



**Energy Audit Report**  
**Tika Ram PG Girls College, Sonapat, Haryana**  
**The Academic Year 2022-23**



## **ENERGY AUDIT REPORT**



### **TIKA RAM PG GIRLS COLLEGE, SONEPAT**

(Affiliated to M.D. University, Rohtak)

Mission Road, Sonapat-131001

Haryana

[www.trgc.edu.in](http://www.trgc.edu.in)

PREPARED BY

**EMPIRICAL EXERGY PRIVATE LIMITED**

Flat No. 201, OM Apartment, 214 Indrapuri Colony,

Bhawarkuan, Indore – 452 001 (M. P.), India

0731-4948831, 7869327256

Email ID: [eempirical18@gmail.com](mailto:eempirical18@gmail.com)

[www.eeplgroups.com](http://www.eeplgroups.com)

(2022-23)



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## **ACKNOWLEDGEMENT**

**Empirical Exergy Private Limited (EEPL), Indore (M.P)** takes this opportunity to appreciate & thank the management of **Tika Ram PG Girls College, Sonapat, Haryana** for allowing us to conduct an energy audit for the college.

We are indeed touched by the helpful attitude and co-operation of all faculties and technical staff, who rendered their valuable assistance and co-operation during the study.


**Rajesh Kumar Singadiya**

**(Director)**

M.Tech (Energy Management), Ph.D. (Research Scholar)  
Accredited Energy Auditor [AEA-0284]  
Certified Energy Auditor [CEA-7271]  
(BEE, Ministry of Power, Govt. of India)  
Empanelled Energy Auditor with MPUVN, Bhopal M.P.  
Lead Auditor ISO 50001:2011 [EnMS) from FICCI, Delhi  
Certified Water Auditor (NPC, Govt of India)  
Chartered Engineer [M-1699118], The Institution of Engineers (India)  
Member of ISHRAE [58150]




## Certificate of Accreditation

 **BUREAU OF ENERGY EFFICIENCY**

Examination Registration No.: ..... **EA- 7271** .....

Accreditation Registration No.: ..... **AEA-284** .....



### Certificate of Accreditation

This is to certify that Mr./Ms. **Shri. Rajesh Kumar Singadiya** ..... having its trade/registered office at ..... has been given accreditation as accredited energy auditor. The certificate shall be effective from **9<sup>th</sup>** day of **May, 2018** .....


The certificate is subject to the provisions of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

This certificate shall be valid until it is cancelled under regulation 9 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

On cancellation, the certificate of accreditation shall be surrendered to the Bureau within fifteen days from the date of receipt of order of cancellation.

Your name has been entered at AEA No. **284** ..... in the register of list of accredited energy auditors. Your name shall be liable to be struck out on the grounds specified in regulation 8 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

Given under the seal of the Bureau of Energy Efficiency, Ministry of Power, this **5<sup>th</sup>** day of **October, 2018**

  
Secretary,  
Bureau of Energy Efficiency  
New Delhi











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**The Audit Team**

The study team constituted of the following senior technical executives from **Empirical Exergy Private Limited,**


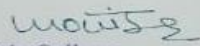
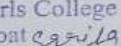
-  **Mr. Rakesh Pathak,** [Director & Electrical Expert]
-  **Mr. Rajesh Kumar Singadiya** [Director & Accredited Energy Auditor AEA-0284]
-  **Mrs. Laxmi Raikwar Singadiya** [Chemical Engineer]
-  **Mr. Sachin Kumawat** [Sr. Project Engineer]
-  **Mr. Hemendra Khadekar** [Sr. Electrical Engineer]
-  **Mr. Charchit Pathak** [Asst. Project Engineer]
-  **Mr. Aakash Kumawat** [Assistant Jr. Engineer]
-  **Mr. Mohan Choudhary** [ Sr. Electrician]



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**Green Monitoring Committee**

