DETAILED ENERGY AUDIT REPORT

Year-2022-2023

GOVT. P.G. COLLEGE

Madhav Rao Schindia Road, Dist.-Guna (M.P.) Pin code 473001

CONDUCTED BY:

SEES ENERGY SOLUTION

296, Shivampuri Colony, Vishal Urban Block A, Flat No. 204, Indore (M.P).-452001

Email Address: seesenergysolutions@gmail.com

Contact number: 98275 78219

Project Title:	**Detailed Energy Audit**
Organization:	**SEES ENERGY SOLUTION.**
Client:	**Govt. P.G. College , Guna** - 473001 Madhya Pradesh, India.
Prepared By	
1. Mr. Rambabu Raghuvanshi (Certified Energy Auditor) 2. Mr. Harshal Mahajan (Energy Consultant)	

SEES ENERGY SOLUTION, INDORE

MR. RAMBABU RAGHUWANSHI
EA-29059
Certified Energy Auditor

Acknowledgement

SEES ENERGY SOLUTION. expresses sincere thanks to the management of **Govt. PG College, Guna** for inviting SEES ENERGY SOLUTION. Conducts comprehensive Energy Audit 2022-2023 of their Premises at **Govt. PG College, Guna**. The field study of this audit was carried out on 30-Sep-2023.

The officials of **Govt. PG College, Guna** have coordinated and helped to the audit team during the field study and measurement. SEES ENERGY SOLUTION .express special thanks to the following persons of Govt. Girls College, Indore.

Internal Audit Team		
1	Principal	Dr. B.K. Tiwari
2	IQAC& NACC Coordinator	Dr. Archana Shrotriya

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.

SEES ENERGY SOLUTION, INDORE

MR. RAMBABU RAGHUWANSHI
EA-29059
Certified Energy Auditor

Ref.No.: SEES/EA/23-24/S/03 Dated 9/11/2023

ENERGY AUDIT
Certificate

This is to certify that **GOVT. P.G. COLLEGE, GUNA** has conducted, Energy audit in the academic year 2022 - 2023 to assess the energy 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. **SEES ENERGY SOLUTION** has verified campus data of **GOVT. P.G. COLLEGE, GUNA** This Energy Audit are also aimed to assess impact of Energy saving initiatives for maintenance of the campus eco-friendly.

Mr. Rambabu Raghuwanshi

EA-29059
Bureau of Energy efficiency
Ministry of Power Govt. of India

List of Contents

Table of Contents

List of Table

List of figures

ABBREVIATION

O&M	Operation and Maintenance
kW	Kilo Watt
P.F	Power Factor
kVA	kilo Volt Ampere
kWh	kilowatt Hour
kVAh	kilovolt Amperes Hour
kVAr	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	-	Govt. P.G. College.
Location	-	GUNA (M.P), India
Owner	-	Government
Contact Person	-	Dr. B.K. Tiwari
No. of Shifts	Nos.	1
Daily Operating Hours	Hrs./day	8
Annual Working Days	Days/yr.	300
Source of Electricity	-	MPPKVVCL
Total connected maximum Load	(kW)	83 kW
Total Sanctioned Load	(kW)	81 kW
Average Energy Charge in per unit	Rs. /kWh	**10.00**

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

The major equipment's installed in **Govt. PG College, Guna.** 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	12.81	15.38%
2	Fan System	31.24	37.52%
3	Air conditioning System	17	20.42%
4	Water Pumping	4.50	5.41%
5	Other Appliances	17.71	21.27%
Total Connected Load		***83.26***	

