used by each air conditioner per month? (kwh).
17. How much electrical equipment including weighing balance are installed at your University? Mention the use (Hours used/day for how many days in a month)
18. How much energy is used by electrical equipment per month? (kwh).
19. How many computers are there in your University? Mention the use (Hours used/day for how many days in a month)

20. How much energy is used by each computer per month? (kwh)

21. How many photocopiers are installed by your University? Mention use (Hours used/day for how many days in a month).

22. How many cooling apparatuses are in installed in your University? Mention use (Hours used/day for how many days in a month)

23. How much energy is used by each cooling apparatus per month? (kwh)
Mention use (Hours used/day for how many days in a month)

24. How much energy is used by each photocopier per month? (kwh) Mention the use (Hours used/day for how many days in a month)

25. How many inverters has your University installed? Mentions use (Hours used/day for how many days in a month)

26. How much energy is used by each inverter per month? (kwh)

27. List of electrical equipment in different labs at your University?
Mention the use (Hours used/day for how many days in a month)

28. How much energy is used by each equipment per month? (kwh)

29. How many street lights are there in your University?

30. How much energy is used by each street light per month? (kwh)

31. How many Televisions are there in your University?

32. How much energy is used by each Television per month? (kwh)

33. Any other item that uses energy. (Please write the energy used per month) Mention the use. (Hours used/day for how many days in a month)

34. Are any alternative energy sources/nonconventional energy sources employed/installed in your University? (photovoltaic cells for solar energy, windmill, energy-efficient stoves, etc.,) Specify.

35. Do you run “switch off” drills at University?

36. Are your computers and other equipment put in power-saving mode?

37. Does your machinery (TV, AC, Computer, weighing balance, printers, etc.) run on standby mode most of the time? If yes, how many hours?

38. What are the energy conservation methods adapted by your University?

39. How many boards are displayed for saving energy awareness?

40. Write a note on the methods/practices/adaptations by which you can
reduce the energy use on your University campus in future.

Calculation of energy for electrical appliances

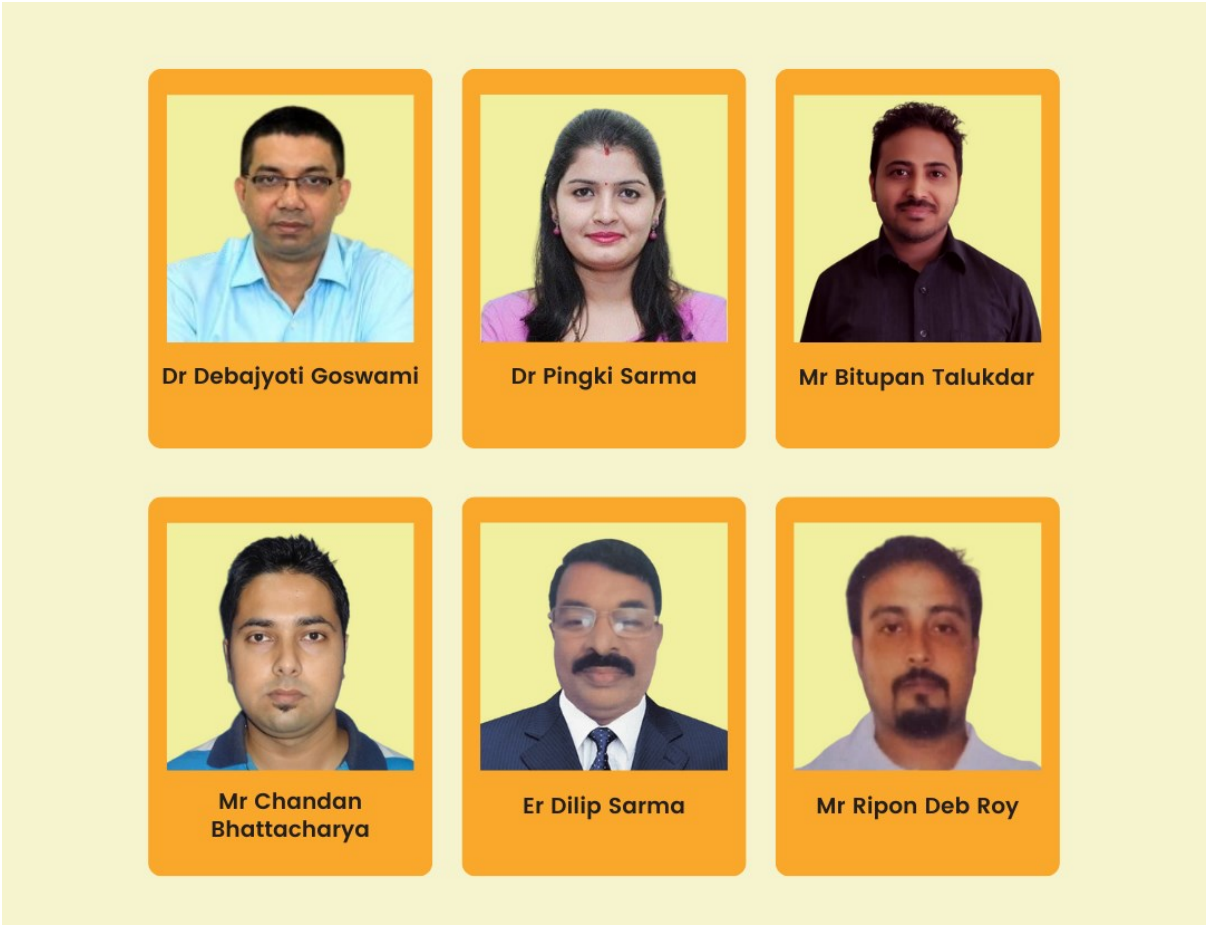
Appliance	Power used in (watt)	Usage per day (hours)	Number of appliances	Average kWh per day (Watt X hours X Number X 1000)	Average kWh per month (Watt X hours X Number X 1000 x 30)
Incandescent bulb					
CFL					
LED					
Other appliances					

CHAPTER 3

AUDIT STAGE

Energy auditing at Assam Science and Technology University was carried out with the assistance of Prof. Subhendu Sekhar Bag (CChem, FRSC, FICS), Professor in the Department of Chemistry & Centre for the Environment at IIT Guwahati, and his team involving different student groups, teaching and non-teaching staff. The energy audit began with the team visiting all University facilities to identify the types of appliances and utilities in use. The team measures the usage per item (Watts indicated on the appliance) and identifies the relevant consumption patterns (such as how often an appliance is used). The staff and students were interviewed to get the usage, frequency or general characteristics of certain appliances. University records and documents were verified several times to clarify the data received through surveys and discussions. The process was completed within twelve months from 5th January 2024 to 30th December 2024.