 <b>DR. MONIKA VERMA</b> Principal	<b>Tika Ram Girls College</b> Affiliated to MDU, Rohtak Mission Road, Sonapat (Haryana)
	Ref. No. TRG/ 2243 ..... Dated 11/04/2023
<b>Constitution of Committee for Energy / Environment/ Green</b>	
<p>In view of Environmental impact assessment &amp; procedure for situation requiring urgent action regarding regular assessment of pollution, soil degradation &amp; waste management following Committee are required to be constituted for saving the Environment w.e.f. date of issue, for the period of three years.</p>	
<b>Name of the Committee</b>	<b>Proposed Name of the Members.</b>
1. Green Audit	1. Dr. Santosh Rathee 2. Ms. Geeta 3. Ms. Poonam 4. Dr. Upasana 5. Dr. Sonia 6. Mrs. Reetu
2. Environment Audit	1. Dr. Santosh Rathee 2. Ms. Geeta 3. Ms. Poonam 4. Dr. Upasana 5. Dr. Sonia 6. Mrs. Reetu
3. Energy Audit	1. Dr. Santosh Rathee 2. Ms. Geeta 3. Ms. Poonam 4. Dr. Upasana 5. Dr. Sonia 6. Mrs. Reetu
<p>Principal  Tika Ram Girls College Sonapat </p>	
<p>☎ 0130-2242059, 9468100659, 9350712944 ✉ principal.trgc@gmail.com 🌐 www.trgc.edu.in</p>	





## **EXECUTIVE SUMMARY**

The executive summary of the energy audit report furnished in this section briefly gives the identified energy conservation measures and other recommendations during the project that can be implemented in a phased manner to conserve energy and increase productivity inside the college campus.

### **ENERGY MANAGEMENT INITIATIVE TAKEN BY THE COLLEGE**

#### **✚ LIGHTING SYSTEM**

The college has been illuminated with 100 % Energy Efficient LED Lighting System. During the audit, It was found that, there is some projects were under construction. As per the discussion with college management future lighting system will be installed with energy-efficient LED lighting as per the discussion green monitoring committee. **It's appreciable.**

### **ENERGY AUDIT RECOMMENDATION**

#### **✚ SOLAR SYSTEM**

There is good potential to install a 20 KWp rooftop grid-connected solar system. The expected annual solar energy generation @ 4 units per KWp is 1,08,544 units.

#### **✚ CEILING FAN**

Replacement of “conventional ceiling fan (55W)” by an energy-efficient star-rated fan or BLDC-based energy-efficient fan (28W) in classrooms, laboratories, and faculties cabins” has great potential for energy saving.

#### **✚ TIMER-CONTROLLED STREET LIGHTS**

It is recommended to installation of “Timer control on street lighting” on the college campus.

#### **✚ IOT-BASED ENERGY MONITORING SYSTEM.**

Installation of a “Cloud-based (IoT based) energy monitoring system” on the electrical feeder, as well as energy monitoring on individual buildings will be a good initiative for energy monitoring as well as a demo project for students and management



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## ENERGY CONSERVATION MEASURES FOR ELECTRICAL SYSTEM

Case Study	Section	Identification	Observation	Recommendation	Annual energy saving (kWh)	Annual cost saving (Rs.)	Investment (Rs.)	Simple payback Period
1	Ceiling Fan	263 Nos ceiling fan working with 55W	Power consumption by an existing ceiling 55W	Replacement of 55W conventional ceiling fan by 28W BLDC energy-efficient ceiling fan	14,770	98,221/-	4,97,070/-	5.1
2	Electrical System	There is good potential for solar plant	100% energy consumption from the grid	Installation of 20 KWp solar system	1,08,544	1,94,180/-	10,00,000/-	5.1





## **CHAPTER-1**

### **INTRODUCTION**

#### **1.1 About College**

Tika Ram PG Girls College is the manifestation of the dream seen by its founder, the legendary saintly figure Ch. Tika Ram. During the span of the last twenty-five years since its establishment in 1992, the college has made remarkable progress in different spheres & has travelled a cherishable journey.

Starting with the bare minimum requirements, the college has undergone a complete transformation. Being set in the heart of the town, the college is not only facilitating urban students but also commutes hailing from suburban or rural areas.

The institution has a spacious girls' hostel with all the facilities. The college has extensive green grounds, PG Block, an Arts Block, Library, well-equipped Labs, Computer Labs, spacious classrooms, and an auditorium providing excellent scope for all curricular & co-curricular activities.

