ASANSOL GIRLS' COLLEGE
(GOVT. SPONSORED)
Affiliated to The Kazi Nazrul University
Dr. Anjali Roy Sarani, Asansol - 713304

Energy Audit

ASANSOL GIRLS' COLLEGE

DR. ANJALI ROY SARANI, ASANSOL
PASCHIM BARDHAMAN, WEST BENGAL
https://agc.ac.in

ENERGY AUDIT REPORT

Session: 2022-2023

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PREFACE

Over the period of several months, a team was in charge of gathering data for the energy audit of the Asansol Girls' College campus.

The purpose of this audit was to find out how convenient it would be to advance the campus's energy competency. The key goals were to reduce energy use while preserving or enhancing human comfort, safety, and health. This audit went beyond just counting the amount of energy used to determine which appliances were the most energy-efficient. Additionally, several typical appliance-related daily habits have been offered, which may aid in lowering usage.

A group of members completed the energy audit survey. All of the data was gathered from every office, department, lab, classroom and moreover from common areas such as canteen, central library, gymnasium, internet café, computer center, server room, seminar room, conference hall and hostels. The work was completed by considering the quantity of lights, fans, air conditioners, and other electrical as well as electronic equipment in every room. The participation of various components in the total electricity consumption was calculated.

Based on an actual survey and in-depth analysis conducted during the audit, the report takes into account the energy consumption trends of the college premises. The study compiles a list of potential steps to preserve and effectively use the resources, sources, and their potential for energy savings was also evaluated.

We anticipate that faculty, staff, and students will optimize adherence to the guidelines in the most efficient manner.

ACKNOWLEDGEMENT

We express our sincere thanks to Dr. Sandip Kumar Ghatak, Principal, Asansol Girls' College for motivating, and giving us the opportunity for energy audit. We would like to express our sincere thanks to Dr. Gautam Jana, Department of Chemistry, and Dr. Meenakshi Chakraborty Sen, Dept. of Physics of Asansol Girls' College for their valuable suggestions. Last but not the least, we thank all the faculty members, staffs who have partially extended their cooperation during the course of the energy audit.

INTRODUCTION

A committee made up of experts and faculties from several reputable institutes carried out this audit. Based on Central and State regulatory and statutory requirements, the Committee created an audit questionnaire. The fundamental information was acquired, compiled and examined by the committee. Overall, the audit finds that Asansol Girls' College campus is a healthy place for students. The committee has recommended both short-term and long-term measures to improve environmental conditions regarding energy efficiency to higher authorities. All College stakeholders have agreed to provide the recommended changes due consideration and to take advantage of available opportunities. Below is a list of the members of the Committee:

Serial No.	Name	Designation
01	Dr. Sandip Kumar Ghatak,	Vice Principal, Asansol Girls' College, Asansol
02	Dr. Biru Rajak	Coordinator, IQAC, Asansol Girls' College, Asansol
03	Dr. Gautam Jana	Assistant Professor, Department of Chemistry, Asansol Girls' College, Asansol
04	Dr. Meenakshi Chakraborty Sen	Associate Professor, Department of Physics, Asansol Girls' College, Asansol
05	Dr. Saptarshi Chakraborty	Principal, Panchakot Mahavidyalaya
06	Dr. Wahidur Rahman	Department of Chemistry, Panchakot Mahavidyalaya
07	Dr. Jayanta Das	Dept. of Physics, Panchakot Mahavidyalaya

ENERGY AUDIT & ITS TYPES

What is Energy Audit? In order to find, measure, and report on opportunities for improved energy performance, an energy audit is a systematic examination of energy use and consumption within a specified energy audit scope.