3.1 FACULTY AND STAFF INVOLVED IN ENERGY AUDITING



3.2 COMMENTS ON-SITE TOUR

The site inspection was conducted with the involvement of students and staff. Questionnaires were completed during the tour, and students and staff actively participated in the data collection process. For most students, this was their first experience with energy auditing. They shared their expectations about the audit and provided valuable suggestions for the audit recommendations.

3.3 REVIEW OF DOCUMENTS AND RECORDS

Documents including stock entry registers, electricity registers, laboratory equipment registers, purchase registers, audited statements, and office registers were reviewed, and relevant data was collected.

3.4 REVIEW OF POLICIES

Discussions were held with the University management regarding their energy management policies and plans. Following the energy audit findings, the management expressed their intention to develop an energy conservation policy for the University. The primary purpose of

the audit was to ensure that campus practices align with the institution's adopted Energy Conservation Policy.

3.5 INTERVIEWS

The audit team interviewed office staff, teaching and non-teaching staff, students, and other University stakeholders to gather information for the energy audit. Additionally, discussions were held with office bearers to clarify any uncertainties regarding specific points.

3.6 SITE INSPECTION

The audit team visited the University and its premises multiple times to collect information. They toured various areas, including classrooms, faculty rooms, laboratories, the canteen, library, office rooms, and parking grounds. The team counted the number and types of vehicles used by stakeholders and verified the fuel consumption for each vehicle with the respective users. The number of LPG cylinders used in the laboratory and canteen was also recorded.

CHAPTER 4

POST AUDIT STAGE

The foundation of any energy audit is that its findings are supported by verifiable documents and information. The audit process aims to track past actions, activities, events, and procedures on a sampled basis to ensure they align with system requirements and are carried out properly. Green audits are part of an ongoing process. While each audit is an individual event, its true value lies in being conducted at regular intervals, allowing results to demonstrate improvements or changes over time. Energy audits are conducted using policies, procedures, documented systems, and objectives as benchmarks. However, there is always some degree of subjectivity involved. The core purpose of any energy audit is to assess how well the organization, management, and equipment are performing. Each of these three components is essential for ensuring the organization's environmental performance aligns with the goals set in its energy policy. The effectiveness of each function and its integration into the overall system will determine the success or failure of the organization's performance.

4.1 KEY FINDINGS AND OBSERVATIONS OF ENERGY AUDIT

The university relies on multiple energy sources to meet its needs: electricity, LPG, diesel, and solar. The average monthly electricity consumption is 900.5 kWh, resulting in an electricity bill of ₹21,147. For June 2024, the university's electricity bill amounted to ₹20,700.00. Additionally, ₹1,704.00 was spent on LPG cylinders for the same month. The university also uses 10 litres of diesel per month to power its generators, costing ₹903.00. The university spends ₹23,307.00 per month on electricity, gas, and diesel, as recorded for June 2024.

The campus infrastructure includes 200 ceiling fans, 350 tube lights, 234 LED lights, 29 CCTV cameras, 21 exhaust fans, 47 air conditioners, one kitchen chimney, 12 speakers, one amplifier, three projectors, 79 computers, 29 printers, seven UPS units, four refrigerators, two chillers, nine network switches, 13 Wi-Fi routers, nine water pumps, two water purifiers, two electric kettles, 13 display screens, three photocopiers, and two gas cylinders. The research facilities house 13 instruments in the Energy Research Laboratory, three in the Tribology Research Laboratory, eight in the Material Science Laboratory, one in the IC Engine Laboratory, seven in the Multi-disciplinary Experimental & Testing Accessible (META) Laboratory, and one in the Plasma Pyrolysis Laboratory.

A 15-kW hybrid Solar Photovoltaic (SPV) power plant is the only alternative energy source on campus. The university follows various energy conservation methods, including rainwater harvesting, optimal water use, reusability, sensor-based devices in water tanks, proper monitoring of electric appliances, and awareness campaigns promoting energy efficiency. Initiatives such as "No Motor Vehicle Day" and encouraging public transport and walking contribute to sustainability. The university does not use incandescent or CFL bulbs, nor does it have room heaters. All computers and equipment are turned off after use, and standby mode is avoided for devices like computers and printers. These initiatives and infrastructure reflect the university's energy efficiency and sustainability commitment.

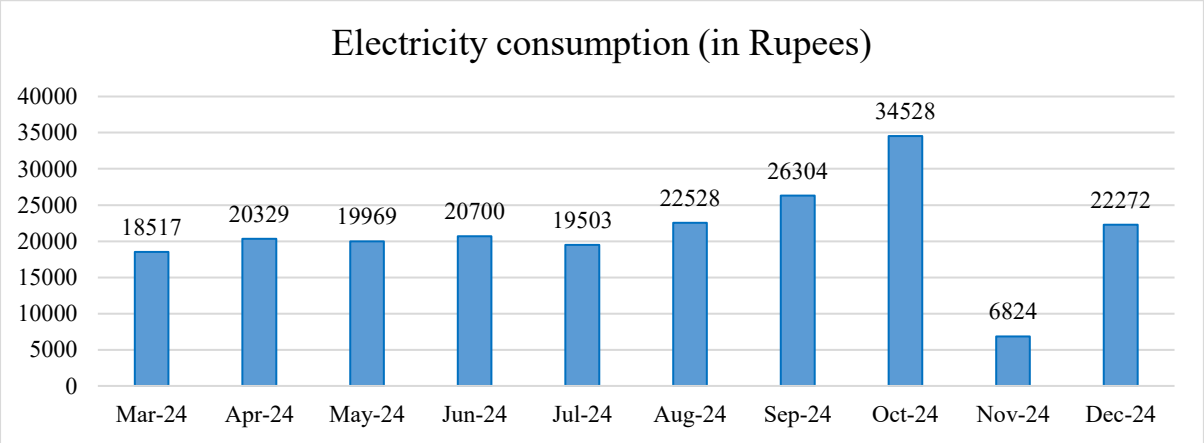


Figure 2: Electricity consumption (in Rupees) of ASTU.