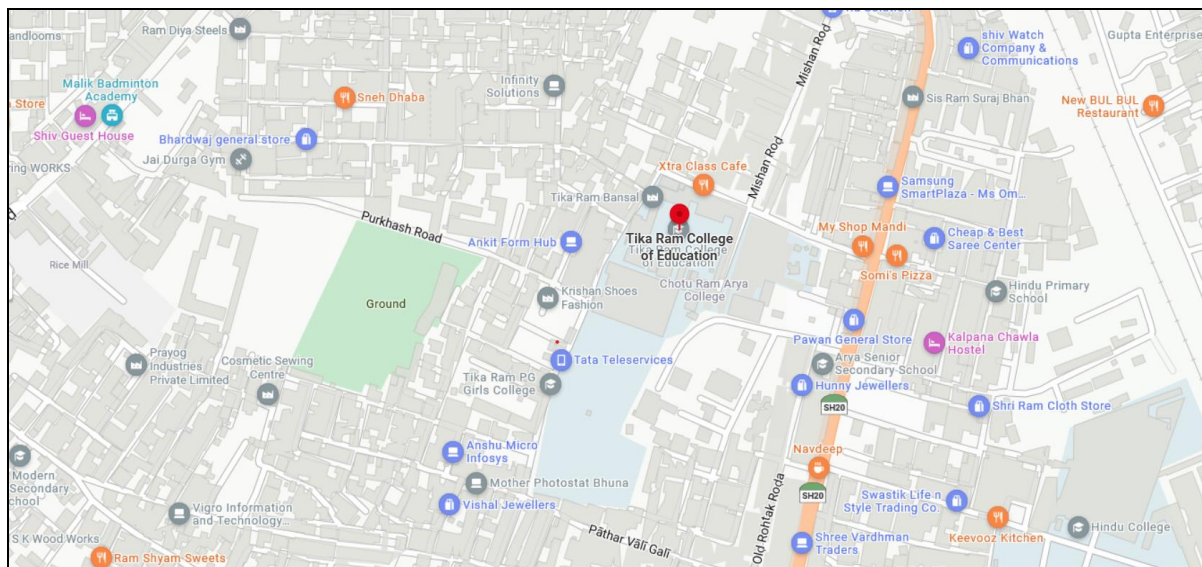
The college has a spacious & well-maintained canteen to cater to the needs of students as well as the members of the staff. The college is working continuously to improve opportunities for disabled, socially disadvantaged & girls from the rural area.



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**Image of Tikaram Girls College from Google map**

### **Vision**

Tika Ram Girls College visualizes a future where rural girls' students are truly empowered through education. A scholarly and vibrant learning environment will be provided to the students. The institute will emerge as an institute of excellence with a difference wherein we develop intellectual, emotional, Cultural, moral, and ethical values in students.

### **Mission**

The mission of the institute is to sensitize rural girls toward society and make them an agent for social change. To direct the mind of the young generation in such a way that they engage themselves in the task of nation-building. Holistic development through participation in curricular and co-curricular activities beyond the curriculum. To develop courage and confidence in the changing global scenario. To motivate the faculty members for academic research and extension activities to help the students to find solutions to the current problems of society. To motivate female students to strive for self-reliance and entrepreneurship.



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### Build-up area of the college

Details are the total build-up area given in the table

Sr.No.	Description	Area (Sqm)
1	Total area of the college	165115.15
2	Total covered area at ground	32120.74
3	Total covered area on the first floor	49687.66
4	Total covered area on the second floor	1870.91
5	Total covered area	133689.31
6	Plantation area, Green lawn, and grounds	56290.43