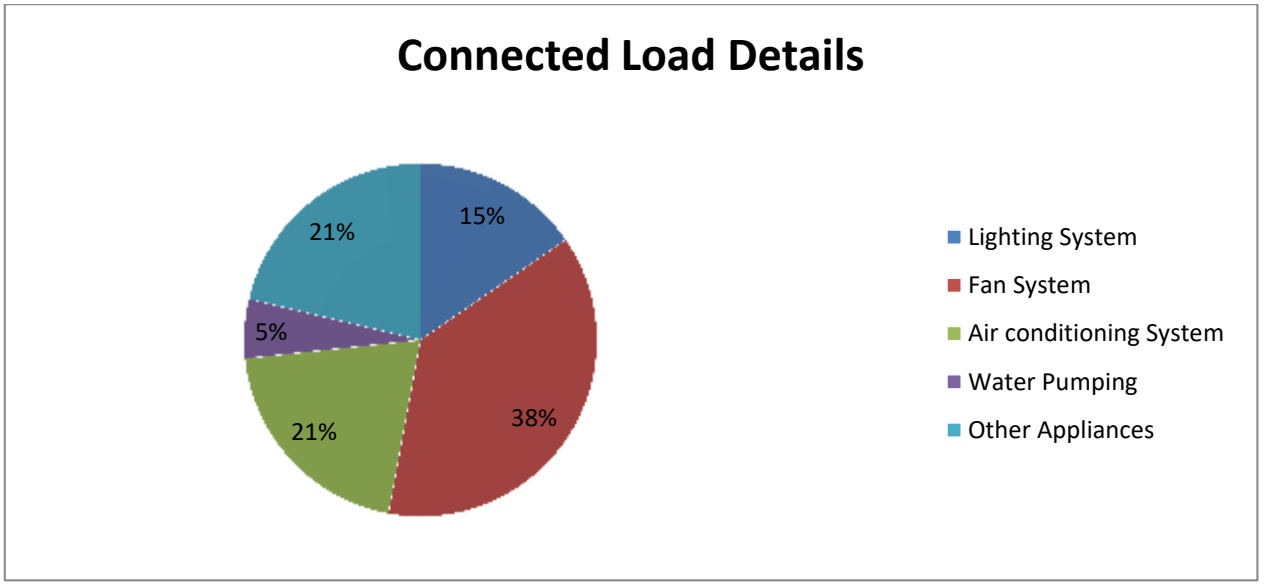

Figure 1. Connected Load details of campus in different zone

- It is observed and analyzed that there are **8 major connection of total sanction load is 81 kW** in College premises.
- As per electricity bills observation and analysis is from **electricity unit (kWh) 92067 kWh for** electricity bill in college premises.
- As per electricity bills observation and analysis **Total 12-month bill Paid is & Rs. 832447.**
- As per electricity bills observation and analysis, **electricity bill Power Factor varies from 0.80-0.99, can be monitor & improve.**

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

b) Proposed Energy Saving Technologies with Cost Economics.

LIGHTING SYSTEM

- We **appreciate to use LED Lighting luminaries** at some location as per site visit.
- We observed during visit, few Lights were FTL 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 **5544 kWh** per year and also will get amount saving approximately **Rs. 5544** 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 **12.80 kW.**
- As per data collection and observation, **Total no. of lighting fixture is 557.**

Ceiling Fan System

- We observed that most of the Fans installed in campus were conventional.
- We are recommended to **replace 444 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 **44755 kWh** per year and also will get amount saving approximately **Rs. 447552.00** per year by replacing conventional Fan with new energy efficient BLDC fan.
- The total load for Ceiling Fan is **31.24 kW**.
- Total No. of Fan fixtures are **444.**

Pumping System

- We observed during Energy Audit and site visit**, 1 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 **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.

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)	**50299**	**kWh**
Total Amount of savings Rs	**5.02**	**Rs. In Lacs**
Total Amount of investments	**12.95**	**Rs. In Lacs**
Pay Back Period	**22**	**Months**

Summary of Energy Conservation Measures

Table 3. Summary of Energy Conservation Measures

S.No.	Energy Conservation Measures	Annual Savings		Investment	Payback
		kWh	Rs.	Rs.	Months
LED TUBE LIGHT					
1	Replace 105 no of Existing 40 W FTL Tube light with Energy efficient 18 W LED Tube light.	5544	55440	52500	11
CEILING FAN					
2	Replace 444 no of Existing 70 W Ceiling Fan with Energy efficient Energy Efficient 28 W BLDC Ceiling Fan.	44755	447552	1243200	33
		50299	502992	1295700	22

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 lead store commendations, 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.