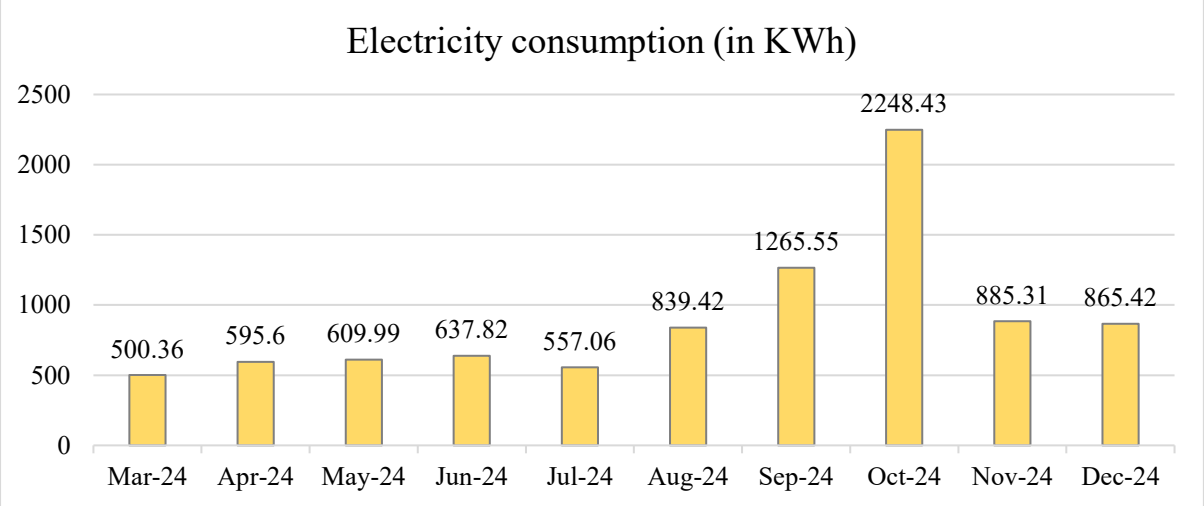


Figure 3: Electricity consumption (in kWh) of ASTU.

Electricity consumption tends to increase significantly due to the growing demand for cooling systems such as air conditioners, fans, and refrigerators. Higher temperatures cause these

devices to operate more frequently and at higher capacities to maintain indoor comfort and prevent overheating of stored goods.

Number of electrical items in the University

Electrical Items	Numbers
Tube Lights	350
Ceiling Fans (Old)	200
LED Lights	234
CCTV Cameras	29
Exhaust Fans	21
Air Conditioners (AC)	47
Kitchen Chimney	1
Speakers	12
Amplifiers	1
Projectors	3
Computers	79
Printers	29
UPSs	7
Refrigerators	4
Chiller	2
Network Switch	9
Wifi	13
Water Pumps	9
Water Purifiers	2
Electric Kettles	2
Displays	13
Photocopiers	3
Gas Cylinders	2
Energy Research Laboratory	13
Tribology Research Laboratory	3
Material Science Laboratory	8
IC Engine Laboratory	1
Multi-disciplinary Experimental & Testing Accessible (META) Laboratory	7
Plasma Pyrolysis Laboratory	1
Total number of electrical items	**1105**

The campus infrastructure comprises 200 ceiling fans, 350 tube lights, 234 LED lights, 29 CCTV cameras, 21 exhaust fans, 47 air conditioners, a kitchen chimney, 12 speakers, an amplifier, three projectors, 79 computers, 29 printers, 7 UPS units, 4 refrigerators, 2 chillers, 9 network switches, 13 Wi-Fi routers, 9 water pumps, 2 water purifiers, 2 electric kettles, 13 display screens, 3 photocopiers, and 2 gas cylinders. The research facilities include 13 instruments in the Energy Research Laboratory, 3 in the Tribology Research Laboratory, 8 in

the Material Science Laboratory, 1 in the IC Engine Laboratory, 7 in the Multi-disciplinary Experimental & Testing Accessible (META) Laboratory, and 1 in the Plasma Pyrolysis Laboratory.

Energy usage in June 2024

Electrical Items	**Energy Usage per month (kWh)**
Tube Lights	112.00
Ceiling Fans	168.00
LED Lights	14.04
CCTV Cameras	52.20
Exhaust Fans	5.04
Air Conditioners (AC)	145.20
Kitchen Chimney	27.00
Speakers	7.20
Amplifiers	7.20
Projectors	2.25
Computers	94.80
Printers	1.95
Refrigerators	122.40
Chiller	0.92
Network Switch	77.76
Wifi	5.61
Water Pumps	6.30
Water Purifiers	0.60
Electric Kettles	9.00
Displays	16.20
Photocopiers	1.20
Energy Research Laboratory	121.20
Tribology Research Laboratory	80.00
Material Science Laboratory	117.30
IC Engine Laboratory	42.00
Multi-disciplinary Experimental & Testing Accessible (META) Laboratory	129.60
Plasma Pyrolysis Laboratory	60.00
Total energy usage per month (kWh)	**1426.96**

The monthly energy consumption across various electrical items and laboratory equipment amounts to 1,426.96 kWh. Among the highest energy-consuming devices are ceiling fans (168.00 kWh), air conditioners (145.20 kWh), refrigerators (122.40 kWh), and several research laboratories, including the META Laboratory (129.60 kWh) and the Energy Research Laboratory (121.20 kWh). Tube lights and computers also contribute significantly, consuming

112.00 kWh and 94.80 kWh, respectively. In contrast, low-energy-consuming devices include chiller units (0.92 kWh), water purifiers (0.60 kWh), and photocopiers (1.20 kWh). Notably, network-related equipment like network switches (77.76 kWh) and Wi-Fi routers (5.60 kWh) collectively add to the total consumption. This data highlights the significant energy demands of both everyday electrical appliances and specialized laboratory equipment, emphasizing the need for efficient energy management strategies to reduce overall consumption and enhance sustainability.

Energy Usage of Ceiling Fans in the University

Department/ Area	Number of Ceiling Fans	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
Energy Research Laboratory (ERL)	2	70	0.07	6	1.68
Material Science Research Laboratory	1	70	0.07	6	0.84
Multidisciplinary Experimental and Testing Accessible Laboratory (METAL)	2	70	0.07	6	1.68
Conference Hall	10	70	0.07	6	8.40
Conference Hall (Corridor)	1	70	0.07	6	0.84
A.T. Room No.001 (Office-ASTU employees union)	2	70	0.07	6	1.68
A.T. Room No.002 (Engineering Wing)	2	70	0.07	6	1.68
A.T. Room No.003 (Yoga Center)	2	70	0.07	6	1.68
A.T. Room No.005 (Computational Research Laboratory)	2	70	0.07	6	1.68
A.T. Room No.006	1	70	0.07	6	0.84
ASTU Canteen	2	70	0.07	6	1.68
Foyer	2	70	0.07	6	1.68
Storeroom No. 001	2	70	0.07	6	1.68
Internal Quality Assurance Cell Room No. 002	2	70	0.07	6	1.68
Academic Register Room No. 003	2	70	0.07	6	1.68
Finance and Accounts Officer-In-Charge (Room No. 008)	8	70	0.07	6	6.72