### College Population

No. of college population year wise

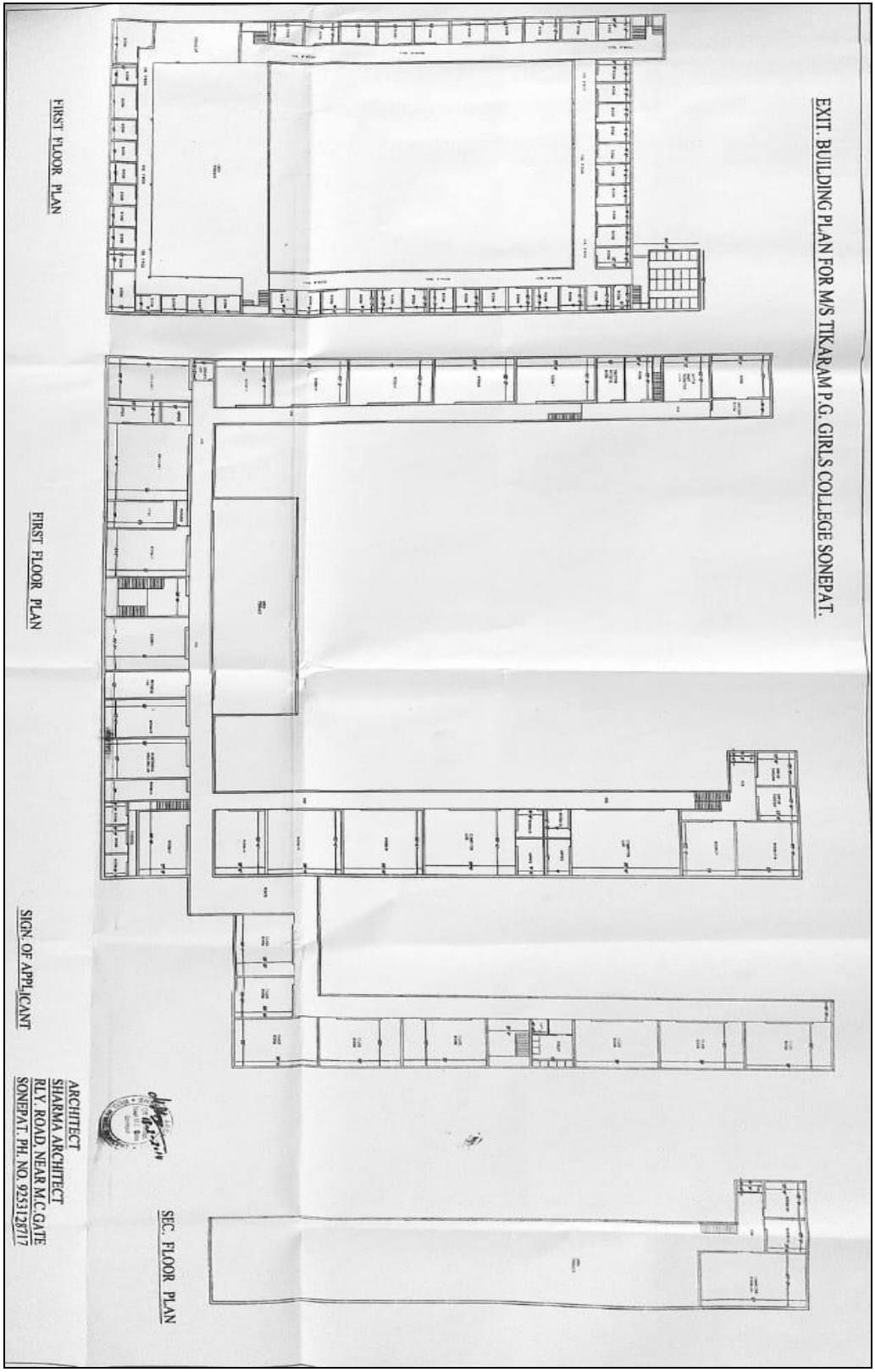
No. of student/staff	2020-21	2021-22	2022-23
Teaching staff	57	61	62
Non-teaching staff	35	43	42
Students	2319	2379	2133



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**Layout of the college campus**









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### 1.2 About Energy Audit

An energy audit helps to understand more about the ways energy is used in any college and helps in identifying areas where waste may occur and scope for improvement exists. The overall energy efficiency from generation to the final consumer becomes 50%. Hence one unit saved by the end user is equivalent to two units generated in the power plant.

An energy audit is the most efficient way to identify the strength and weaknesses of energy management practices and to find a way to solve problems. An energy audit is a professional approach to utilizing economic, financial, social, and natural resources responsibly. Energy audits “adds value” to management control and are a way of evaluating the system.

**Empirical Exergy Private Limited (EEPL), Indore M.P.** carried out the “Energy Audit” at the site to find gaps in the energy consumption pattern for **Tikaram PG Girls College, Sonapat, Haryana**. A technical report is prepared as per the need and the requirement of the project.

### 1.3 Objectives of Energy Auditing

An energy audit provides a vital information base for an overall energy conservation program covering essentially energy utilization analysis and evaluation of energy conservation measures. It aims at:

- Identifying the quality and cost of various energy inputs.
- Assessing the present pattern of energy consumption in different cost centers of operations.
- Relating energy inputs and production output.
- Identifying potential areas of the thermal and electrical energy economy.
- Highlighting wastage in major areas.
- Fixing energy-saving potential targets for individual cost centers.
- Implementation of measures for energy conservation & realization of savings.





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### 1.4 Methodology:

The methodology adopted for achieving the desired objectives viz.: Assessment of the current operational status and energy savings includes the following:

- ✚ Discussions with the concerned officials for identification of major areas of focus and other related systems.
- ✚ A team of engineers visited the site and had discussions with the concerned officials/supervisors to collect data/information on the operations and load distribution within the plant and the same for the overall premises. The data were analyzed to arrive at a baseline energy consumption pattern.
- ✚ Measurements and monitoring with the help of appropriate instruments including continuous and/or time-lapse recording, as appropriate and visual observations were made to identify the energy usage pattern and losses in the system.
- ✚ Trend analysis of costs and consumptions.
- ✚ Capacity and efficiency test of major utility equipment, wherever applicable.
- ✚ Estimation of various losses
- ✚ Computation and **in-depth analysis** of the collected data, including utilization of computerized analysis and other techniques as appropriate, were done to draw inferences and to evolve a suitable energy conservation plan for improvements/reduction in specific energy consumption.

