

DETAILED ENERGY AUDIT REPORT

Year-2022-2023



Shyam Lal Pandaviya GOVT. Post Graduate College

C.P. Colony, Near 7 No. Chourah, Moarar,
Gwalior -474006 M.P

CONDUCTED BY:

SABS ENERGY ENVIRO PVT. LTD.



WE BUILD A SOLID FOUNDATION FOR SAVING ENERGY

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Organization:	SABS ENERGY ENVIRO PVT. LTD.
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SABS ENERGY ENVIRO PVT. LTD., INDORE



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Acknowledgement

SABS ENERGY ENVIRO PVT. LTD. expresses sincere thanks to the management of SLP Govt. P.G. College, Morar, Gwalior for inviting SABS ENERGY ENVIRO PVT. LTD. conducts comprehensive Energy Audit 2022-2023 of their Premises at SLP Govt. P.G. College, Morar, Gwalior. The field study of this audit was carried out on 18-July 2023.

The officials of SLP Govt. P.G. College, Morar, Gwalior have coordinated and helped to the audit team during the field study and measurement. SABS ENERGY ENVIRO PVT. LTD. express special thanks to the following persons of SLP Govt. P.G. College, Morar, Gwalior.

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9	IQAC Member,	Dr. Sagar Ghosh
10	IQAC Member,	Shri Keshav Shukla

We are also thankful to all other Teachers and staffs for the keen interest shown in this study and the courtesy extended. We are thankful to the management for giving us the opportunity to be involved in this very interesting and challenging project.

We would be happy to provide any further clarifications, if required, to facilitate implementation of the recommendations.

SABS ENERGY ENVIRO PVT. LTD., INDORE



MR. SANJAY SINGH EA-1462
Certified Energy Auditor
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ENERGY AUDIT Certificate



This is to certify that **Shyam Lal Pandaviya Govt. Post Graduate College, Morar, Gwalior** has conducted, Energy audit in the academic year 2022 - 2023 to assess the environmental initiative planning, efforts, activities, implemented in the college campus like Light , Fan, pump, electrical load , Conservation of Energy, Energy Management and various Environmental Awareness activities. **SABS Energy Enviro. Pvt. Ltd.** has verified campus data of **Shyam Lal Pandaviya Govt. P.G. College, Morar, Gwalior** This Energy Audit are also aimed to assess impact of Energy saving initiatives for maintenance of the campus eco-friendly.



Mr. Sanjay Singh

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EA 1462 Bureau of Energy efficiency

Ministry of Power Govt. of India

Save Energy Save Nation





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ABBREVIATION

O&M	Operation and maintenance
kW	Kilo Watt
P.F	Power Factor
kVA	kilo Volt Ampere
kWh	kilowatt Hour
kVAh	kilovolt Amperes Hour
kVA _r	kilovolt Amperes Reactive
ACs	Air Conditioners
FTL	Fluorescent Tube Light Lamp
TR	Ton of Refrigeration
SPC	Specific Power Consumption
CMH	Cubic Meter per Hour
STL	Single Tube Light
DTL	Double Tube Light
Amp	Ampere
Volt	Voltage
BLDC	Brushless Direct current
Nos	Numbers
Hrs	Hours
MPMKVVCL	Madhya Pradesh Madhya Kshetra Vidyut Vitaran Company Ltd.

EXECUTIVE SUMMARY

❖ College Details:

Particulars	Units	Details
Name of the College	-	SLP Govt. P.G. College, Morar, Gwalior
Location	-	Gwalior (M.P), India
Owner	-	Government
Contact Person	-	Dr. Sadhna Shrivastava
No. of Shifts	Nos.	1
Daily Operating Hours	Hrs./day	8
Annual Working Days	Days/yr.	300
Source of Electricity	-	MPMKVVCL
Total connected maximum Load	kW	53.66 kW
Total Sanctioned Load	(kW)	28 kW
Average Energy Charge in per unit	Rs. /kWh	9.88

a) Existing Major Energy Consuming Technology and Electricity billing analysis:

The major equipment's installed in **SLP Govt. P.G. College, Morar, Gwalior** like Lighting fixtures, Fans and Other appliances

Table 1 Connected Load (kW)

S. No.	Type of Electrical System	Connected Load Power (kW)	Connected Load (%)
1	Lighting System	4.83	9.01%
2	Fan System	5.07	9.45%
3	Air conditioning System	11.76	21.92%
4	Water Pumping	4.50	8.39%
5	Other Appliances	27.50	51.24%
Total Connected Load		53.66	

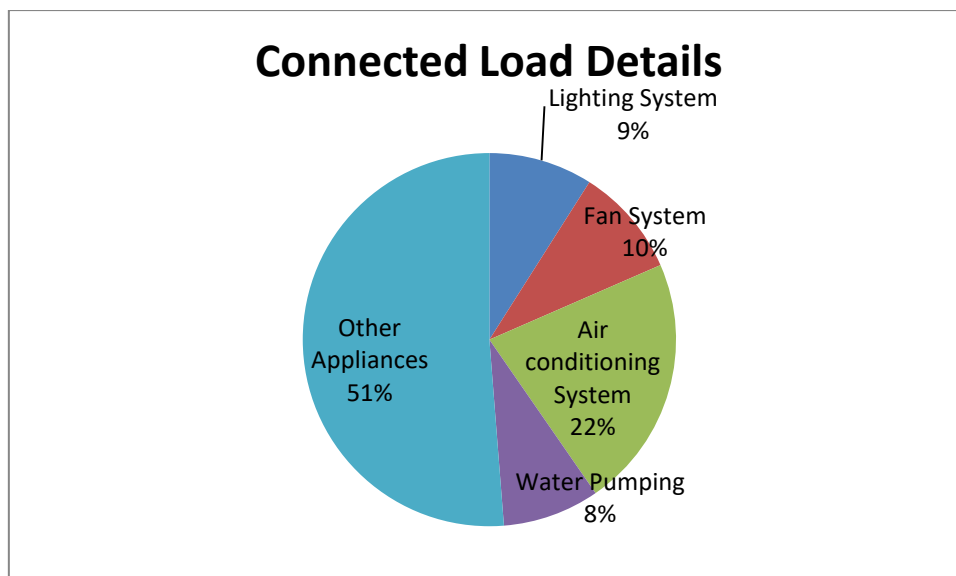


Figure 1 Connected Load details of campus in different zone

- As per electricity bills observation and analysis, **Total 5 connection of Sanction load is 6.71,8, 12,1, 10 kW** in College premises.
- As per electricity bills observation and analysis is from **average electricity unit (kWh) consumed is 50578 kWh** for electricity bill in college premises.
- As per electricity bills observation and analysis **Total 12-month bill Paid is & Rs. 4,43,123.00.**
- As per electricity bills observation and analysis, **electricity bill Power Factor varies from 0.80-0.99.**

Note -Please maintain electricity bill logbook properly in record for monitoring and analysis of electricity bill.

b) Proposed Energy Saving Technologies with Cost Economics

❖ LIGHTINGSYSTEM

- We appreciate to use **LED Lighting luminaries** at some location as per site visit.
- We observed during visit, few Lights were T5 tube light consuming high electricity.
- We are **suggesting to purchases all electrical** equipment as per star leveling program by Bureau of energy. Efficiency, and will get huge amount of electricity saving.
- We are suggesting conducting regular **Cleaning and maintenance of lighting fixtures** in every 5-6 months. To increase performance of Lighting and also improve their Lux level.
- We will get energy saving approximately **5702 kWh** per year and also will get amount saving approximately **Rs. 56340** per year by replacing conventional T5 Tube light with new energy efficient LED Tube light .
- As per data collection and site visit, Total Connected lighting load at College Campus is **4.83 kW**.
- As per data collection and observation, **Total no. of lighting fixture is 198**.