Conference Room (Room No. 107)	6	70	0.07	6	5.04
Registrar Room (Room No. 106)	2	70	0.07	6	1.68
Kitchen (Room No. 105)	1	70	0.07	6	0.84
Room No. 103	2	70	0.07	6	1.68
Vice Chancellor Room (Room No. 102)	7	70	0.07	6	5.88
Secretary to The Vice-Chancellor (Room No. 101)	2	70	0.07	6	1.68
Corridor	2	70	0.07	6	1.68
Solar Room	1	70	0.07	6	0.84
Room No. 201 & 202 Examination Room	10	70	0.07	6	8.40
Room No. 208	2	70	0.07	6	1.68
Corridor	2	70	0.07	6	1.68
Faculty Room ABG03 And ABG04	2	70	0.07	6	1.68
Faculty Room ABG01 and ABG02	4	70	0.07	6	3.36
Table Tennis Room	2	70	0.07	6	1.68
UPS Room	1	70	0.07	6	0.84
Library	6	70	0.07	6	5.04
Central Store	1	70	0.07	6	0.84
Entrepreneurship Development Center	2	70	0.07	6	1.68
GF corridor	2	70	0.07	6	1.68
Room No. 101 (Research Scholar Room)	4	70	0.07	6	3.36
Room No. 102 (Academic Block)	5	70	0.07	6	4.20
Room No. 103	4	70	0.07	6	3.36
ABF02 (Faculty Room)	1	70	0.07	6	0.84
Seminar Hall	10	70	0.07	6	8.40
Seminar Hall-Additional Room	2	70	0.07	6	1.68
FF Corridor	2	70	0.07	6	1.68
Room No. 201 & 202	8	70	0.07	6	6.72
Room No. 203	6	70	0.07	6	5.04
Room No. 204	8	70	0.07	6	6.72
Vikshit Bharat @2047 Cell	1	70	0.07	6	0.84
Room No. 205	4	70	0.07	6	3.36
SF Corridor	2	70	0.07	6	1.68
Annex Building	3	70	0.07	6	2.52

Foyer	2	70	0.07	6	1.68
Resulting Processing Unit-I (Room No. 005)	4	70	0.07	6	3.36
Resulting Processing Unit-II (Room No. 007)	4	70	0.07	6	3.36
Staff Room-I (Room No. 003)	4	70	0.07	6	3.36
Deputy Controller of Examination (Room No. 002)	2	70	0.07	6	1.68
Controller of Examination	2	70	0.07	6	1.68
Record Room-I (Room No. 101)	2	70	0.07	6	1.68
Answer Script Store (Room No. 102)	6	70	0.07	6	5.04
Evaluation Room (Room No. 103)	6	70	0.07	6	5.04
Record Room-I (Room No. 105)	4	70	0.07	6	3.36
Staff Room-II (Room No. 107)	4	70	0.07	6	3.36
Total Energy usage per month (kWh)					**168.00**

Energy usage of Tube Lights in the University

Department/ Area	Number of Tube Lights	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
Energy Research Laboratory (ERL)	3	40	0.04	2	0.96
Tribology research laboratory	3	40	0.04	2	0.96
Material science research laboratory	3	40	0.04	2	0.96
Multidisciplinary experimental and testing accessible laboratory (METAL)	3	40	0.04	2	0.96
A.T. Room No.001 (office-ASTU employees union)	2	40	0.04	2	0.64
A.T. Room No.002 (Engineering Wing)	2	40	0.04	2	0.64
A.T. Room No.003 (Yoga Center)	2	40	0.04	2	0.64
A.T. Room No.005 (Computational Research Laboratory)	2	40	0.04	2	0.64
A.T. Room No.006	1	40	0.04	2	0.32

Internal Quality Assurance Cell Room No. 002	3	40	0.04	2	0.96
Academic Register (Room No. 003)	6	40	0.04	2	1.92
Finance and Accounts Officer in Charge Room No. 008	8	40	0.04	2	2.56
Conference Room No. 107	11	40	0.04	2	3.52
Registrar Room No. 106	3	40	0.04	2	0.96
Room No. 103	3	40	0.04	2	0.96
Secretary to The Vice Chancellor Room No. 101	3	40	0.04	2	0.96
Room No. 201 &202 Examination Room	6	40	0.04	2	1.92
Room No. 208	2	40	0.04	2	0.64
Faculty Room ABG03 And ABG04	2	40	0.04	2	0.64
Faculty Room ABG01 And ABG02 (Washroom)	2	40	0.04	2	0.64
Table Tennis Room	6	40	0.04	2	1.92
UPS Room	2	40	0.04	2	0.64
Library	9	40	0.04	2	2.88
Central Store	3	40	0.04	2	0.96
Entrepreneurship Development Center	8	40	0.04	2	2.56
GF Corridor	32	40	0.04	2	10.24
Room No. 101 (Research Scholar Room)	4	40	0.04	2	1.28
Room No. 102 (Academic Block)	10	40	0.04	2	3.20
Room No. 103	10	40	0.04	2	3.20
ABF02 (Faculty Room)	1	40	0.04	2	0.32
Seminar Hall	16	40	0.04	2	5.12
Seminar Hall-Additional Room	8	40	0.04	2	2.56
FF Corridor	34	40	0.04	2	10.88
Room No. 201 & 202	12	40	0.04	2	3.84
Room No. 203	8	40	0.04	2	2.56
Room No. 204	10	40	0.04	2	3.20
Vikshit Bharat @2047 Cell	1	40	0.04	2	0.32
Room No. 205	8	40	0.04	2	2.56
SF Corridor	32	40	0.04	2	10.24
Annex Building	8	40	0.04	2	2.56
Foyer	4	40	0.04	2	1.28

Resulting Processing Unit-I (Room No. 005)	6	40	0.04	2	1.92
Resulting Processing Unit-II (Room No. 007)	6	40	0.04	2	1.92
Staff Room-I Room No. 003	6	40	0.04	2	1.92
Deputy Controller of Examination (Room No. 002)	4	40	0.04	2	1.28
Controller of Examination	4	40	0.04	2	1.28
Record Room-I (Room No. 101)	4	40	0.04	2	1.28
Answer Script Store Room (Room No. 102)	8	40	0.04	2	2.56
Evaluation Room (Room No. 103)	6	40	0.04	2	1.92
Record Room-I (Room No. 105)	4	40	0.04	2	1.28
Staff Room-II (Room No. 107)	6	40	0.04	2	1.92
Total Energy usage per month (kWh)					**112.00**

Energy usage of LED Light in the University

Department/ Area	Number of LED Light	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
UPS Room (30KVA) (Besides ERL)	1	10	0.01	1	0.06
Energy Research Laboratory (ERL)	4	10	0.01	1	0.24
Tribology Research Laboratory	4	10	0.01	1	0.24
Material Science Research Laboratory	4	10	0.01	1	0.24
Multidisciplinary Experimental and Testing Accessible Laboratory (METAL)	4	10	0.01	1	0.24
Corridor (From ERL to METAL)	8	10	0.01	1	0.48
Conference Hall	12	10	0.01	1	0.72
Conference Hall (Corridor)	3	10	0.01	1	0.18
Conference Hall (Side Corridor)	4	10	0.01	1	0.24