### 1.5 Present Energy Scenario

- ✚ The college uses energy in the form of electricity purchased from Uttar Haryana Bijli Vitran Nigam Limited with sanctioned load of 35.7 kW. The total billing amount of **Tikaram Girls PG College** is Rs.1,12,699/- concerning annual energy consumption 16,923 unit analysis period from Apr-2022 to Mar-2023.
- ✚ The annual average per unit charges paid by the institute is Rs. 6.65 per unit.

## CHAPTER- 2

### POWER SUPPLY SYSTEM

#### 2.1 DG Set

There are four DG sets on the college campus. Two DG set are working and two are under maintenance. Details of the DG Set are given table. 2.2

Table 2.2 Technical specifications for DG set

Sr.No.	Parameter	Technical Specification DG Set-01	Technical Specification DG Set-02
1	Make	Greaves	Kirloskar
2	M/c No	3108031002161	
3	Capacity (KVA)	30	63
4	Rated Voltage	415	415
5	Frequency	50	50
6	Power Factor	0.8	0.8
7	RPM	1500	1500
8	Phase	Three	



Figure 2.1:- DG sets on college campus

#### Observation

- ✚ DG sets are used only in case of power failure.



## CHAPTER- 3

### ELECTRICITY BILL ANALYSIS

#### 3.1 Monthly Electrical Energy

The monthly electricity bills are provided by college and visibility of bill the monthly electrical energy consumption year 2022-23 with sanctioned load 19.20 KW, 7.50 KW, 9.0 KW simultaneously.

#### Sanctioned Load (19.20 KW)

Sr. No.	Month & Year	Total Unit Consumption (kWh)	Total Amount (Rs.)	Per Unit Charges (Rs./kWh)
1	Apr-2022 to May-2022	3,933	29,996	7.63
2	Jan-2023 to Mar-2023	909	23,005	25.31
3	Jun-2022 to Sep-2022	1,811	18,997	10.49
4	Sep-2022 to Nov-2022	1,333	12,758	9.57
	Total	7,986	84,756	13.25

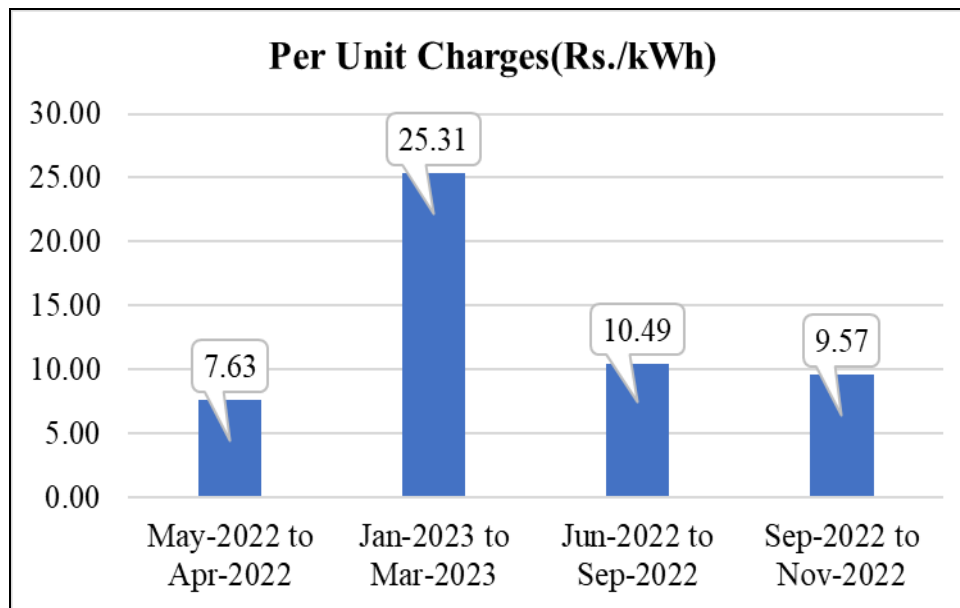


Figure 3.1:- Graphical presentation of actual per-unit charges for the year 2022-23

#### Observation:

The average energy charge is Rs 13.25 /kWh.