Energy audit analysis generally involves:

- Analysis of energy consumable systems and the utility bills
- Survey about the condition of the system
- Understanding the need of the consumer
- Evaluating the possible energy conservation measures
- Estimating the energy saving potential

Energy Conservation: This indicator covers natural gas, cars, high-energy-consuming devices in science labs, lighting, and appliances including air conditioners, energy sources, energy monitoring, and energy consumption. Energy use needs no justification because it is an obvious component of campus sustainability and should be included in the assessment. Use of least papers in daily basis substituted by the electronic messages and notices are the another aspects of the energy conservation strategies are exercised here.

Type of Energy Audit: There are mainly three categories of energy audit.

(1) Walk-Through Audit: A walk-through assessment of the campus is part of this audit, which identifies areas that require more investigation as well as maintenance, operational or defective equipment issues. The outcomes of a stroll involve locating possible energy-saving possibilities, evaluating how well energy-saving measures are being implemented qualitatively, and estimating the amount of energy that could be saved by audit.

(2) General Audit: The preliminary audit is expanded upon by the general audit, also known as the mini-audit or whole site energy audit. For a duration of 12 to 36 months, utility bills are gathered, enabling the auditor to assess the facility's energy consumption patterns and demand rate frameworks. Given the facility's operational characteristics, this kind of audit will be able to find any energy-conservation methods that are suitable for it.

(3) Investment Grade Audit: This audit provides a thorough breakdown of energy consumption, together with a qualitative review of the implementation, a breakdown of the investments, operations and maintenance expenses, and an examination of the investment model.

NECESSITY OF ENERGY AUDIT AT EDUCATIONAL INSTITUTE

The current educational system is focused on providing the students with a high-quality education through the use of a variety of electric and electronic tools, such as computers, internet access, audio-visual classrooms, video conference capabilities, LCD projectors, wi-fi, etc. In this sense, it is important to maximize the uses of various electric and electronic teaching tools, and students should receive training on how to do so. To maintain the facilities' good condition, regular auditing activities are necessary for the school system to use the aforementioned equipment continuously. Frequent auditing activities support the best possible use of the equipment, diagnosis of the electrical leakage, and equipment maintenance. Regular auditing helps to minimize power consumption and prevent needless waste.

Since educational institutions employ large numbers of people and have more opportunities for energy conservation, which is defined as reducing energy consumption without sacrificing quantity or quality, they are typically chosen for energy audits.

ABOUT THE COLLEGE

Asansol Girls' College
Dr. Anjali Roy Sarani, Asansol
PaschimBardhaman, West Bengal

This college's mission encompasses not just the pursuit of academic excellence but also the inspiration, guidance, and empowerment of our students to become critical thinkers, lifelong learners, and contributing members of a dynamic global community. The college responsibly creates an environment for the students' multifaceted development that is both intellectually stimulating and supportive of their growth. This enables them to reach their full potential and become inspired learners, creative problem solvers, and innovative thinkers who are ready to succeed in the twenty-first century. This is only feasible in a comprehensive, student-centered setting where their gifts, skills, and capacities are recognized, developed, and supported. The college is a destiny to the students to reflect, communicate, and demonstrate their abilities.

Name of the Institute	Asansol Girls' College
Address	Dr. Anjali Roy Sarani, Asansol, PaschimBardhaman, W.B., 713304
Year of establishment	1950
Total Campus Area	19627.2536 Sq.Mts.
Total Built up Area	3452.18 Sq.Mts.
Total Open Space Area	16175.07 Sq.Mts.
Total Green Area	14557 Sq.Mts.
Number of Departments	20
Total Number of Classrooms	38
Total Number of Labrooms	17
Smart Classroom	6
Principal Office	1
IQAC Room	1
Committee Room	1
Office	5
Staff Room	1
Washrooms	25
Disable Friendly washroom	1
Students Common room	1
Lift with ramps	1
Pump house	1
NSS	1
Computer center	1
Smart Room	1
Conference Hall, Rabindra Kaksha	1
Purifiers	4
Eco Generator	3
Solar Panel	1
CCTV Camera	25
Bicycle and Motor Cycle Stand	3
Principal Quartar	1
Staff Quartar	4
Gate Keeper's Room	1

METHODOLOGY OF ENERGY AUDIT

The energy audit was done in accordance with the following steps:

1. **Historical Data Analysis:**Analyzing historical data entails examining the current energy consumption trend, which is done by examining at the specifics of the past 12 months' electricity bills. This data is then compared to same corresponding to the last few years to comprehend the energy conservation efficiency of the college.