A.T. Room No.001 (Office-ASTU Employees Union)	1	10	0.01	1	0.06
A.T. Room No.002 (Engineering Wing)	1	10	0.01	1	0.06
A.T. Room No.004 (Executive Engineer)	1	10	0.01	1	0.06
A.T. Room No.005 (Computational Research Laboratory)	1	10	0.01	1	0.06
A.T. Room No.006	1	10	0.01	1	0.06
A.T. Room No.007 and 008 (Gents and Ladies Toilets)	2	10	0.01	1	0.12
Corridor	3	10	0.01	1	0.18
ASTU Canteen	4	10	0.01	1	0.24
Steel Container	1	10	0.01	1	0.06
Foyer	5	10	0.01	1	0.30
Store (Room No. 001)	1	10	0.01	1	0.06
Gents Toilet (Room No. 004)	5	10	0.01	1	0.30
Washroom Finance and Accounts Officer (Room No. 005)	3	10	0.01	1	0.18
Kitchen Room No. 006	2	10	0.01	1	0.12
Ladies Washroom (Room No. 007)	1	10	0.01	1	0.06
Finance and Accounts Officer Incharge (Room No. 008)	6	10	0.01	1	0.36
Ground Floor Corridor	8	10	0.01	1	0.48
Staircase	2	10	0.01	1	0.12
Conference (Room No. 107)	2	10	0.01	1	0.12
Registrar (Room No. 106)	1	10	0.01	1	0.06
Kitchen (Room No. 105)	2	10	0.01	1	0.12
Gents Toilet (Room No. 104)	2	10	0.01	1	0.12
Side Grill	1	10	0.01	1	0.06
Vice Chancellor (Room No. 102)	21	10	0.01	1	1.26
Corridor	13	10	0.01	1	0.78
Staircase	2	10	0.01	1	0.12
Solar Room	4	10	0.01	1	0.24
Staircase	4	10	0.01	1	0.24

Room No. 201 &202 Examination Room	27	10	0.01	1	1.62
Room No. 203 (Washroom Coe Only)	1	10	0.01	1	0.06
Room No. 204 (Washroom)	5	10	0.01	1	0.3
Room No. 205	3	10	0.01	1	0.18
Room No. 206	2	10	0.01	1	0.12
Room No. 208	6	10	0.01	1	0.36
Corridor	15	10	0.01	1	0.90
Faculty Room ABG01 and ABG02	10	10	0.01	1	0.60
Annex Building	3	10	0.01	1	0.18
Foyer	2	10	0.01	1	0.12
Washroom Gents	3	10	0.01	1	0.18
Washroom Ladies	3	10	0.01	1	0.18
Corridor	4	10	0.01	1	0.24
Washroom Gents	3	10	0.01	1	0.18
Washroom Ladies	3	10	0.01	1	0.18
Total Energy usage per month (kWh)					**14.04**

Energy usage of CCTV Cameras in the University

Department/ Area	Number of CCTV cameras	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
UPS Room (30KVA) (Besides ERL)	1	5	0.005	24	1.80
Energy Research Laboratory (ERL)	1	5	0.005	24	1.80
Tribology Research Laboratory	1	5	0.005	24	1.80
Material Science Research Laboratory	1	5	0.005	24	1.80
Multidisciplinary Experimental and Testing Accessible Laboratory (METAL)	1	5	0.005	24	1.80
Corridor (From ERL to METAL)	2	5	0.005	24	3.60
Conference Hall	2	5	0.005	24	3.60
Conference Hall (Corridor)	1	5	0.005	24	1.80
ASTU Canteen	1	5	0.005	24	1.80
Steel Container	2	5	0.005	24	3.60

Foyer	1	5	0.005	24	1.80
Store Room (Room No. 001)	1	5	0.005	24	1.80
Conference Room (Room No. 107)	2	5	0.005	24	3.60
Registrar Room (Room No. 106)	1	5	0.005	24	1.80
Corridor	2	5	0.005	24	3.60
Resulting Processing Unit-I (Room No. 005)	1	5	0.005	24	1.80
Resulting Processing Unit-II (Room No. 007)	1	5	0.005	24	1.80
Controller of Examination	1	5	0.005	24	1.80
Corridor	1	5	0.005	24	1.80
Record Room-I (Room No. 101)	1	5	0.005	24	1.80
Answer Script Store Room (Room No. 102)	1	5	0.005	24	1.80
Evaluation Room (Room No. 103)	2	5	0.005	24	3.60
Record Room-I (Room No. 105)	1	5	0.005	24	1.80
Total Energy usage per month (kWh)					**52.20**

Energy Usage of Exhaust Fans in the University

Department/ Area	Number of Exhaust Fans	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
UPS Room (30KVA) (Besides ERL)	2	40	0.04	1	0.48
Store Room (Besides METAL)	2	40	0.04	1	0.48
Reception	1	40	0.04	1	0.24
Gents Toilet (Room No. 004)	3	40	0.04	1	0.72
Washroom Finance and Accounts Officer (Room No. 005)	1	40	0.04	1	0.24
Ladies Washroom (Room No. 007)	1	40	0.04	1	0.24
Registrar (Room No. 106)	1	40	0.04	1	0.24
Kitchen (Room No. 105)	1	40	0.04	1	0.24
Gents Toilet (Room No. 104)	1	40	0.04	1	0.24

Secretary to The Vice Chancellor (Room No. 101)	1	40	0.04	1	0.24
Room No. 203 (Washroom Coe Only)	1	40	0.04	1	0.24
Room No. 204 (Washroom)	1	40	0.04	1	0.24
Room No. 205	1	40	0.04	1	0.24
Room No. 206	1	40	0.04	1	0.24
Room No. 207 (Washroom)	1	40	0.04	1	0.24
Faculty Room ABG01 and ABG02 (Washroom)	2	40	0.04	1	0.48
Total Energy usage per month (kWh)					**5.04**

Energy usage of Air Conditioners in the University

Department/ Area	Number of Air Conditioners (AC)	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
Energy Research Laboratory (ERL)	2	1200	1.2	1	4.80
Tribology Research Laboratory	2	1200	1.2	1	4.80
Material Science Research Laboratory	2	1200	1.2	1	4.80
Multidisciplinary Experimental and Testing Accessible Laboratory (METAL)	2	1200	1.2	1	4.80
Conference Hall	4	1800	1.8	1	14.40
A.T. Room No.004 (Executive Engineer)	1	1800	1.8	1	3.60
A.T. Room No.005 (Computational Research Laboratory)	2	1200	1.2	1	4.80
Store Room No. 001	1	1200	1.2	1	2.40
Finance and Accounts Officer in Charge (Room No. 008)	3	1800	1.8	1	10.80
Conference Room (Room No. 107)	3	1800	1.8	1	10.80
Registrar Room (Room No. 106)	1	1200	1.2	1	2.40
Room No. 103	1	1800	1.8	1	3.60
Vice Chancellor Room (Room No. 102)	2	1200	1.2	1	4.80
Secretary to The Vice-Chancellor (Room No. 101)	1	1800	1.8	1	3.60