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**Sanctional Load (7.50 KW)**

Sr. No.	Month & Year	Total Unit Consumption (kWh)	Total Amount (Rs.)	Per Unit Charges (Rs./kWh)
1	Mar-2022 to Apr-2022	3395	5,208	1.53
2	Jan-2023 to Mar-2023	3015	3,015	1.00
4	Oct-2022 to Nov-2022	320	3,512	10.98
5	Dec-2022 to Jan-2023	376	2,606	6.93
	Total	6730	11,735	4.50

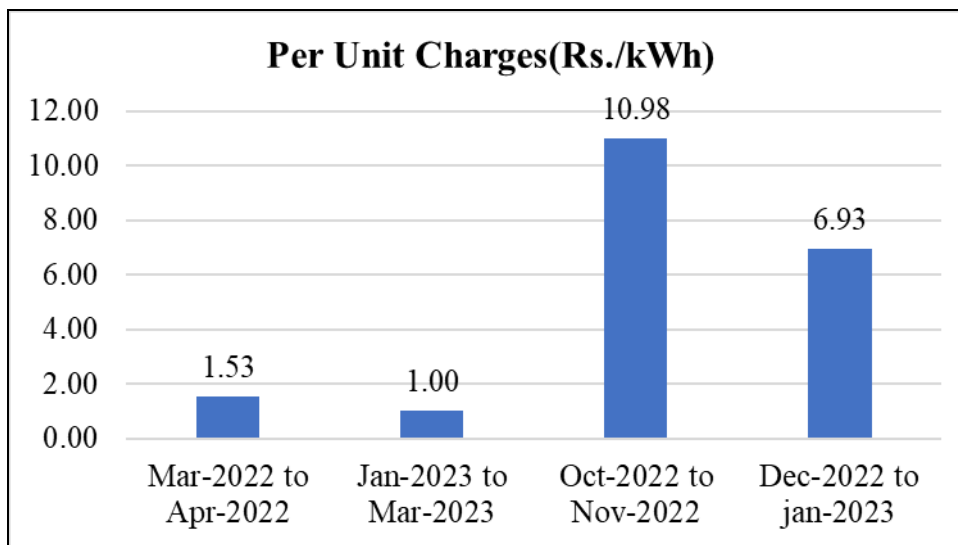


Figure 3.2:- Graphical presentation of actual per-unit charges for the year 2022-23

**Observation:**

The average energy charge is Rs 4.50 /kWh



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**Sanctional Load (9.0 KW)**

Sr. No.	Month & Year	Total Unit Consumption (kWh)	Total Amount (Rs.)	Per Unit Charges (Rs./kWh)
1	Nov-2022 to Jan-2023	2,207	16,208	7.34
2	Jan-2023 to Mar-2023	2,093	15,372	7.34
	Total	2,207	16,208	7.34

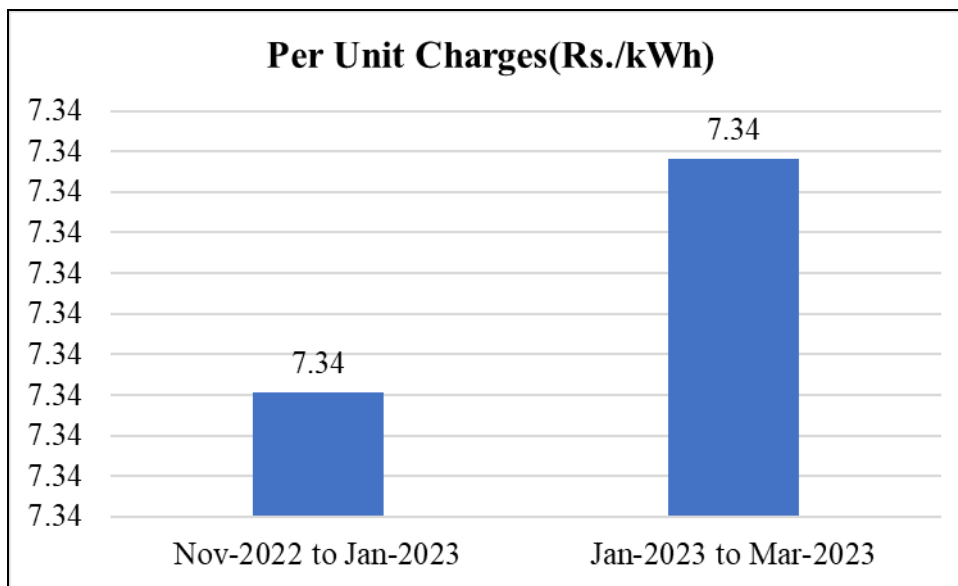


Figure 3.3:- Graphical presentation of actual per-unit charges for the year 2022-23