2. **Actual Measurement and Analysis:**In order to estimate sector-wise load consumption, this stage entails measuring the real site and conducting field trials using a variety of portable measurement tools.

3. **Energy Conservation Opportunities – Identification and Evaluation:** The potential for energy conservation found during the energy audit are evaluated in this step. It indicates the practical guidelines and suggestions to the college for the potential energy savings in future.

ENERGY CONSUMPTION PROFILE

Following are the major components of electricity consumption in the institution:

Name of the component	Total Number (frequency)	Wattage (of a single component/unit)
Tube Light	401	50
LED Tube	167	
CFL Bulb	6	30
LED Bulb	44	10
Halogen	12	
Marker	12	
Ceiling Fan	293	75
Mounted Wall Fan	31	60
Stand Fan	1	60
Exhaust Fan	4	50
Projector	2	250
Smart Board	3	220
Split AC	11	1500
Speaker	13	100
Aqua Guard	5	50
Computer	85	200
Xerox Machine	4	800
Printer	12	250
Refrigerator	6	400
Water Pump	4	500
Wi-fi Router	1	20
Television	1	70
Cooler	1	400

Comparison of Electric Bills:

Year	Unit Consumed	Comparison	Electric Bill Paid (Rs.)	Comparison
2018-19 Q1	20232		203500	
2018-19 Q2	36656		372235	
2018-19 Q3	39783		421379	
2018-19 Q4	20466		185540	
Total	117137	0.46	1182654	
2019-20	21829		221214	
2019-20	31581		320617	
2019-20	39992		377046	
2019-20	25406		379112	
	118808	0.465	1297989	+115335
2020-21			543442	-754547
2020-21				
2020-21				
2020-21				
2021-22	22352		466667	
2021-22	2689		73200	
2021-22	25041		539867	-3575
2021-22				
2022-23	8280		112836	
2022-23	19517		195771	
2022-23	16544		169643	
2022-23	19147		191339	
	63488	0.25	669589	+129722

Per Head Unit consumption

Session: 2022-2023						
Number of Students	No. of Teachers	No. of NTS	Casual Staffs	Total no. of Members	Unit Consumption (kWh)	Unit per Head/year
2606	97	29	9	2741	63488	23.16