❖ Ceiling Fan System

- We observed that most of the Fans installed in campus were conventional.
- We are recommended to **replace 72 no. of 70 W Ceiling fan with New Super energy efficient 5 star rated BLDC ceiling fan** and will get huge amount of electricity saving as per Star leveling program by Bureau of Energy Efficiency.
- We are **suggesting to purchases new energy efficient BLDC fan as per Star leveling program by Bureau of Energy Efficiency, and will get huge amount of electricity saving**.
- Energy Saving calculation **and recommendation for the existing Conventional** Ceiling fans with BLDC super energy efficient fan has been given in this report.
- We are suggesting **conducting regular Cleaning and maintenance** of Fan at least in every 6 months to increase performance of Fan.
- We are also suggesting improving their Air delivery of Fan by Replacing New energy efficient BLDC Fan as per 5 stars leveling of Bureau of energy efficiency.
- We will get energy saving approximately **6250 kWh** per year and also will get amount saving approximately **Rs. 61746.00** per year by replacing conventional Fan with new energy efficient BLDC fan.
- The total load for Ceiling Fan is **5.07 kW**.
- Total No. of Fan fixtures are **72**.

❖ Pumping System

- We observed during Energy Audit and site visit, **2 Pump of Capacity 3 HP were installed** within college campus for drinking water, Flushing and gardening purpose.
- Power consumption of each **3 HP pump was 2.25 kW** as per site visit and measurement.

- We are suggesting purchasing **5 star rated pumps and will get huge** amount of saving as per Star leveling program by Bureau of Energy Efficiency 2020.
- We are **suggesting installing Solar Pumping system and** will get huge amount of savings.

❖ Other Different Type of Connected Load:

There are different types of other equipment's like Computer, Printer, Xerox machine, Water Cooler, Refrigerator and other lab equipment's are installed at various location and they also contribute electricity consumption

- We suggest to **purchase equipment's as per Star leveling program** by Bureau of Energy Efficiency 2020, and will get huge amount of electricity saving.
- Maintenance of all the equipment's should be done regularly.

c) Saving Highlights

Table 2 Lighting Saving Highlights

Total Amount of savings (kWh)	5702	kWh
Total Amount of savings Rs	0.56	Rs. In Lacs
Total Amount of investments	1.08	Rs. In Lacs
Pay Back Period	23	Months

Table 3 Ceiling Fan Saving Highlights

Total Amount of savings (kWh)	6250	kWh
Total Amount of savings Rs.	0.61	Rs. In Lacs
Total Amount of investments	2.01	Rs. In Lacs
Pay Back Period	39	Months

Summary of Energy Conservation Measures

Table 4 Summary of Energy Conservation Measures

S. No.	Energy Conservation Measures	Annual Savings		Investment	Payback
		kWh	Rs.	Rs.	Months
LED TUBE LIGHT					
1	Replace 198 no of Existing 30 W T5/T12 Tubelight with Energy efficient 18 W LED Tube light.	5702	56340	108900.00	23
	Total	5702	56340	108900.00	23

Table 5 Summary of Energy Conservation Measures

S. No.	Energy Conservation Measures	Annual Savings		Investment	Payback
		kWh	Rs.	Rs.	Months
CEILING FAN					
1	Replace 72 nos of Existing 70 W Ceiling Fan with Energy efficient Energy Efficient 28 W BLDC Ceiling Fan.	6250	61746	201600	39
	Total	6250	61746	201600	39

We also recommend installing Online Grid Connected Solar System of 20 kWp capacity for annual unit generation of 24,000 kWh which leads to be approx. 47% of annual energy requirement.

CHAPTER-1

INTRODUCTION

1.1 Energy Audit

Energy Audit is an effective means of establishment present efficiency levels and identifying Potential areas of improvement in energy consumption.

Energy audit of utility systems largely helps, which are given below:

- Reducing the energy consumption with resultant reduction in electricity bills.
- Audit involves data collection, data verification and detailed analysis of the data.
- The analysis leads to recommendations, which are short term (with minimum investment), medium term (with moderate investment) and long term (with capital expenditure).
- The cost benefit analysis of various energy conservation proposals enables managements to take decisions regarding implementation schedules.

Energy conservation is a worldwide objective to save the human being from possible disaster. Under the mandate of The Energy Conservation Act 2001, the Bureau of Energy Efficiency and Government of India are implementing various programmes to provide momentum of the energy conservation movement in the country. Energy Auditing is most vital part of the conservation of energy. In order to improve the efficiency of the Energy consuming system, energy auditing is the first necessary action to be taken by the concerned firm. Through the energy auditing actual parameters can be detected at each step, which can be compared with the standard achievable parameters. For proper Energy auditing and energy accounting, parameters need to be monitored on regular.

SLP Govt. P.G. College, Morar, Gwalior has engaged SABS ENERGY ENVIRO PVT. LTD. for conducting detailed energy audit in their premises for the year of 2022-23.

1.2 Methodology & Approach

The audit involved basic design data collection for various electrical & thermal utilities, kick of meeting with concern departmental engineers & managers, carrying out various field measurements, performance analysis and loss analysis covering all major energy consuming sections of **SLP Govt. P.G. College, Morar, Gwalior** to realistically assess losses mainly in energy consuming utility areas and potential for energy savings. The major areas of study include:

- Building energy bills analysis.
- Electrical supply and distribution system analysis
- Lighting system analysis.
- Water pumping system analysis.
- Buildings envelop analysis.
- Specific Energy Consumption.

During study several interactions was made to the office personnel and technicians to share the actual operational features of equipment, equipment's maintenance schedule and equipment breakdown, down

Time of machineries, safety measures etc. At the same time required data was collected from the various departments and review the same with the operational actual data.

The study focused on improving energy use efficiency and identifying energy saving opportunities at various equipment's. The analyses included simple payback period and life cycle cost calculations where investments are required to be made to implement recommendations, to establish their economic viability.

1.3 Instrument used in Energy Audit:

We have a wide array of latest, sophisticated, portable, diagnostic and measuring instruments to support our energy audit investigations and analyses. The audit study made use of various portable instruments along with plant online instrumentations, for carrying out various measurements and analyses. The specialized instruments that were used during the energy audit include:

- Power Analyzer.
- Ultra-Sonic Flow Meter.
- Digital power clamp meter & multi-meter (2745 KUSAMMECO)
- Digital Hygrometer HD-304HTC
- Digital Lux Meter (LX-101A HTCTM)
- Digital Anemometer (AVM -07HTC)
- IR Thermometers for temperature measurement HTC TM (IR -50 to 15500C)
- Digital distance meter
- Measuring Tap meter

CHAPTER-2

SITE VISIT AND INSPECTION

2.1 College Details

Shyamlal Pandaviya Govt.PG College, Morar was established in 1970 with aim to impart education of Science to students of rural and semi urban area .Now it become multidisciplinary co-education college and acquired renowned position in rural area of Morar. The college is recognized by UGC under 2f -12B act 1956 .It is affiliated to Jiwaji University Gwalior. The college is enriched with highly qualified and experienced faculties, sports Officer and Librarian. Total 7 UG program,9 PG program ,one PG diploma program in yoga and 5 Ph.D .Program were running in the college. The college has two NCC units, and one NSS units. The library of the college is well structured with E-Library facility. It has 24 well spacious and we'll ventilated room out of which five smart class room we'll equipped with ICT facilities. The students are punctual, sincere and participated in many extracurricular activities and sports .They also learn human values through various awareness rally and camps of NCC and NSS units outside the campus..The total strength of college is 4597(4320boys and 277 girls) The aim of the college is to produce well educated ,self dependent, and socially responsible student for future..

VISION:

Shyamlal Pandviya Government P.G. College, Morar, Gwalior, seeks to be an excellent learning center of high academic standards with more and more access, equity, excellence and employability by using all high-quality modes of teaching and learning for overall development of students..

MISSION:

- To ensure Inclusion and Access of Quality education.
- To help with all possible means to underprivileged and differently able students.
- To Provide an Environment of learning that enhances dissemination of knowledge.
- To enhance the holistic approach aiming at integration of traditional knowledge with innovative and advanced practices.
- To impart Social, Environmental and Gender sensitivity in students through extension outreach.
- To help students to attain Moral, Emotional and National Integrity.

2.2 Site visit and site inspection

Energy audit team visited at college campus premises and also had completed of electrical measurement and appliances data collection.



Figure 2 Front View of the College



Figure 3 Library Building



Figure 4 Lux Level Measurement at site



Figure 5 Class Rooms

CHAPTER-3

ELECTRICITY BILL ANALYSIS

Shyamlal Pandviya Govt.PG College ,Morar, Gwalior receives power from, Madhya Pradesh Madhya Kshetra Vidyut Vitran Company Limited.