Solar Room	2	1200	1.2	1	4.80
Room No. 201 & 202 Examination Room	1	1200	1.2	1	2.40
Faculty Room ABG01 and ABG02	1	1200	1.2	1	2.40
Library	2	1800	1.8	1	7.20
Room No. 102 (Academic Block)	2	1800	1.8	1	7.20
Room No. 103	2	1200	1.2	1	4.80
Seminar Hall	4	1800	1.8	1	14.40
Resulting Processing Unit-I (Room No. 005)	1	1800	1.8	1	3.60
Resulting Processing Unit-II (Room No. 007)	1	1800	1.8	1	3.60
Controller of Examination	1	1800	1.8	1	3.60
Evaluation Room (Room No. 103)	1	1800	1.8	1	3.60
Staff Room-II (Room No. 107)	2	1800	1.8	1	7.20
Total Energy usage per month (kWh)					**145.20**

Energy Usage of Speakers in the University

Department/ Area	Number of Speakers	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
Conference Hall	6	100	0.1	1	3.60
Conference room no. 107	2	100	0.1	1	1.20
seminar hall	2	100	0.1	1	1.20
Room no. 203	2	100	0.1	1	1.20
Total Energy usage per month (kWh)					**7.20**

Energy Usage of Kitchen Chimneys in the University

Department/ Area	Number of Kitchen Chimney	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
Kitchen room no. 006	1	4500	4.5	1	27
Total Energy usage per month (kWh)					**27**

Energy Usage of Amplifiers in the University

Department/ Area	Number of Amplifiers	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
Conference Hall	1	1200	1.2	1	7.20
Total Energy usage per month (kWh)					**7.20**

Energy Usage of Projectors in the University

Department/ Area	Number of Projectors	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
Conference Hall	1	250	0.25	0.5	0.75
Conference Room (Room No. 107)	1	250	0.25	0.5	0.75
Entrepreneurship Development Center	1	250	0.25	0.5	0.75
Total Energy usage per month (kWh)					**2.25**

Energy usage of Desktop PCs in the University

Department/ Area	Number of Desktop PC	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
Energy Research Laboratory (ERL)	2	200	0.2	6	2.40
Tribology Research Laboratory	3	200	0.2	6	3.60
Material Science Research Laboratory	4	200	0.2	6	4.80
Multidisciplinary Experimental and Testing Accessible Laboratory (METAL)	4	200	0.2	6	4.80
Conference Hall	1	200	0.2	6	1.20
A.T. Room No.002 (Engineering Wing)	1	200	0.2	6	1.20
A.T. Room No.005 (Computational Research Laboratory)	18	200	0.2	6	21.60
Reception	2	200	0.2	6	2.40
Store Room (Room No. 001)	1	200	0.2	6	1.20
Academic Register (Room No. 003)	3	200	0.2	6	3.60
Finance and Accounts Officer In charge	7	200	0.2	6	8.40

(Room No. 008)					
Conference Room (Room No. 107)	3	200	0.2	6	3.60
Registrar Room (Room No. 106)	1	200	0.2	6	1.20
Vice Chancellor (Room No. 102)	1	200	0.2	6	1.20
Secretary to The Vice-Chancellor (Room No. 101)	2	200	0.2	6	2.40
Room No. 208	1	200	0.2	6	1.20
Library	2	200	0.2	6	2.40
Entrepreneurship Development Center	1	200	0.2	6	1.20
Room No. 102 (Academic Block)	3	200	0.2	6	3.60
Room No. 103	3	200	0.2	6	3.60
Resulting Processing Unit-I (Room No. 005)	2	200	0.2	6	2.40
Resulting Processing Unit-II (Room No. 007)	4	200	0.2	6	4.80
Staff Room-I (Room No. 003)	3	200	0.2	6	3.60
Deputy Controller of Examination (Room No. 002)	1	200	0.2	6	1.20
Controller of Examination	1	200	0.2	6	1.20
Evaluation Room (Room No. 103)	1	200	0.2	6	1.20
Staff Room-II Room No. 107	4	200	0.2	6	4.80
Total Energy usage per month (kWh)					**94.80**

Energy usage of Printers in the University

Department/ Area	Number of Printers	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
Reception	1	250	0.25	0.05	0.075
Academic Register (Room No. 003)	2	250	0.25	0.05	0.15
Finance and Accounts Officer In charge (Room No. 008)	3	250	0.25	0.05	0.225
Vice Chancellor (Room No. 102)	1	250	0.25	0.05	0.075
Secretary to The Vice Chancellor	1	250	0.25	0.05	0.075

(Room No. 101)					
Room No. 208	1	250	0.25	0.05	0.075
Library	2	250	0.25	0.05	0.15
Entrepreneurship Development Center	1	250	0.25	0.05	0.075
Room No. 102 (Academic Block)	3	250	0.25	0.05	0.225
Room No. 103	3	250	0.25	0.05	0.225
Resulting Processing Unit-II (Room No. 007)	1	250	0.25	0.05	0.075
Staff Room-I (Room No. 003)	2	250	0.25	0.05	0.15
Deputy Controller of Examination (Room No. 002)	1	250	0.25	0.05	0.075
Controller of Examination	1	250	0.25	0.05	0.075
Staff Room-II (Room No. 107)	3	250	0.25	0.05	0.225
Total Energy usage per month (kWh)					**1.95**

Energy usage of UPS in the University

Department/ Area	Number of UPS	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
Energy Research Laboratory (ERL)	1	10000	10	24	7200
Foyer	1	1000	1	24	720
Finance and Accounts Officer in Charge (Room No. 008)	1	1000	1	24	720
Side Grill	1	10000	10	24	7200
Secretary to The Vice Chancellor (Room No. 101)	1	1000	1	24	720
Seminar Hall	1	10000	10	24	7200
UPS Room (Room No. 008)	1	10000	10	24	7200
Total Energy usage per month (kWh)					**30960**

Energy Usage of Refrigerators in the University

Department/ Area	Number of Refrigerators	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
Tribology Research Laboratory	1	200	0.2	24	28.80

Multidisciplinary Experimental and Testing Accessible Laboratory (METAL)	1	200	0.2	24	28.80
ASTU Canteen	1	200	0.2	24	28.80
Vice Chancellor Room No. 102	1	250	0.25	24	36.00
Total Energy usage per month (kWh)					**122.4**

Energy usage of Water Chillers in the University

Department / Area	Number of Water Chillers	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
Storeroom beside METAL	2	230	0.23	1	0.92
Total Energy usage per month (kWh)					**0.92**