Energyconservationisaworldwideobjectivetosavethehumanbeingfrompossibledisaster.Underthemandate of The Energy Conservation Act 2001, the Bureau of Energy Efficiency and Government of India are implementing various programmers 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.

Govt. PG College, Guna has engaged **SEES ENERGY SOLUTION.** 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 depart mental engineers& managers ,carrying out various field measurements, performance analysis and loss analysis covering all major energy consuming sections of **Govt. PG College, Guna.** 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 (4545 MECO)
- Digital Hygrometer 625 TESTO
- Digital Lux Meter (LX-101A HTCTM)
- Digital Anemometer (AVM -07HTC)
- IR Thermometers for temperature measurement FLUKE 61 (IR -50 to 1550ºC)
- Digital distance meter
- Measuring Tap meter

CHAPTER-2
SITE VISIT AND INSPECTION

2.1 College Details

Govt. Post Graduate College, Guna (M.P.) affiliated to Jiwaji University Gwalior is one of the most prestigious colleges of Gwalior division. Keeping the motto always in mind the college makes every effort to achieve excellence in academics and co-curricular activities.

The college which was established in 1957 and having faculties like arts, commerce & science.

VISION:
To provide the students quality education and to develop their personality by imparting moral education to them so as to make them responsible citizens of the country who can contribute effectively in nation building and social upliftment besides choosing a good profession.

MISSION:

- To provide excellent up-to-date knowledge to the students.
- To develop the personality of the students through extracurricular and sports activities.
- To strengthen the existing teaching learning methods to achieve excellence in Higher Education.
- To expand and strengthen the research facilities beneficial for all.

2.2 Site visit and field inspection

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

Figure 2. Law College Building

Figure 3. B-Block & Library Building

Figure 4. Lux Level Reading Measurement at site

2.3 Power Measurement

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

Figure 5. Different Meters in College Building

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

CHAPTER-3
ELECTRICITY BILL ANALYSIS

Govt. PG College, Guna 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. 832447** 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 4 Electricity Bill -1 Govt. P.G. College, IVRS- N2419054591

Monthly Electricity bill Govt. P.G. College Guna. - 2022-23 IVRS-N2419054591								
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	41.3	27.96	5477.8	9075	35605.7	0.98	42043.66	7.7
Sep-22	41.3	29.36	4737.6	9075	30794.8	0.98	37599.02	7.9
Oct-22	41.3	30.9	5349	9075	32654.6	0.96	41729.60	7.8
Nov-22	41.3	32.4	3277	9075	33162.2	0.97	42237.20	12.9
Dec-22	41.3	34	3684	9075	35584.8	0.96	44659.80	12.1
Jan-23	41.3	33.7	3777	9075	34854.5	0.95	43929.50	11.6
Feb-23	41.3	31.5	4612	9075	34253.2	0.95	43328.24	9.4
Mar-23	41.3	17.56	3651.8	9075	23736.7	0.95	32804.39	9.0
Apr-23	41.3	24.52	4778	9075	31057.9	0.96	39795.62	8.3
Jun-23	41.3	36.2	5895.2	9900	38318.8	0.96	48077.24	8.2
Jul-23	41.3	38.12	6670.6	10450	43358.9	0.95	62921.96	9.4
Aug-23	41.3	34.4	6282	9350	40833	0.97	57396.08	9.1
Sep-23	41.3	32.4	4733.6	9075	30768.4	0.98	46477.12	9.8
			62925.6				582999.4	