3.1 Month Wise Energy Consumption

The maximum demand, energy consumption, fixed charges, energy charges and total bill in Rs. 4, 43,123.00, for the academic year 2022-2023 are showing below tables as per the details from the College bill. All the one year's data has been represented by the various graphs. This indicator addresses energy consumption, energy sources, energy monitoring, and electricity consumption.

Tariff Schedule LV - 2

NON-DOMESTIC:

LV 2.1

Applicability:

This tariff is applicable for light, fan and power to Schools / Educational Institutions including workshops and laboratories of Engineering Colleges / Polytechnics/ITIs (which are registered with /affiliated/ recognized by the relevant Govt. body or university), Hostels for students or working women or sports persons.

Tariff:

Tariff shall be as given in the following table:

Sub category	Energy Charge (paise/unit) Urban/ Rural areas	Monthly Fixed Charge (Rs.)	
		Urban areas	Rural areas
Sanctioned load-based tariff (only for connected load up to 10 kW)	630	150 per kW	120 per kW
Demand based tariff Mandatory for Connected load above 10 kW	630	270 per kW or 216 per kVA of billing demand	230 per kW or 184 per kVA of billing demand

Figure 6 Electricity Tariff 2022-23

Table 6 Electricity Bill -1 Shyamlal Pandviya Govt.PG College, Morar 2022-23

Monthly Electricity bill SLP College Gwalior city - 2022 IVRS-N2901019815								
Months	Sanctioned Load (kW)	MDI	kWh	Fixed charges (Rs.)	Energy Charges (Rs.)	Power Factor	Total bill (Rs.)	Average Per unit Charges Rs./kWh
Aug-22	6.71	0	1187	1092	7715.5	0.8	9713	8.18
Sep-22	6.71	0	1132	1092	7358	0.8	9364	8.27
Oct-22	6.71	0	1106	1092	7354	0.8	9137	8.26
Nov-22	6.71	0	1142	1092	7423	0.8	8943	7.83
Dec-22	6.71	0	1127	1092	7325.5	0.8	8955	7.95
Jan-23	6.71	0	1125	1092	7312.5	0.8	9098	8.09
Feb-23	6.71	0	1131	1092	7351.5	0.8	9364	8.28
Mar-23	6.71	0	1128	1092	7332	0.8	9464	8.39
Apr-23	6.71	0	1137	1092	7390.5	0.8	9649	8.49
May-23	6.71	0	1351	1092	8781.5	0.8	10155	7.52
Jun-23	6.71	0	1210	1092	7865	0.8	9616	7.95
Jul-23	6.71	0	1233	1092	8014.5	0.8	13358	10.83

Table 7 Electricity Bill -2 Shyamlal Pandviya Govt.PG College, Morar 2022-23

Monthly Electricity bill GOVT BOYS DEGREE COLLAGE Gwalior city-2022 IVRS-N2901019819								
Months	Sanctioned Load (kW)	MDI	kWh	Fixed charges (Rs)	Energy Charges (Rs)	Power Factor	Total bill (Rs)	Average Per unit Charges Rs/kWh
Aug-22	8	4	700	1248	4550	0.8	4826	6.89
Sep-22	8	3	2021	1248	13136.5	0.9	13154	6.51
Oct-22	8	3	987	1248	6310	0.9	7745	7.85
Nov-22	8	3	881	1248	5726.5	0.9	7237	8.21
Dec-22	8	3	813	1248	5284.5	0.9	6886	8.47
Jan-23	8	3	960	1248	6240	0.9	7961	8.29
Feb-23	8	3	975	1248	6337.5	0.9	8262	8.47
Mar-23	8	2	628	1248	4082	0.9	6051	9.64
Apr-23	8	2	826	1248	5369	0.9	7457	9.03
May-23	8	5	1226	1248	7969	0.9	9280	7.57
Jun-23	8	6	1234	1248	8021	0.9	9778	7.92
Jul-23	8	9	1386	1404	9009	0.9	18176	13.11

Table 8 Electricity Bill -3 Shyamlal Pandviya Govt.PG College, Morar 2022-23

Monthly Electricity bill SHYAM LAL COLLAGE Gwalior city - 2022 IVRS-N2901019817								
Months	Sanctioned Load (kW)	MDI	kWh	Fixed charges (Rs)	Energy Charges (Rs)	Power Factor	Total bill (Rs)	Average Per unit Charges Rs/kWh
Aug-22	12	8.32	1310	3025	8515	0.97	11709	8.94
Sep-22	12	8	1285	3025	8352	0.96	11638	9.06
Oct-22	12	3.1	443	3025	2956	0.97	6049	13.65
Nov-22	12	3.9	500	3025	3250	0.97	6313	12.63
Dec-22	12	3.1	423	3025	2749.5	0.97	5911	13.97
Jan-23	12	3.1	571	3025	3656	0.96	7165	12.55
Feb-23	12	4.8	560	3025	3640	0.98	6962	12.43
Mar-23	12	3.4	573	3025	3724.5	0.97	7170	12.51
Apr-23	12	4.4	541	3025	3516.5	0.99	6996	12.93
May-23	12	5.8	694	3025	4511	0.96	7379	10.63
Jun-23	12	9.2	1129	3025	7338.5	0.98	10327	9.15
Jul-23	12	9.3	1025	3025	6662.5	0.97	10838	10.57

Table 9 Electricity Bill -4 Shyamlal Pandviya Govt.PG College, Morar 2022-23

Monthly Electricity bill SLP COLLAGE Gwalior city - 2022 IVRS-N2901019193								
Months	Sanctioned Load (kW)	MDI	kWh	Fixed charges (Rs)	Energy Charges (Rs)	Power Factor	Total bill (Rs)	Average Per unit Charges Rs/kWh
Aug-22	10	1	199	1560	1300	0.8	2895	14.55
Sep-22	10	6	200	1560	1300	0.9	2872	14.36
Oct-22	10	0	200	1560	1300	0.9	2904	14.52
Nov-22	10	0	200	1560	1300	0.9	2914	14.57
Dec-22	10	0	200	1560	1300	0.8	2948	14.74
Jan-23	10	0	200	1560	1300	0.8	2985	14.93
Feb-23	10	0	200	1560	1300	0.8	3022	15.11
Mar-23	10	6	200	1560	1300	0.9	3063	15.32
Apr-23	10	2	200	1560	1300	0.9	3103	15.52
May-23	10	6	200	1560	1300	0.9	2862	14.31
Jun-23	10	11	386	1716	1300	0.9	3079	7.98
Jul-23	10	6	238	1560	1300	0.9	2964	12.45