Energy Usage of Network Switches in the University

Department/ Area	Number of Network Switches	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
A.T. Room No.005 (Computational Research Laboratory)	2	60	0.06	24	17.28
Finance and Accounts Officer in Charge (Room No. 008)	1	60	0.06	24	8.64
Conference Room (Room No. 107)	2	60	0.06	24	17.28
Secretary to The Vice-Chancellor (Room No. 101)	2	60	0.06	24	17.28
Annex Building	2	60	0.06	24	17.28
Total Energy usage per month (kWh)					**77.76**

Energy Usage of Displays/ Screens in the University

Department/ Area	Number of Displays	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
Foyer	2	200	0.2	1	2.40
Internal Quality Assurance Cell (Room No. 002)	1	200	0.2	1	1.20
Conference Room (Room No. 107)	3	200	0.2	1	3.60
Vice Chancellor Room No. 102	2	200	0.2	1	2.40

Room No. 101 (Research Scholar Room)	1	300	0.3	1	1.80
Seminar Hall	1	200	0.2	1	1.20
Room No. 203	1	200	0.2	1	1.20
Room No. 204	1	200	0.2	1	1.20
Controller of Examination	1	200	0.2	1	1.20
Total Energy usage per month (kWh)					**16.20**

Energy Usage of Wi-Fi Routers in the University

Department/ Area	Number of Wi-Fi Routers	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
Multidisciplinary Experimental and Testing Accessible Laboratory (METAL)	1	6	0.006	6	0.432
Finance and Accounts Officer in Charge (Room No. 008)	1	6	0.006	6	0.432
Room No. 102 (Academic Block)	1	6	0.006	6	0.432
Annex Building	2	6	0.006	6	0.864
Foyer	1	6	0.006	6	0.432
Resulting Processing Unit-I (Room No. 005)	1	6	0.006	6	0.432
Resulting Processing Unit-II (Room No. 007)	1	6	0.006	6	0.432
Staff Room-I (Room No. 003)	1	6	0.006	6	0.432
Deputy Controller of Examination (Room No. 002)	1	6	0.006	6	0.432
Record Room-I (Room No. 101)	1	6	0.006	6	0.432
Answer Script Store Room (Room No. 102)	1	6	0.006	6	0.432
Record Room-I (Room No. 105)	1	6	0.006	6	0.432
Total Energy usage per month (kWh)					**5.61**

Energy usage of Water Purifiers in the University

Department/ Area	Number of Water Purifiers	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
Near UPS Room	1	25	0.025	2	0.60
Total Energy usage per month (kWh)					**0.60**

Energy Usage of Electric Kettles in the University

Department/ Area	Number of Electric Kettles	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
Kitchen room no. 105	1	1500	1.5	0.5	4.50
Room no. 208	1	1500	1.5	0.5	4.50
Total Energy usage per month (kWh)					**9.00**

Energy Usage of Pumps in the University

Department/ Area	Number of Pumps	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
Conference Hall (Side Corridor)	1	750	0.75	0.08	0.36
Corridor	1	2250	2.25	0.08	1.08
Bore Well (80 Feet)	1	1125	1.125	0.08	0.54
Terrace (Fire Motor Pump)	1	2250	2.25	0.08	1.08
Solar Motor Pump	1	1125	1.125	0.08	0.54
Terrace	1	375	0.375	0.08	0.18
Water Pump Around Campus	1	1500	1.5	0.08	0.72
Water Pump Around Campus	1	1500	1.5	0.08	0.72
Water Pump Around Campus	1	2250	2.25	0.08	1.08
Total Energy usage per month (kWh)					**6.30**

Energy Usage of Photocopiers in the University

Department/ Area	Number of Photocopiers	Power Consumed (watts)	Power in kW	Working Time (hours per day)	Energy Usage per month (kWh)
Finance and accounts officer in charge (Room No. 008)	1	800	0.8	0.25	0.40

Resulting processing unit-I (Room No. 005)	2	800	0.8	0.25	0.80
Total Energy usage per month (kWh)					**1.20**

Energy usage of the Energy Research Lab in the University

Department/ Area	Name of instruments	Power in kW	Working Time (hours per month)	Energy Usage per month (kWh)
Energy Research Lab	Thermogravimetric Analyser	4	8	32.00
Energy Research Lab	Differential Scanning Calorimeter	3	3	9.00
Energy Research Lab	Rheometer	2	6	12.00
Energy Research Lab	Refractometer	0.9	3	2.70
Energy Research Lab	Oil Extraction Unit	1	4	4.00
Energy Research Lab	Ultrasonicator	0.75	6	4.50
Energy Research Lab	Digital Viscometer	0.3	2	0.60
Energy Research Lab	Distillation Unit	0.9	6	5.40
Energy Research Lab	Hot Air Oven	2	12	24.00
Energy Research Lab	Fire and Flash Point Apparatus	1.5	4	6.00
Energy Research Lab	Cloud and Point Apparatus	1.5	6	9.00
Energy Research Lab	Bomb Calorimeter	2	2	4.00
Energy Research Lab	Volatile Matter Furnace	1	8	8.00
Total Energy usage per month (kWh)				**121.20**

Energy usage of the Tribology Research Lab in the University

Department/ Area	Name of instruments	Power in kW	Working Time (hours per month)	Energy Usage per month (kWh)
Tribology Research Lab	Fourball Tribometer	4	8	32.00
Tribology Research Lab	Journal-Bearing Test Rig	4	6	24.00
Tribology Research Lab	Pin/Ball on Disk	4	6	24.00
Total Energy usage per month (kWh)				**80.00**

Energy usage of the Material Science Lab in the University

Department/ Area	Name of instruments	Power in kW	Working Time (hours per month)	Energy Usage per month (kWh)
Material Science Lab	Muffle Furnace	1	12	12.00
Material Science Lab	Oven	1	12	12.00
Material Science Lab	Cold/Hot Molding	0.75	6	4.50
Material Science Lab	Vacuum Die Casting	3.5	12	42.00
Material Science Lab	Microhardness	1	12	12.00
Material Science Lab	Optical Microscope	0.9	12	10.80
Material Science Lab	Sample Polishing	1	12	12.00
Material Science Lab	Sample Sectioning	1	12	12.00
Total Energy usage per month (kWh)				**117.30**

Energy usage of the IC Engine Lab in the University

Department/ Area	Name of instruments	Power in kW	Working Time (hours per month)	Energy Usage per month (kWh)
IC Engine Lab	IC Engine with Flue Gas Analyzer	3.5	12	42.00
Total Energy usage per month (kWh)				**42.00**

Energy usage of the META Laboratory in the University

Department/ Area	Name of instruments	Power in kW	Working Time (hours per month)	Energy Usage per month (kWh)
META Laboratory	iPVD Reactor	6	12	72.00
META Laboratory	Glow Discharge Reactor	4.5	8	36.00
META Laboratory	Contact Angle Measurement System	1.2	6	7.20
META Laboratory	TTO Derived Reactor	2.4	2	4.80
META Laboratory	HR Spectrometer	1.2	2	2.40
META Laboratory	Heating Controller Unit	1.2	2	2.40