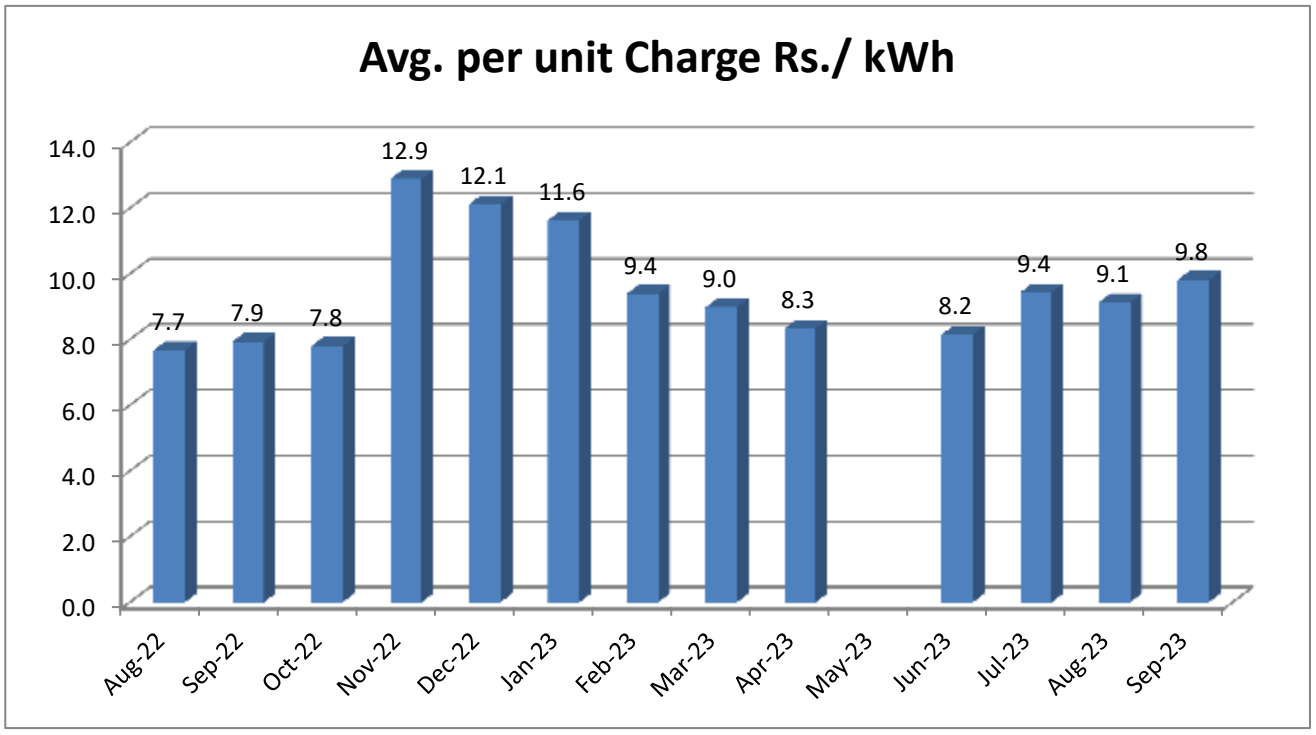

Figure 7. Per Unit Charges of IVRS- N2419054591

Table 5 Electricity Bill -2 Govt. P.G. College, Guna IVRS- N2419058383

Monthly Electricity bill Govt. P.G. College Guna. - 2022-23 IVRS-N2419058383								
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	9	1	117	1404	760.5	0.8	2176.2	18.6
Sep-22	9	1	117	1404	760.5	0.8	2176.2	18.6
Mar-23	9	4	1263	1404	8209.5	0.7	10906.81	8.64
Apr-23	9	4	1909	1404	12408.5	0.9	14135.12	7.40
May-23	9	3	1387	1404	9015.5	0.9	10686.77	7.70
Jun-23	9	11	1742	1716	11323	0.9	13684.38	7.86
Jul-23	9	11	2317	1716	15060.5	0.9	16792.55	7.25
Aug-23	9	11	2144	1716	13936	0.8	15584.11	7.27
Sep-23	9	11	790	1716	5135	0.8	6551.39	8.29
			11786				92693.53	