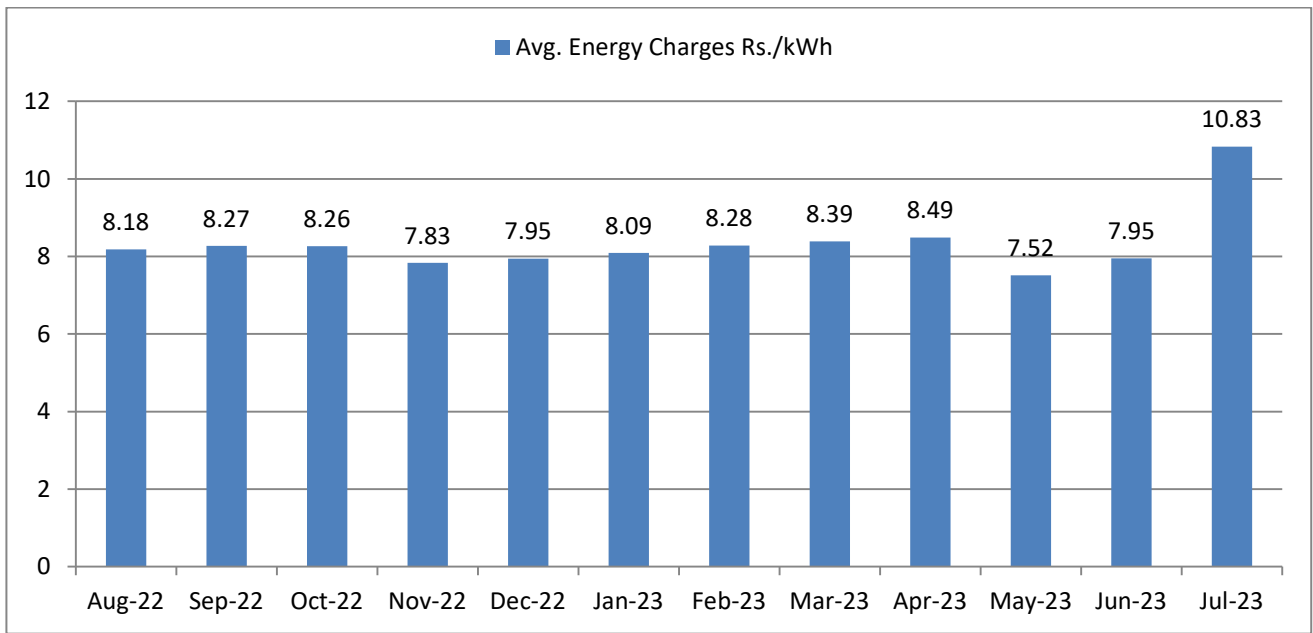


Figure 7 Per Unit Charges of IVRS-N2901019815

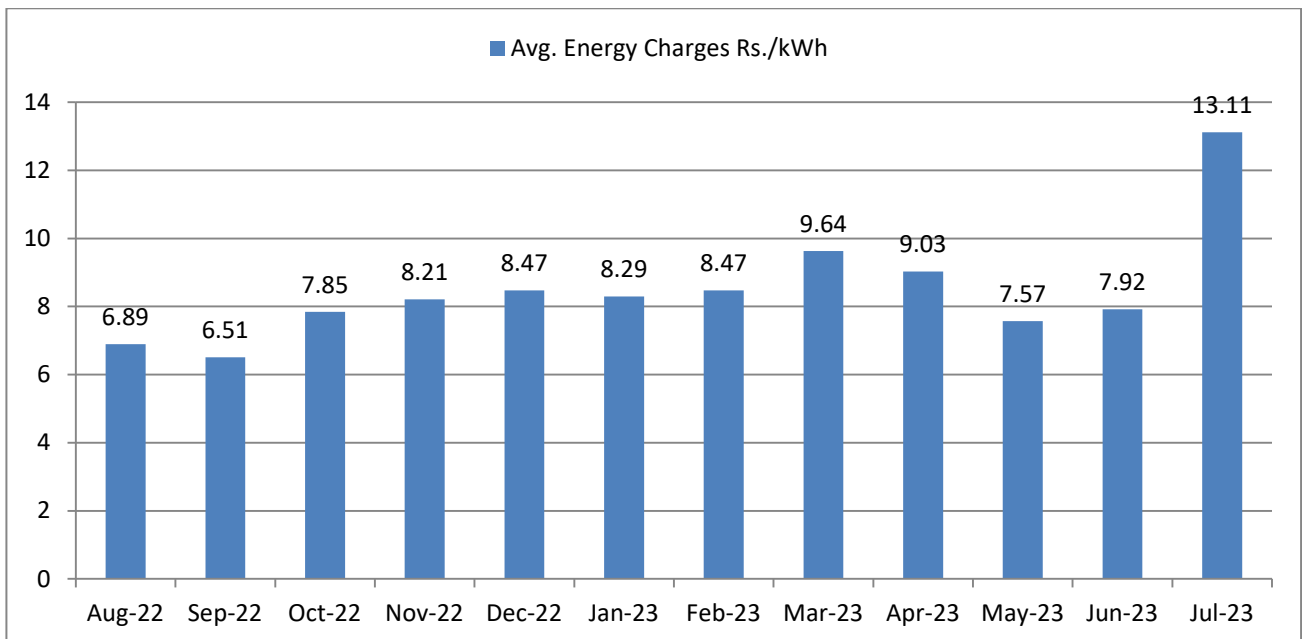


Figure 8 per Unit Charges for Meter - IVRS-N2901019819

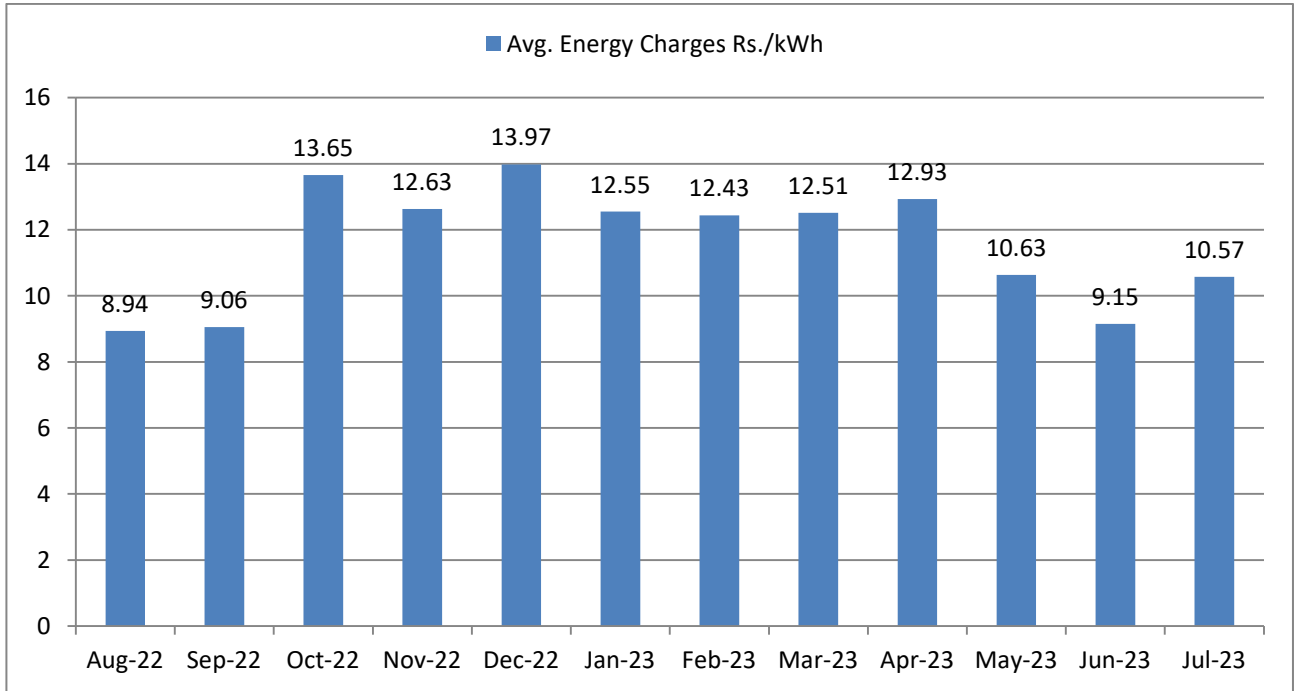


Figure 9 Per Unit Charges for Meter - IVRS-N2901019817

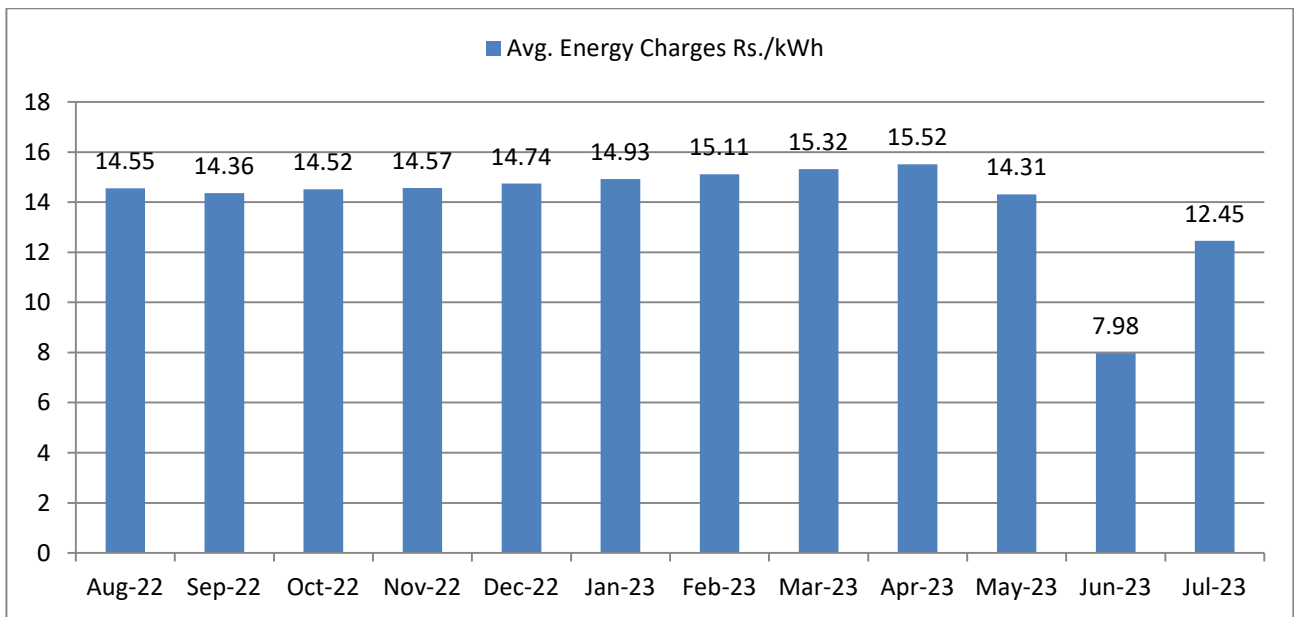


Figure 10 Per Unit Charges for Meter - IVRS-N2901019193

3.2 OBSERVATIONS & COMMENTS:

- As per electricity bills observation and analysis, **Total Sanction load is 28 kW with 5 Nos. of connection** in College premises.
- As per electricity bills observation and analysis from **electricity unit (kWh) consumed is 50578 kWh for** electricity bill in college premises.
- As per electricity bills observation and analysis **Total 12-month bill Paid is Rs. 4, 43,123.00.**
- As per electricity bills observation and analysis, **electricity bill Power Factor varies from 0.80-0.98.**

CHAPTER-4

POWER MEASUREMENT AND ANALYSIS

4.1 Power Measurement

Power measurement was done in the campus by the audit team. Power is measured at the transformer section.

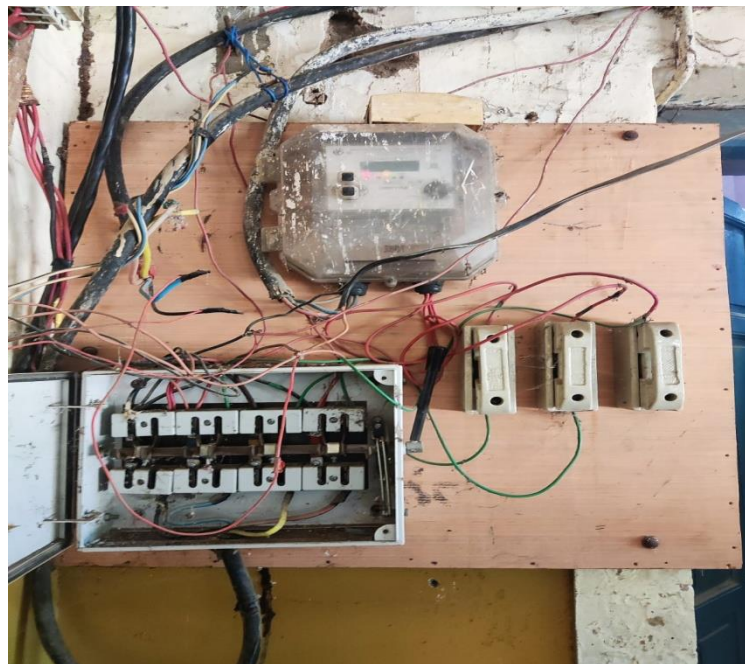


Figure 11, Meter at various buildings

Power is also measured at the Panels. The figure below shows the reading on the panels which was also measured by the auditor.

CHAPTER - 5

LIGHTING SYSTEM

5.1 Lighting Fixtures: :

The SLP Govt. P.G. College, Morar, Gwalior has high lighting load and various type of indoor and outdoor lighting fixture are installed in college campus. The lux measurement was also done at the time of audit. All the parameters are given in the below table:

Table 10 Different type of lighting fixture

Govt. SLP College, Morar , Dist. Gwalior							
Sr. No.	Location	Location of Fixtures	Types of Lighting	No. of Lighting fixture	Power (W)	Total Power (W)	Lux Level
	Admin Building	Main Clerical Room	LED Bulb	2	9	18	75-90
		Main Clerical Room	Tube light T8	1	32	32	75-90
		Cabin Nr Main Clerical Room	T12	1	40	40	80-120
		Cabin Nr Main Clerical Room	T8	1	32	32	80-120
		Store Room	LED Bulb	1	9	9	90-140
		Store Room	Tube light T8	1	40	40	90-140
		Account Office	Tube light T8	3	32	96	180-230
		Fee Room	LED	1	20	20	70-120
		Fee Room	Tube light	1	30	30	70-120
		Scholarship Room	Tube light T12	1	40	40	130-150
		Scholarship Room	Tube light T8	2	30	60	130-150
		Principal Room	LED Tube light	1	20	20	45-105
		Principal Room	LED	7	20	140	110-300
		Principal Room	CFL	3	20	60	110-300