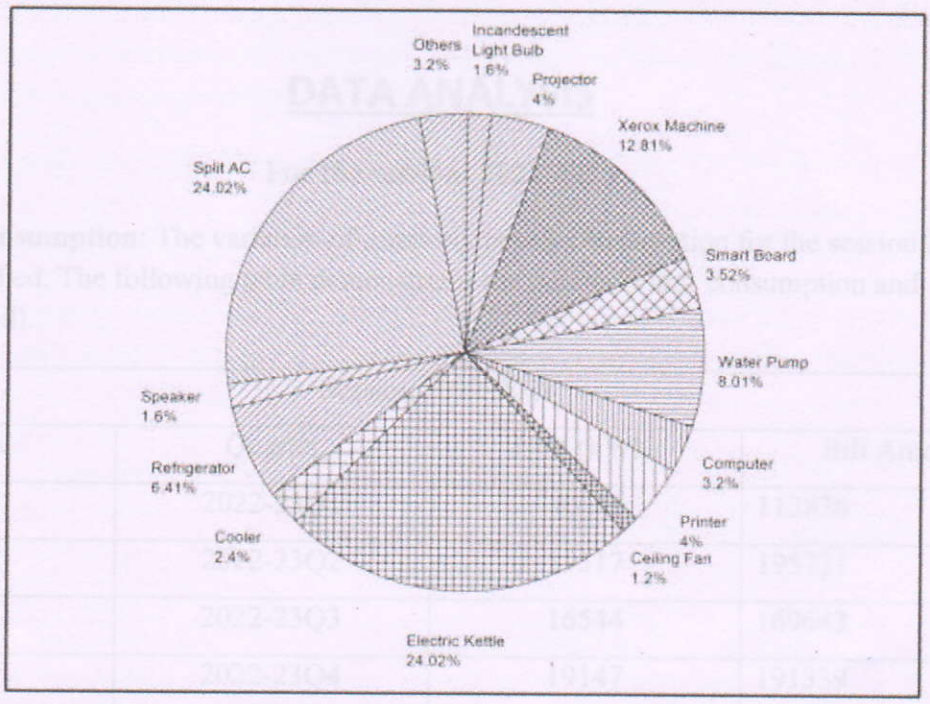

Figure 1: Pie-chart Plot of the Relative Wattage of Various Electrical Components

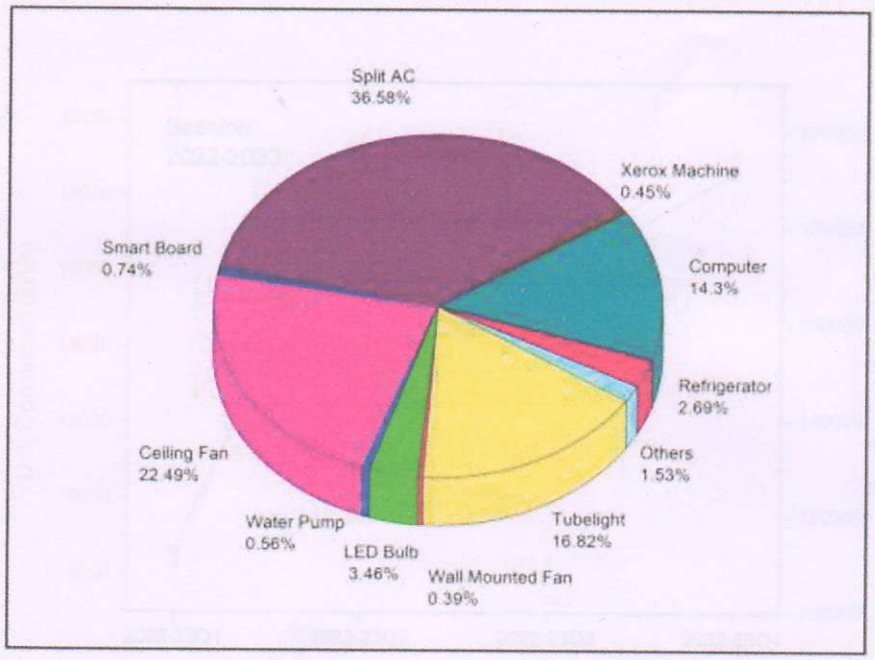

Figure 2: Plot of Relative Power Consumption by Various Electrical Components

DATA ANALYSIS

For the session: 2022-2023

Energy Consumption: The variation of quarterly power consumption for the session 2022-2023 is studied. The following table demonstrates the quarterly unit consumption and electricity bill.

Session 2022-2023			
Sr. No.	Quarter	Unit (kWh)	Bill Amount
1	2022-23Q1	8280	112836
2	2022-23Q2	19517	195771
3	2022-23Q3	16544	169643
4	2022-23Q4	19147	191339
	Total	63488	669589