**Observation:**

The average energy charge is Rs 7.34 /kWh



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**3.2 ON-site power measurement in college**

Sr.No.	Location	Voltage	Current	Power Factor	Power Consumption (kW)
1	New building	420	11.8	0.87	7.5
2	Old building	409	10.4	0.91	6.7
3	Security	417	5.6	0.88	3.6
4	Principal home/Mess	416	9.2	0.85	5.6
5	Hostel warden	230	0.9	0.92	0.3
6	Old Mesh Canteen	418	1.2	0.92	0.8





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**CHAPTER-4**  
**CONNECTED LOAD**

**4.1 Connected load details of the college**

Sr.No.	Electrical Equipment	Quantity (Nos)
1	LED tube light	206
2	Ceiling Fan	263
3	Air Conditioner	11
4	Computer	105
5	Photocopy machine	1
6	Street light	17
7	Halogen	4
6	Printer	5

**4.2 Connected Load sharing electrical equipment**

Sr. No.	Equipment's	Unit Power (Watt)	Quantity (Nos)	Total Power (Watt)	Load share%
1	LED tube light	20	206	4120	4.26
2	Ceiling Fan	55	263	14465	14.95
3	Air conditioner(1.5ton)	1160	10	11600	11.99
4	Air conditioner(2 ton)	55490	1	55490	57.34
5	Computer	80	105	8400	8.68
6	Photocopy machine	250	1	250	0.26
7	Printer	50	20	1000	1.03
8	Street light	50	17	850	0.88
9	Halogen	150	4	600	0.62
	Total			96775	100.00