	Comm. Computer Lab.	Comm. Computer Lab.	LED	4	20	80	60-90
		Comm. Computer Lab.	Tube light T8	1	30	30	80-100
		Comm. Computer Lab.	Tube light T12	1	40	40	80-100
		Class Room 22	Tube light 12	1	40	40	50-90
		Class Room 22	Incandescent Lamp	2	40	80	50-90
		Class Room 21	Incandescent Lamp	2	200	400	40-400
		Class Room 21	LED Tube light	2	20	40	50-70
		Outdoor		4	50	200	200-250
		Maths Smart Class	Tube light T8	1	30	30	50-80
		Conference Room	Tube light T8	8	30	240	80-110
		Career Guidance Cell	LED Tube light	2	20	40	90-130
		Career Guidance Cell	LED Bulb	1	9	9	90-130
	Commerce	Commerce Dept.	Tube light T8	2	30	60	90-120



Dept.	Political Science	LED Tube light	1	20	20	90-110	
	Political Science	LED Bulb	2	9	18	90-110	
	English Dept.	LED Bulb	3	9	27	40-190	
	Smart Class	LED Bulb	4	9	36	160-200	
Old Building	Science Dept. Chem. Room	LED Bulb	1	9	9	40-90	
	Science Dept. Chem. Room	Tube light T12	2	40	80	40-90	
	Science Dept. Chem. Room	LED Tube light	10	20	200	20-50	
	Science Dept. Chem. Room	LED Bulb	8	9	72	20-50	
	Science Dept. Chem. Room	Tube light T8	1	30	30	30-50	
	Exam Control Room	LED Tube light	5	20	100	40-110	
	Exam Control Room	Tubelight T8	5	30	150	40-110	
	Physics Dept.	LED Tube light	2	20	40	60-110	
	Physics Dept.	Tubelight T8	1	30	30	60-110	
	Computer Lab.	LED Round	6	6	36	400-500	
	Computer Lab.	LED Tube light	2	20	40	400-500	
	Sociology	Tube light T8	1	30	30	50-80	
	Zoology	Tube light T12	4	30	120	450-590	
	NCC+ Dept. of Sports	Tube light T8	3	30	90	20-50	
	Maths Dept.	LED Tube light	3	20	60	100-250	
	Botany Dept.	Tube light T8	4	30	120	100-450	
	Botany Dept.	LED Tube light	2	20	40	100-450	
	New Physics Lab.	LED Tube light	18	20	360	250-300	
	Corridor	LED Tube light	13	20	260	300-350	
	Geography Dept.	LED Tube light	1	20	20	100-150	
	Geography Lab.	LED Tube light	2	20	40	80-120	
	NCC	LED Tube light	2	20	40	120-160	
	New Building	Class Room 1	LED Tube light	4	20	80	90-220
		Class Room 2	LED Tube light	4	20	80	90-220
Class Room 3		LED Tube light	4	20	80	90-220	
Class Room 4		LED Tube light	4	20	80	90-220	
Library Building	Library	LED Tube light	2	20	40	165-180	
	E-Library	LED Tube light	1	20	20	60-130	
		LED Bulb	1	9	9	65-90	
	Room Book Shelf	Tube light T8	7	30	210	70-90	
	Room Book Shelf	LED Tube light	2	20	40	70-90	
	Corridor	LED Tube light	2	20	40	70-90	
	Library Room	Tube light T12	2	40	80	20-70	
	Corridor	Tube light T12	2	40	80	80-140	
Total Power Consumption in kW			4.833				
Total no. of Lighting Fixture			198				