Table 1: Shows quarter-wise unit consumption and electricity expenditure

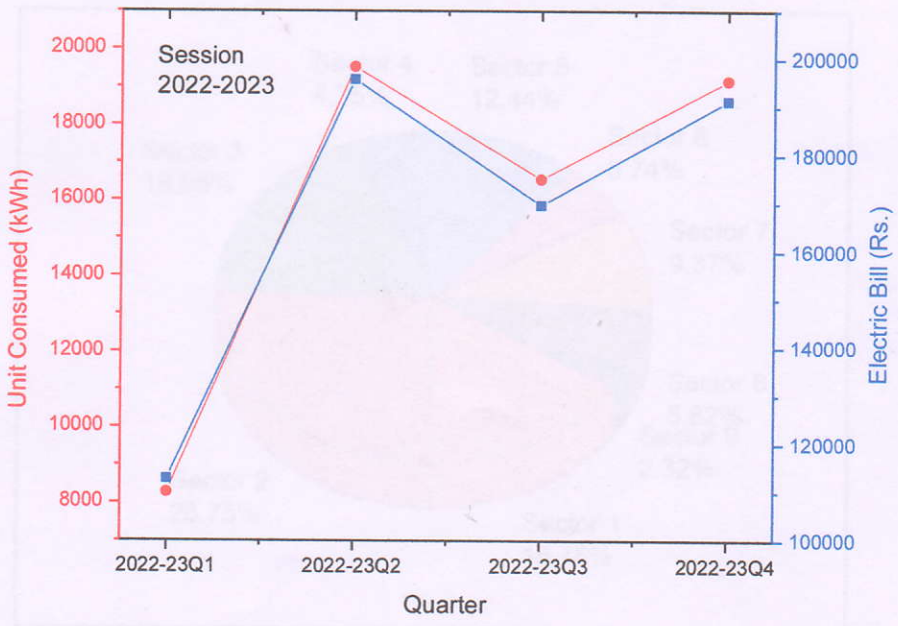

Figure 3: Quarter-wise variation of electricity unit consumption and expenses are shown for the session 2022-23

In table 1, the quarter-wise consumption of electricity units and the corresponding electricity bills are shown where an overall increment of the consumption could be observed. The relative change in power consumption is plotted in figure3.

Estimation of Sector-Wise Energy Distribution: The data for the distribution of loads at various offices, departments, library, canteen, staff rooms etc. were collected by the survey team.

The whole college premise is divided into several suitable sectors and the power consumption in these sectors is roughly estimated. The allotments of different sectors are described below:

Name of Sectors	Rooms
Sector-1	Principal chamber, Office room, Meeting room, Server Room, Teaching Staff Room
Sector-2	Departments of Physics, Chemistry, Computer Science, Botany, Geography, Zoology
Sector-3	All classrooms
Sector-4	Canteen, Internet café, Gymnasium
Sector-5	Conference hall, Seminar room
Sector-6	Hostels, Students Common room
Sector-7	Computer center
Sector-8	Library
Sector-9	Corridor, Outside building area