META Laboratory	Magnetic Stirrer (3 No.s)	1.2	4	4.80
Total Energy usage per month (kWh)				**129.60**

Energy usage of the Plasma Pyrolysis Laboratory in the University

Department/ Area	Name of instruments	Power in kW	Working Time (hours per month)	Energy Usage per month (kWh)
Plasma Pyrolysis Laboratory	Plasma Pyrolysis Plant	15	4	60.00
Total Energy usage per month (kWh)				**60.00**

4.2 EVALUATION OF ENERGY AUDIT FINDINGS

Evaluating the energy audit findings reveals key insights into energy consumption patterns and potential areas for optimization. The total monthly energy usage stands at 1,426.96 kWh, with ceiling fans (168.00 kWh), air conditioners (145.20 kWh), and refrigerators (122.40 kWh) being among the highest consumers. Research laboratories contribute significantly, particularly the META Laboratory (129.60 kWh) and the Energy Research Laboratory (121.20 kWh). While energy-efficient LED lights consume only 14.04 kWh, traditional tube lights account for 112.00 kWh, indicating an opportunity for replacement with more efficient alternatives. Similarly, network equipment such as network switches (77.76 kWh) and computers (94.80 kWh) highlight the need for energy-saving measures like automated shutdown policies. Low-energy-consuming appliances such as water purifiers (0.60 kWh), chillers (0.92 kWh), and photocopiers (1.20 kWh) contribute minimally to the overall load. The findings emphasize the necessity of adopting energy-efficient technologies, implementing behavioural changes, and optimizing laboratory operations to reduce energy costs and enhance sustainability.

Current saving methods adopted in the University

To reduce energy consumption, the University has implemented several measures aimed at promoting energy efficiency. These include replacing traditional tube lights with LED tube lights and LED bulbs, which consume significantly less energy while providing comparable illumination. Old, energy-intensive ceiling fans have been gradually replaced with energy-efficient models that reduce power usage without compromising performance. The University also prioritizes the use of energy-efficient appliances, such as modern refrigerators and desktop PCs with lower power consumption ratings. Furthermore, awareness programs and initiatives encourage staff and students to adopt sustainable practices, such as switching off electrical

devices when not in use. These strategies collectively contribute to lowering the overall energy footprint of the campus while fostering a culture of sustainability.

4.3 CONSOLIDATION OF AUDIT FINDINGS

We hope that students will develop a greater appreciation and understanding of the impact of their actions on the environment. They have successfully been able to determine the impacts on energy consumption through various auditing exercises. By participating in this energy auditing procedure, they have gained knowledge about the need for sustainability on the University campus.

4.4 MAJOR AUDIT OBSERVATIONS

- The energy conservation awareness initiatives are not substantial.
- There is no Energy policy/ energy policy statement indicating the commitment of the University towards its performance.
- Solar power generation has to be strengthened.
- The communication process for awareness about energy conservation is found inadequate.
- Assessment of electrical load calculation is yet to be done by the University.
- The monthly use of electricity in the University is low.
- There are fans of the older generation and non-energy efficient which can be phased out by replacing with new energy efficient fans.
- Regular monitoring of equipment and immediate rectification of any problems.
- **10** litres of fossil fuel are burned every month for the functioning of the University.

4.5 PREPARATION OF ACTION PLAN

Policies referring to the University's management and approaches towards the use of resources need to be considered. The University should have an energy policy for its sustainable development. The energy policy formulated by the management of the University should be implemented meticulously. The University should have a policy on awareness raising or training programs and the University also should have a procurement policy (the University's policy for purchasing materials).

4.6 FOLLOW UP ACTION AND PLANS

Energy Audits are exercises which generate considerable quantities of valuable management information. The time, effort and cost involved in this exercise are often significant and to be able to justify this expenditure, it is important to ensure that the findings and recommendations

of the audit are considered at the correct level within the organisation and that action plans and implementation programs result from the findings. Audit follow-up is part of the wider process of continuous improvement. Without follow-up, the audit becomes an isolated event that soon becomes forgotten in the pressures of organisational priorities and the passing of time.

4.7 CONCLUSION AND RECOMMENDATIONS

The study reveals that HVAC systems are the largest energy consumers, accounting for 31.22% of total energy usage, followed by office and IT equipment at 18.66%. A significant portion of this energy is wasted due to outdated systems, such as inefficient cooling solutions (e.g., old ceiling fans) and traditional tube lights. However, the findings highlight substantial opportunities for energy savings. Upgrading to LED tube lights could slash lighting energy consumption by up to 55%. Implementing energy management systems could further drive an overall reduction of 16%.

To achieve these savings, the following measures are recommended. Replace outdated tube lights with energy-efficient LED tube lights. Upgrade old ceiling fans to energy-efficient models. To ensure optimal performance, introduce regular maintenance schedules for all cooling appliances, including air conditioners, ceiling fans, wall fans, stand fans, and exhaust fans. Install smart meters for real-time energy monitoring and management. Educate staff and students on energy conservation practices to foster a culture of sustainability. Explore renewable energy options, such as additional solar panel installations, and leverage government incentives and grants for green energy projects.

CHAPTER 5

EXIT MEETING

The exit meeting was conducted by Prof. Subhendu Sekhar Bag. It was a mechanism to provide the management and staff with broad feedback on the preliminary findings of the audit team before completing the audited report. The exit meeting was held at the University on 27th December 2024. Clarification on certain information gathered was sought by the audit team from the management and staff of the University.

DRAFT AUDIT REPORT

The information gathered by the audit team was consolidated as a draft audit report. This draft report was then circulated to the audit team and those directly concerned with the audit to check the report for accuracy. The draft Energy Audit report was also discussed in the exit meeting.

FINAL AUDIT REPORT

The final audit report is the corrected final document which contains the findings and recommendations of the audit. It will also form one of the bases of future audits because the information it contains informs some of the tests and analyses that need to be performed in the future. The final Audit Report was submitted on 30th December 2024 to the vice-chancellor of the University.

FOLLOW UP AND ACTION PLANS

Energy Audits form a part of an on-going process. Innovative green initiatives have to be designed and implemented every year to make the University environmentally sustainable. Follow-up programs of Energy Auditing recommendations should be done meticulously before the next audit.

NEXT AUDIT

To promote continuous improvement, it is recommended to conduct the next Energy Auditing during the year 2027.

TRANSPARENCY OF ENVIRONMENTAL AUDIT REPORT

An Energy Audit report is one of the useful means of demonstrating an organisation's commitment to openness and transparency. If an organisation believes it has nothing to hide from its stakeholders, then it should feel confident enough to make its Energy Audit reports freely available to those who request them. As a basic rule, Energy Audit reports should be made available to all stakeholders.

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