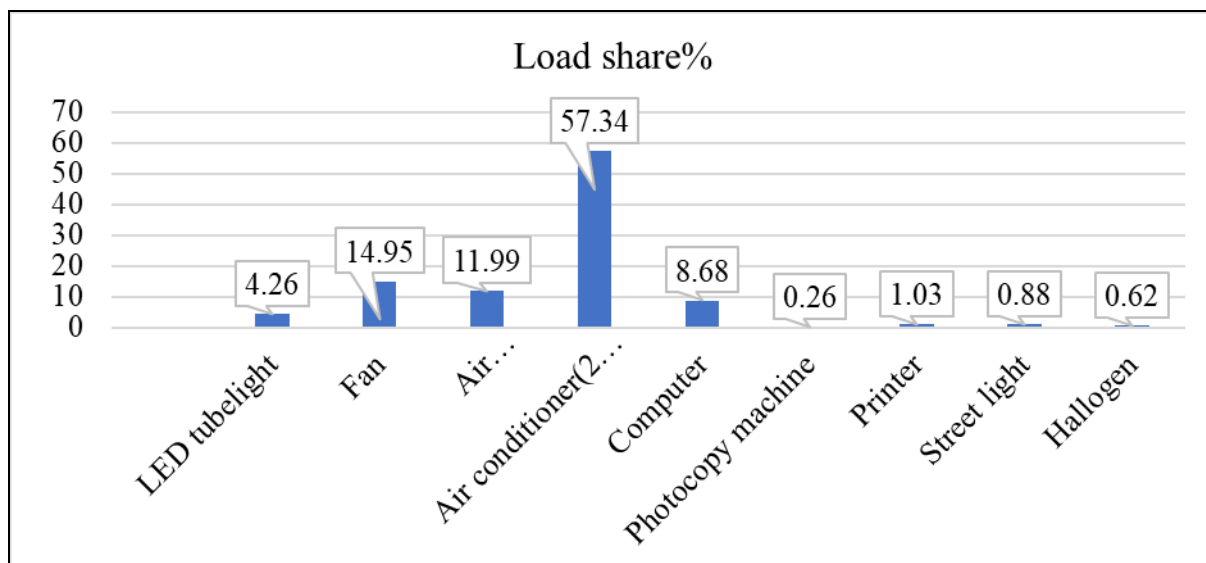


Figure 4.1:- Equipment loading Share % year-2022-23

### 4.3 Some Photographs of Electrical Equipment

	
<p><b>PhotocopyMachine</b></p>	<p><b>LED Street light</b></p>
	
<p><b>LED tube light</b></p>	<p><b>Air conditioner</b></p>



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#### 4.4 Lux measurement

Old building Lux Measurement

Sr. No.	Location / Room No.	Lux reading
1	Classroom	149, 150, 156
2	Political Science	189, 190, 195
3	Economics Dept.	155, 160, 164
4	English dept.	154, 150, 148
5	Maths dept.	138, 140, 145
6	Classroom	178, 168, 180
7	Physics lab 1	178, 195, 150
8	Hindi lab	149, 150, 165
9	Staff room	115, 125, 138
10	Physics lab 2	210, 217, 225
11	Physics dept	178, 167, 180
12	Physics lab 3	190, 195, 200
13	Chemistry lab	259, 249, 250
14	Staff room	158, 145, 157
15	Chemistry lab 2	189, 195, 200
16	Library	340, 357, 360
17	Geography Lab 2	156, 159, 164
18	History Dept.	149, 156, 160
19	Geography Lab 1	195, 120, 175
20	Geography Dept.	210, 224, 226
21	Physical dept.	135, 210, 248
22	Physical lab	195, 210, 270
23	English & Hindi dept.	175, 185, 190
24	Computer lab	198, 250, 257
25	History/ Political dept	130, 145, 150
26	Computer dept.	162, 152, 174
27	Computer lab2	251, 248, 235



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New building

Sr. No.	Location / Room No.	Lux reading
1	Principal Office	441, 357, 371
2	Retiry room	330, 331, 296
3	Office	205, 209, 220
4	Deputy Supretended	319, 321, 340
5	Commerce dept.	240, 237, 241
6	Computer lab	191, 186, 172
7	Common room	177, 196, 182
8	Red cross room	183, 189, 196
9	Gym	201, 215, 229

Sr. No.	Location / Room No.	Lux reading
1	Classroom	162, 155, 170
2	Classroom	134, 156, 162
3	Warden room	144, 146, 130
4	room	152, 167, 142
5	room	162, 167, 177
6	Guard room	170, 162, 164
7	Hall	275, 280, 390
8	Mess/Canteen	415, 420, 435
9	Principal home	179, 192, 193
10	Driver Staff	271, 275, 280





**CHAPTER- 5**  
**ENERGY CONSERVATION MEASURES**

**4.1 Case Study**

Replacement of 55W conventional ceiling fan by 28W BLDC energy-efficient ceiling fan in phase manner

Sr. No	Item	Parameter	Unit
1	Rated Power of Ceiling Fan	55	W
2	Nos. of Fan	263	Nos
3	Working Hrs./Day	10	Hrs./Day
4	Working Days/Year	260	Days/Year
5	Energy Efficient BLDC Fan Rated Power	28	W
6	Energy Saving Potential	18462	kWh/Year
7	Load Factor	0.8	
8	Expected Annual Energy Saving	14770	kWh/Year
9	Per Unit Charges	6.65	Rs/kWh
10	Expected Money Saving	98,221/-	Rs./Year
11	Cost of New Ceiling Fan	1,800/-	Rs./Pieces
12	Investment in New Fan Purchasing	4,73,400/-	Rs.
13	Maintenance Investment@5%	23,670/-	Rs.
14	Total Investment	4,97,070/-	Rs.
15	Simple Pay Back Period	5.1	Year

**Total Calculated Monetary Saving Potential in Ceiling Fan = Rs 98,221/-**

**Note:- Energy savings depend on the operation hour per day and the load factor of the systems.**





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## 4.2 Case Study

### Installation of 20 KWp solar roof-top system

Solar unit (Energy) Generation calculation: -

Sr. No	Parameter	Value	Unit
1	Expected solar potential capacity (As per unit consumption Year-2022-23)	20	kWp
2	Expected solar unit generation @4 unit/day/kWp	80	kWh/Day
3	Expected Annual solar unit generation of the Solar Plant	29,200	kWh/Year
4	Annual unit consumption of college (Year 2022-23)	1,08,544	kWh/Year
5	Potential solar energy share	27	%
Payback Period Calculation			
1	Total solar unit generation of the system(20 kWp)	29,200	kWh/ year
2	Overall energy charges per unit as per Electricity bill	6.65	Rs/kWh
3	Expected revenue generation	1,94,180	Rs./year
4	Expected cost of 1kw solar plant @50Rs.perwatt	50,000/-	Rs./KWp
5	Expected total investment	10,00,000/-	Rs.
6	Simple payback period of the project	5.1	year



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**END OF THE REPORT**

**THANKS**