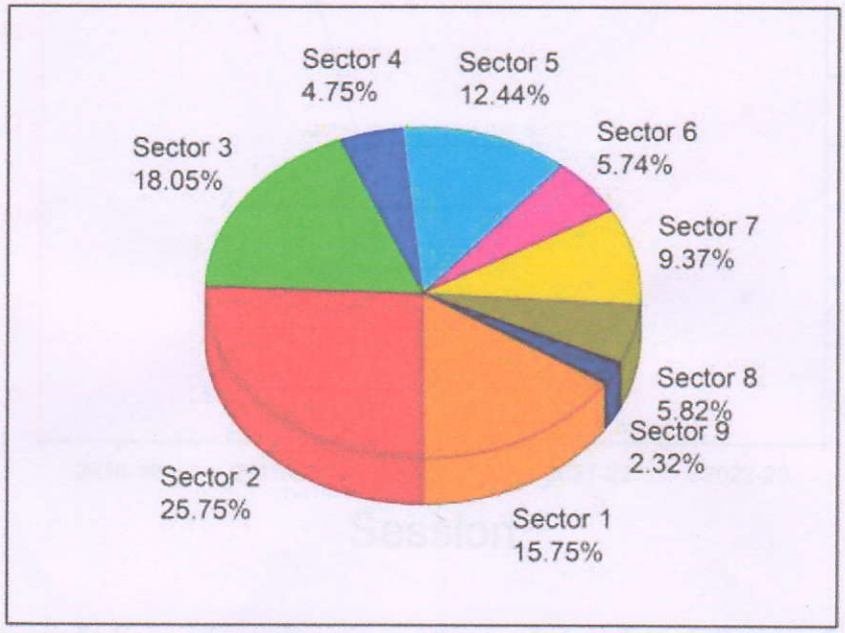

Figure 4: Sector wise estimated power consumption 2022-2023

YEAR-WISE ELECTRICITY CONSUMPTION

Here the year-wise electricity unit consumption and corresponding financial expenditures are enlisted for the last five years:

Session	Unit consumption	Electricity Bill
2018-19	117137	1182654
2019-20	118808	1297989
2020-21	0	543442
2021-22	25041	539867
2022-23	63488	669589

Table 2: Year-wise unit consumption and electricity bill

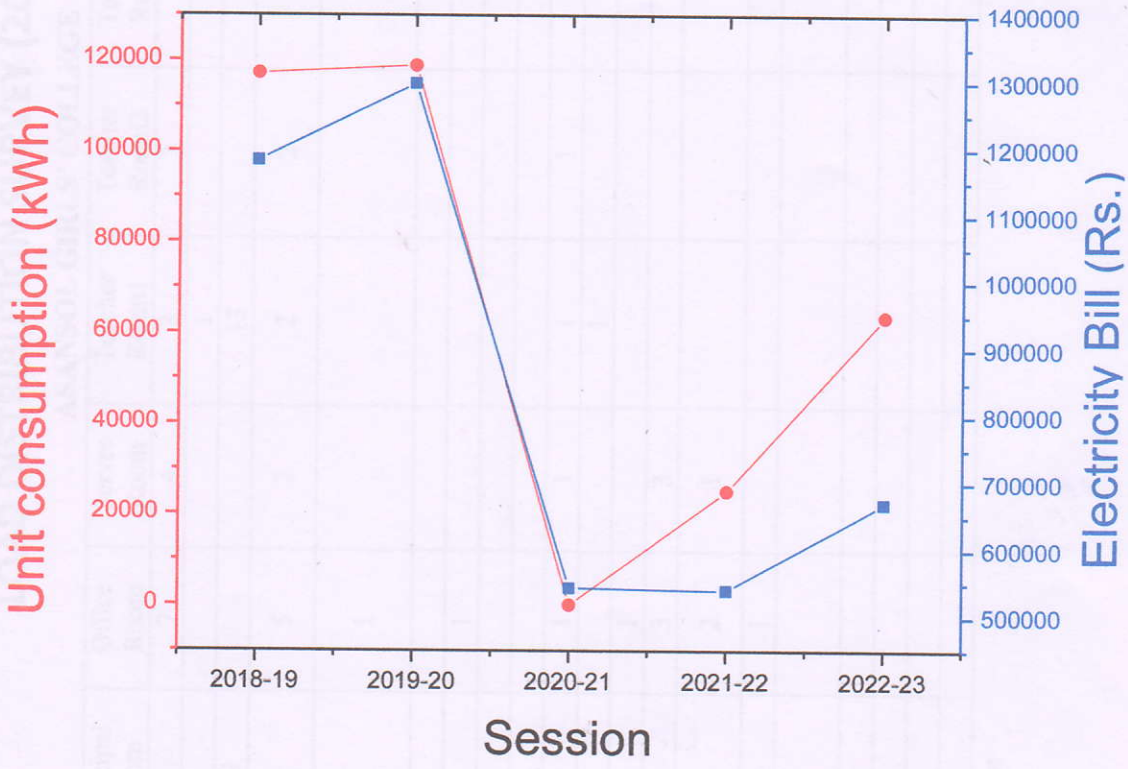

Figure 5: Year-wise unit consumption and electricity bill data plot

LOAD DISTRIBUTION SURVEY (2022-2023)