5.2 OBSERVATIONS & COMMENTS:

- We **appreciate to use LED Lighting luminaries** at some location as per site visit.
- We observed during visit, few Lights were T5 consuming high electricity
- We **are suggesting to purchases all electrical** equipment as per star leveling program by Bureau of energy efficiency, and will get huge amount of electricity saving.
- We are suggesting to conduct regular **Cleaning and maintenance of lighting fixtures** in every 5-6 months to increase performance of Lighting and also improve their Lux level.
- We will get energy saving approximately **5702 kWh** per year and also will get amount saving approximately **Rs. 56340** per year by replacing conventional T5 Tube light with new energy efficient LED Tube light .
- As per data collection and site visit, Total Connected lighting load at College Campus is **4.83 kW**.
- As per data collection and observation, **Total no. of lighting fixture is 198**.

LED TUBE LIGHT PROPOSAL

Proposal 1

Quotation for replacement of 198 Nos. existing 28 W T5 tube light with Energy efficient Energy Efficient 18 W LED Tube light in College.

Energy Saving	
Total no of Approximate 30 W T5	198
Replacement of 30 Watt T5 with capacity of 18 Watt LED	18
Average daily running time for 30 Watt T5 in hour	8
Total Energy Consumed by 30 W T5	30
Total Energy Consumed by 198 no. of 28 Watt T5 kWh per day	47.5
Annual Energy Consumed by 28 Watt T5 (300 working Days) kWh	14256
Annual Energy Consumed by 198 no. of 18 Watt LED in kWh	8554
Prospective Annual Energy Savings in kWh	5702
Annual Savings in Rupees (taking Average Rs.9.88 Per unit charge for 300 day a year)	56340
Initial investment required for 308 no. of 18 Watt LED (Price for @ 550 per 18 Watt)	108900.00
Payback Period in months only	23
Life of the project years	15
Depreciation Cost Rs	7260.0
ROI {(Net annual savings – Depreciation cost)/ Investment} x 100%	45

CHAPTER-6 FAN SYSTEM

There is various ceiling fan installed at various location in the **SLP Govt. P.G. College, Morar, Gwalior** and they also contribute very high electricity consumption. All of the fans are conventional and hence high energy consuming.

6.1 Details of Different type of fans:

The detail of the fans is given in the below table:

Table 11 Different type of Fan

SLP Govt. P.G. College, Morar, Gwalior						
Sr. No.	Location	Location of Fan	Types of Fan	No.of Fan	Power (W)	Total Power (W)
	Admin Building	Main Clerical Room	Ceiling Fan	1	70	70
		Attached Room to Main Clerical Room	Stand Fan	1	50	50
		Store Room	Padestel Fan	1	70	70
		Store Room	Exhaust Fan	1	60	60
		Account Section	Ceiling Fan	1	70	70
		Fee Room	Ceiling Fan	1	70	70
		Scholarship Room	Ceiling Fan	2	70	140
		Principal Room	Ceiling Fan	1	70	70
		Principal Room	Ceiling Fan	3	70	210
	Comm.Computer Lab.	Comm.Computer Lab.	Ceiling Fan	2	70	140
		Class Room 22	Ceiling Fan	6	70	420
		Class Room 21	Ceiling Fan	6	70	420
		Maths Smart Class	Ceiling Fan	6	70	420
		Conference Room	Ceiling Fan	12	70	840
		Career Guidance Cell	Ceiling Fan	2	70	140
	Commerce Dept.	Commerce Dept.	Ceiling Fan	2	70	140
		English Dept.	Ceiling Fan	2	70	140
		Smart Class	Ceiling Fan	2	70	140
	Old Building	Science Dept. Chemistry Room	Ceiling Fan	4	85	340
		Science Dept. Chemistry Room	Ceiling Fan	2	70	140
		Science Dept. Chemistry Room	Ceiling Fan	1	70	70
		Science Dept. Chemistry Room	Ceiling Fan	2	70	140
		Computer Lab.	Ceiling Fan	4	70	280
		Sociology	Ceiling Fan	1	70	70
		Zoology	Ceiling Fan	5	70	350
		NCC+ Dept. of Sports	Ceiling Fan	1	70	70
		Maths Dept.	Ceiling Fan	2	70	140
		Botany Dept.	Ceiling Fan	5	70	350
		New Physics Lab.	Ceiling Fan	9	70	630

		New Chemistry Lab.	Ceiling Fan	9	70	630
		Geography Lab.	Ceiling Fan	3	70	210
		NCC	Ceiling Fan	2	70	140
	New Building	Class Room 1	Ceiling Fan	6	70	420
		Class Room 2	Ceiling Fan	6	70	420
		Class Room 3	Ceiling Fan	6	70	420
		Class Room 4	Ceiling Fan	6	70	420
	Library Building	Library	Ceiling Fan	1	70	70
		E-Library	Ceiling Fan	1	70	70
		Room Book Shelf	Ceiling Fan	6	70	420
		Corridor	Ceiling Fan	2	70	140
		Library Room	Ceiling Fan	6	70	420
		Corridor	Ceiling Fan	2	70	140
Total Power Consumption in kW				5.07		
Total no. of Fan Fixture				72		

6.2 OBSERVATIONS & COMMENTS

- We observed, most of the Fan was conventional.
- We are recommended to **replace 72 no. of 70 W Ceiling fan with New Super energy efficient 5 star rated BLDC ceiling fan** and will get huge amount of electricity saving as per Star leveling program by Bureau of Energy Efficiency.
- We are **suggesting to purchases new energy efficient BLDC fan as per Star leveling program by Bureau of Energy Efficiency, and will get huge amount of electricity saving.**
- Energy Saving calculation **and recommendation for the existing Conventional** Ceiling fans with BLDC super energy efficient fan has been given in this report.
- We are suggesting **conducting regular Cleaning and maintenance** of Fan at least in every 6 months to increase performance of Fan.
- We are also suggesting improving their Air delivery of Fan by Replacing New energy efficient BLDC Fan as per 5 stars leveling of Bureau of energy efficiency.
- We will get energy saving approximately **6250 kWh** per year and also will get amount saving approximately **Rs. 61746** per year by replacing conventional Fan with new energy efficient BLDC fan.
- The total load for Ceiling Fan is **5.07 kW**.
- Total No. of Fan fixtures are **72**.



CEILING FAN PROPOSAL

Proposal 1

Replacement of 72 Nos. Existing 70 W Ceiling Fan with Energy efficient Energy Efficient 28 W BLDC Fan in College.

Energy Saving	
Total no of Approximate 70 W Ceiling Fan	72
Replacement of 70Watt Ceiling Fan with capacity of 28 Watt BLDC Fan	28
Average daily running time for 70 Watt Ceiling Fan in hour	8
Total Energy Consumed by 70 W Ceiling Fan	70
Total Energy Consumed by 72 no. of 70 Watt Ceiling Fan kWh per day	40.32
Annual Energy Consumed by 70 Watt Ceiling Fan (300 working Days) kWh	11088
Annual Energy Consumed by 72 no. of 28 Watt Ceiling Fan in kWh	4838
Prospective Annual Energy Savings in kWh	6250
Annual Savings in Rupees (taking Average Rs. 9.88 Per unit charge for 300 day a year)	61746
Initial investment required for 72 no. of 28 Watt Ceiling Fan(Price for BLDC Fan @ 2800 per 28 Watt BLDC Fan)	201600
Payback Period in months only	39
Life of the project years	15
Depreciation Cost Rs	13440
ROI {(Net annual savings – Depreciation cost)/ Investment} x 100%	24

CHAPTER -7

AIR CONDITION SYSTEM

There are 7 Nos. of AC are installed at various locations in the College, and they also contribute electricity consumption.