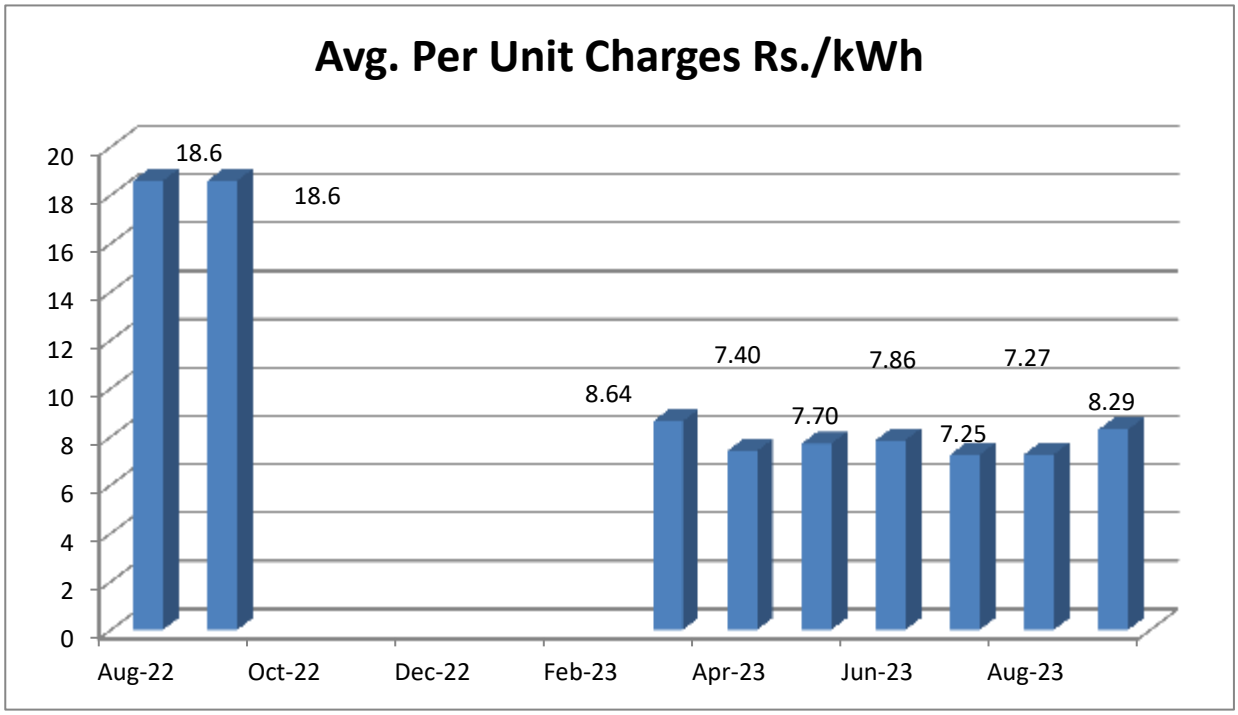

Figure 8. Per Unit Charges of IVRS- N2419058383

Table 6 Electricity Bill -2 Govt. PG College, Guna IVRS-N2419014551

Monthly Electricity bill Govt. . P.G. College Guna. - 2022-23 IVRS-N2419014551								
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	4.65	2.1	140	780	910	0.8	2286	16.33
Sep-22	4.65	2.2	140	780	910	0.89	2267.52	16.20
Mar-23	4.65	5	294	780	1911	0.8	2790.96	9.49
Apr-23	4.65	4	640	780	4160	0.7	5595.35	8.74
May-23	4.65	3	890	780	5785	0.8	6890.39	7.74
Jun-23	4.65	0	608	780	3952	0.8	5064.36	8.33
Jul-23	4.65	0	713	780	4634.5	0.8	6403.07	8.98
Aug-23	4.65	3	2027	780	13175.5	0.76	15636.6	7.71
Sep-23	4.65	3	582	780	3783	0.95	5232.19	8.99
			6034				52166.44	