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Load Type	Principal Room	Office Room	Server Room	Teacher Room1	Teacher Room2	Teacher Room3	Meeting Room	Canteen	Internet Cafe	Gym
Tube Light		7	4	3	3		1		3	6
CFL				1						
LED Bulb	19			13			14	6		
Ceiling Fan		5	2	2	2	5	2	1		5
Wall Mounted Fan	1	1				1	1			
Stand Fan	1									
Exhaust Fan	1	1				3		1		
Projector										
Smart Board										
Split AC	1	1	1	1	1	1	1	1		
Speaker				1						1
Aquaguard		1						1		
Computer	1	3	3			3	2		7	
Xerox Machine	1	2	1							
Printer	1	1								
Electric Kettle	1									
Refrigerator	1							2		
Water Pump										
Television	1					1				
Cooler										

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LOAD DISTRIBUTION SURVEY (2022-2023)

ASANSOL GIRLS' COLLEGE

LoadType	Physics	Math	Comp. Sc.	Zoology	Botany	Chemistry	Geography	All Classroom	Conf. Hall	Seminar Room	Comp.Center	Library
Tube Light	5	3	9	10	2	5	12	86				18
CFL					1		5					
LED Bulb				1		10	2		64	13	35	18
Ceiling Fan	5	1	8	9	4	1	15	114				7
Wall Mounted Fan	1				1				9	8		
Stand Fan												
Exhaust Fan					1							
Projector									1	1		
Smart Board		1	1	1								
Split AC	1	1	2	2	1	1	1		6	2	3	2
Speaker									12			
Aquaguard												1
Computer	1	1	15	1		1	10		1	1	30	5
Xerox Machine												1
Printer				1		1	1					1
Electric Kettle							1					
Refrigerator				1	1	1						
Water Pump												
Television										1		
Cooler												1

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LOAD DISTRIBUTION SURVEY (2022-2023)

ASANSOL GIRLS' COLLEGE

Load Type	College Corridor	Outside Building	Girls' Common Room	Girls' Hostel	Boys' Hostel	Total
Tube Light	21		2	18	22	**240**
CFL						**7**
LED Bulb	50		2			**247**
CeilingFan			3	7	16	**214**
WallMountedFan						**23**
Stand Fan						**1**
Exhaust Fan	1					**8**
Projector						**2**
Smart Board						**3**
Split AC						**30**
Speaker						**13**
Aquaguard					1	**5**
Computer						**85**
Xerox Machine						**4**
Printer						**7**
Electric Kettle						**2**
Refrigerator						**6**
Water Pump	2	1			1	**4**
Television	1					**4**
Cooler						**1**

INFERENCES FROM DATA ANALYSIS

- The time series plot of total unit consumption per academic year in fig. 5 shows a gradual increment from the session 2020-2021. In the sessions 2020-2021 and 2021-2022, the reduced electricity consumptions are noted due to COVID lockdown periods.
- Energy consumption per head per year is 23.16 unit for the session 2022-2023. The institute should follow the following energy-saving measures/recommendations to reduce its consumption in future academic sessions.

ENERGY-SAVING RECOMMENDATIONS

- The college should conduct more save-energy awareness programs for students and staff.
- More energy efficient fans should be installed
- Auto-power-switch off systems may be introduced wherever possible and practicable.
- The college has installed solar panels this year. Setting up of more energy efficient solar panels is recommended.
- Efficiency of Diesel Generator needs to be improved.
- Shut off unnecessary computers, printers, and copiers while not in use
- Turn off all the classroom lights and fan while not in use.
- Reduce the usage of Air Conditioner as much as possible.
- Use the water pumps in a more efficient way.
- Increase the number of LED in the campus, mostly in classrooms.

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