7.1 Different Type of Air-conditions

Table 12 Different type of equipment system

Air- Conditioning System Location Wise SLP Govt. P.G. College Morar									
Sr. No	Location	No. of AC	Air Conditioning				Power Consumption		Specific Power Consumption
			Type	Star	Make	Ton	In W	Total Power (Toneg)	kW/TR
1	Principal Cabin	1	Split	0	Samsung	1.5	1730	1.5	
2	Computer Lab.	6	Split	3	Samsung	1.5	1730	9	
Total no. of AC		7	TOTAL POWER CONSUMPTION in (Tons)				10.5		
			TOTAL POWER CONSUMPTION in (kW)				10.3		

7.2 OBSERVATIONS & COMMENTS

- Total Connected load **10.3 kW**.
- We suggest to **purchase equipment's as per Star leveling program** by Bureau of Energy Efficiency 2020, and will get huge amount of electricity saving.
- Maintenance of all the equipment's should be done regularly.

CHAPTER - 8

OTHER EQUIPMENTS LOAD

There are different types of other equipment's like Printer, PC, Water Cooler, Refrigerator and other lab equipment's are installed at various locations in the College, Indore and they also contribute electricity consumption.

8.1 Different Type Other Equipment's

Table 13 Different type of equipment system

Other equipments location wise SLP Govt P.G. College Morar, Gwalior						
Sr. No.	Location	Location of Product	Type of Product	Number of Product	Power (Watts)	Total Power (Watts)
1			PC	48	100	4800
2			Printer	10	650	6500
3			TV 32" Monitor	3	41	123
4			Fridge	7	350	2450
5			Projector	4	350	1400
6			Photocopier	3	350	1050
7			Drinking water cooler	5	575	2875
8			Air Cooler Small	9	200	1800
9			Air Cooler	13	500	6500
			Total Power in kW			27.5

8.2 OBSERVATIONS & COMMENTS

- Total Connected load **27.5 kW**.
- We suggest to **purchase equipment's as per Star leveling program** by Bureau of Energy Efficiency 2020, and will get huge amount of electricity saving.
- Maintenance of all the equipment's should be done regularly.

CHAPTER -9

PUMPING SYSTEM

Submersible Pumps

There is 2 no. of 3 HP capacity of submersible pump installed within college campus for drinking water, Flushing and gardening purpose.

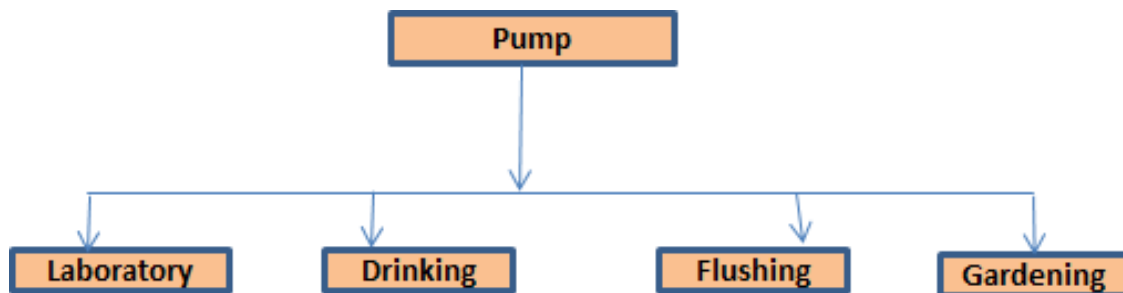


Table 14 Major usage area of pump

Pumps Details:

Pump Details SLP Govt. P.G. College, Morar, Gwalior						
Sr. No.	Location	Location of Pump	Types of Pumps	No. of Pump	Power (HP)	Total Power (KW)
1	College Campus	Back side	Submersible Pump	2	3	2.25
Total Power in kW						4.50

Observation and Comments

- We observed during Energy Audit and site visit, **2 Pumps, of Capacity 3HP within** College campus for drinking water, Flushing and gardening purpose.
- Power consumption of 3 HP pump was **4.50 kW** as per site visit and measurement.
- We are suggesting purchasing **5 star rated pumps and will get huge** amount of saving as per Star leveling program by Bureau of Energy Efficiency2020.
- We are **suggesting installing Solar Pumping system and** will get huge amount of savings.

GENERAL TIPS FOR ENERGY CONSERVATION IN DIFFERENT UTILITIES SYSTEMS

Electricity:

- Schedule your operations to maintain a high load factor
- Minimize maximum demand by tripping loads through a demand controller
- Use standby electric generation equipment for on-peak high load periods.
- Correct power factor to at least 0.99 under rated load conditions.
- Set transformer taps to optimum settings.
- Shut off unnecessary computers, printers, and copiers at night.

Motors:

- Properly size to the load for optimum efficiency.
- (High efficiency motors offer of 4 - 5% higher efficiency than standard motors)
- Check alignment.
- Provide proper ventilation
- (Forevery10°C increase in motor operating temperature over recommended peak, the motor life is estimated to be halved)
- Check for under-voltage and over-voltage conditions.
- Balance the three-phase power supply.
- (An Imbalanced voltage can reduce 3 - 5% in motor input power)
- Demand efficiency restoration after motor rewinding.

Fans:

- Use smooth, well-rounded air inlet cones for fan air intakes.
- Avoid poor flow distribution at the fan inlet.
- Minimize fan inlet and outlet obstructions.
- Clean screens, filters, and fan blades regularly.
- Use aero foil-shaped fan blades.
- Minimize fan speed.
- Use variable speed drives for large variable fan loads.

Pumps:

- Operate pumping near best efficiency point.
- Modify pumping to minimize throttling.
- Adept to wide load variation with variable speed drives or sequenced control of smaller units.
- Stop running both pumps -- add an auto-start for an on-line spare or add a booster pump in the problem area.
- Use booster pumps for small loads requiring higher pressures.
- Increase fluid temperature differentials to reduce pump ingrates.
- Repair seals and packing to minimize water waste.
- Balance the system to minimize flows and reduce pump power requirements.
- Use siphon effect to advantage: don't waste pumping head with a free-fall (gravity) return.

Lighting:

- Reduce excessive illumination levels to standard levels using switching; decamping, etc. (Know the electrical effects before doing decamping.)
- Aggressively control lighting with clock timers, delay timers, photocells, and/or occupancy sensors.
- Install efficient alternatives to incandescent lighting, mercury vapor lighting, etc. Efficiency (lumens/watt) of various technologies range from best to worst approximately as follows: low pressure sodium, high-pressure sodium, metal halide, fluorescent, mercury vapor, incandescent.
- Select ballasts and lamps carefully with high power factor and long-term efficiency in mind.
- Upgrade obsolete fluorescent systems to Compact fluorescents and electronic ballasts
- Consider lowering the fixtures to enable using less of them.
- Consider day lighting, skylights, etc.
- Consider painting the walls a lighter color and using less lighting fixtures or lower wattages.
- Use task lighting and reduce background illumination.
- Re-evaluate exterior lighting strategy, type, and control. Control it aggressively.
- Change exit signs from incandescent to LED.

DG Sets:

- Optimize loading
- Use waste heat to generate steam/hot water /power an absorption chiller or preheat process or utility feeds.

- Clean air filters regularly
- Insulate exhaust pipes to reduce DG set room temperatures
- Use cheaper heavy fuel oil for capacities more than 1MW

Buildings:

- Seal exterior cracks/openings/gaps with caulk, gasketing, weather stripping, etc.
- Consider new thermal doors, thermal windows, roofing insulation, etc.
- Install windbreaks near exterior doors.
- Replace single-pane glass with insulating glass.
- Consider covering some window and skylight areas with insulated wall panels inside the building.
- If visibility is not required but light is required, consider replacing exterior windows with insulated glass block.
- Consider tinted glass, reflective glass, coatings, awnings, overhangs, draperies, blinds, and shades for sunlit exterior windows.
- Use landscaping to advantage.
- Add vestibules or revolving doors to primary exterior personnel doors.
- Use intermediate doors in stairways and vertical passages to minimize building stack effect.
- Use dock seals at shipping and receiving doors.
- Bring cleaning personnel in during the working day or as soon after as possible to minimize lighting and HVAC costs.

Waste & Waste water:

- Recycle water, particularly for uses with less-critical quality requirements.
- Recycle water, especially if sewer costs are based on water consumption.
- Balance closed systems to minimize flows and reduce pump power requirements.
- Eliminate once-through cooling with water.
- Use the least expensive type of water that will satisfy the requirement.
- Fix water leaks.
- Test for underground water leaks. (It's easy to do over a holiday shutdown.)
- Check water overflow pipes for proper operating level.



- ❑ Automate blow down to minimize t.
- ❑ Provide proper tools for wash down -- especially self-closing nozzles.
- ❑ Install efficient irrigation.
- ❑ Reduce flows at water sampling stations.
- ❑ Eliminate continuous overflow at water tanks.
- ❑ Promptly repair leaking toilets and faucets.
- ❑ Use water restrictors on faucets, showers ,etc.
- ❑ Use self-closing type faucets in restrooms.
- ❑ Use the lowest possible hot water temperature.
- ❑ Use freeze protection valves rather than manual bleeding of lines.
- ❑ Consider leased and mobile water treatment systems, especially for deionized water.
- ❑ Seal sumps to prevent seepage inward from necessitating extra sump pump operation.
- ❑ Install pretreatment to reduce TOC and BOD surcharges.
- ❑ Verifythewatermeterreadings.(You'dbeamazedhowlongameterreadingcanbeestimatedafter the meter breaks or the meter pit fills with water!)
- ❑ Verify the sewer flows if the sewer bills are based on them.

Miscellaneous:

- ❑ Meter any unmetered utilities. Know what normal efficient use is. Track down causes of deviations.
- ❑ Shut down spare, idling, or unneeded equipment.
- ❑ Make sure that all of the utilities to redundant areas are turned off -- including utilities like cooling water.
- ❑ Install automatic control to efficiently coordinate, chillers, cooling tower cells, etc.
- ❑ Renegotiate utilities contracts to reflect current loads and variations.
- ❑ Consider buying utilities from neighbors, particularly to handle peaks.
- ❑ Minimize use of flow bypasses and minimize bypass flow rates.
- ❑ Consider alternatives to high-pressure drops across valves.
- ❑ Turn off winter heat tracing that is on in summer.

Annexure - 1

Standard Lux Level

Activity	Illumination (lux, lumen/m ²)
Public areas with dark surroundings	20 - 50
Simple orientation for short visits	50 - 100
Working areas where visual tasks are only occasionally performed	100 - 150
Warehouses, Homes, Theaters, Archives	150
Easy Office Work, Classes	250
Normal Office Work, PC Work, Study Library, Groceries, Show Rooms, Laboratories	500
Supermarkets, Mechanical Workshops, Office Landscapes	750
Normal Drawing Work, Detailed Mechanical Workshops, Operation Theatres	1,000
Detailed Drawing Work, Very Detailed Mechanical Works	1500 - 2000
Performance of visual tasks of low contrast and very small size for prolonged periods of time	2000 - 5000
Performance of very prolonged and exacting visual tasks	5000 - 10000
Performance of very special visual tasks of extremely low contrast and small size	10000 - 20000

Annexure - 2

Energy saver for air conditioning system



PATENT
PUBLISHED



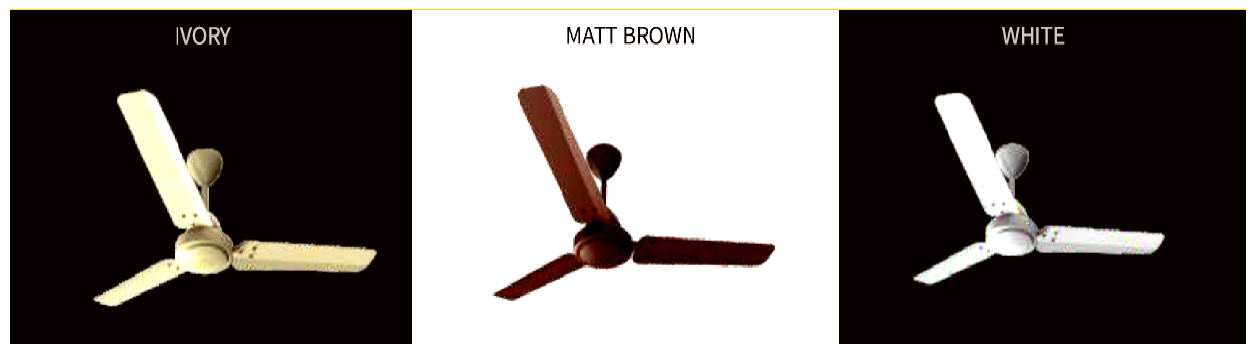
Airtron is the World's First & Only Programmable, Dual-Sensor Driven Microprocessor which saves up to 35% Electricity on all Air Conditioners with Precision Control of Set Temperature and a payback of barely 4-6 months.

IMPORTANT VALIDATIONS N.B. The Set Temp. was the Same WITH / WITHOUT the Airtron.				
SL. NO.	NAME OF THE COMPANY	COUNTRY	AC TYPE	SAVINGS
1	ENERGY EFFICIENCY SERVICES LTD . (EESL GOVT. OF INDIA)	INDIA	SPLIT	44.00%
2	L.G. ELECTRONICS INDIA LTD.	INDIA	SPLIT (INVERTER)	26.00%
3	VIDEOCON TELECOM	INDIA	SPLIT	20.00%
4	TATA COMMUNICATION LTD.	INDIA	SPLIT	28.30%
5	LARSEN & TOUBRO LTD.	INDIA	SPLIT	25.80%
6	TATATELE SERVICES LTD.	INDIA	SPLIT	33.00%
7	TATA POWER LTD.	INDIA	SPLIT	37.50%
8	ASHOK LEYLAND LTD.	INDIA	WINDOW	29.40
9	ZENITH ENERGY (BEE, ACCREDITED ENERGY AUDITOR)	INDIA	SPLIT	37.00%
10	ACCENTURE SERVICES PVT. LTD.	INDIA	SPLIT	37.00%
11	M/S. UNIC MAGNATE	INDIA	SPLIT	58.00%
12	SATURN PYRO (UTIM REGISTRATION OFFICE)	MALAYSIA	CEILING-SPLIT	36.00%
13	SATURN PYRO (AT MALAYSIA POLICE H.Q.)	MALAYSIA	WALL -SPLIT	34.00%
14	CPE ENERGY SDN BHD	MALAYSIA	SPLIT	57.00%

Annexure – 3

Super Energy efficient BLDC Ceiling Fan

	900 mm	1050 mm	1200 mm	1400 mm
Warranty (Years)	3 Years	3 Years	3 Years	3 Years
Blade Span (mm/inch)	900/36	1050/42	1200/48	1400/56
RPM	450	430	350	270
Service Value	7.1	6.6	7.8	7.7
Input Voltage (V)	140-285	140-285	140-285	140-285
Power Consumption (W)	28	32	28	35
Frequency (Hz)	48-52	48-52	48-52	48-52
Air Delivery (CMM)	200	210	220	270
Power Factor	>0.98	>0.98	>0.98	>0.99
No. of Blades	3	3	3	3
Bearing (Double)	Deep Groove Double Sided Steel Shielding			
Remote Control (12 Keys)	Speed Control, Boost Mode, Timer and Sleep Mode			



Comparison Between Ordinary,5 Star Rated and Super-Efficient Fans

Parameters	Ordinary Fan	5 Star Rated Fan	Super-Efficient Fan
Wattage	75	50	28
RPM (speed)	380	330	360-380
CMM (air delivery)	230	210	220-230
Power factor	>0.9	>0.95	>0.99
Regulator	Yes	Yes	Not Required (Remote controlled)
Input Voltage	230	230	140-285V
Warranty	1-2 year	1-2 year	3 years
MRP	1300-1600	1800-2500	3690