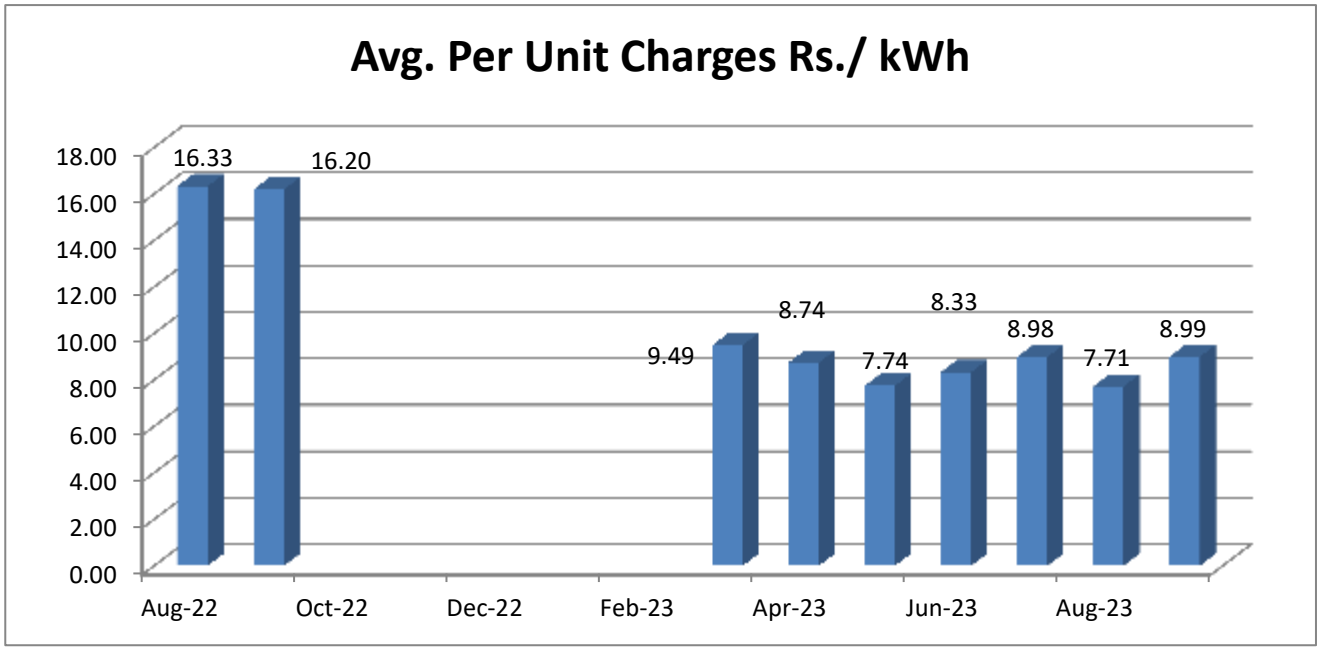

Figure 9. Per Unit Charges of IVRS-N2419014551

3.2 Observations & Comments:

- It is observed that, **Total Sanction load is 81 kW with Nos. 8 of connection** in College premises.
- As per electricity bills observation and analysis from **electricity unit (kWh) consumed 92067 kWh for** electricity bill in college premises.
- As per electricity bills observation and analysis **Total 12-month bill Paid is Rs. 832447.00.**
- As per electricity bills observation and analysis, **electricity bill Power Factor varies from 0.81-0.99.**

CHAPTER - 4

LIGHTING SYSTEM

4.1 Lighting Fixtures:

The Govt. PG College, Guna 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 7. **Different type of lighting fixture:**

Govt. P.G. College, Guna.							
Sr. No.	**Location**	**Location of Fixtures**	**Types of Lighting**	**No. of Lighting fixture**	**Power (W)**	**Total Power (W)**	**Lux Level**
1	Ground Floor	Principle cabin	LED Round	18	12	216	125-165
		Account Section	Tubelight	3	20	60	80-98
		Account Section	FTL	2	40	80	80-98
		Account Section	LED Bulb	1	12	12	80-98
		Office	Tubelight	6	20	120	130-160
		General Physics	Tubelight	3	20	60	75-100
		General Physics	FTL	2	40	80	75-100
		Professor & Head Cabin	Tubelight	3	20	60	109-122
		Professor & Head Cabin	FTL	1	40	40	109-122
		Room No.1	LED	8	20	160	110-130
		Corridor	Tubelight	4	20	80	125-140
		Hall No. 30	FTL	12	40	480	120-140
		Hall No. 30	LED Flood	2	100	200	120-140
		Corridor - 2	Tubelight	7	20	140	125-140
		Store	Tubelight	4	20	80	140-160
		Hindi Dept.	Tubelight	3	20	60	110-135
		Room No.1	FTL	4	40	160	50-115
		Room No.2	FTL	4	40	160	50-115
		Room No.3	FTL	4	40	160	50-115
		Girls Room.	Tubelight	2	20	40	140-160
		Girls Room.	FTL	1	40	40	140-160
		Computer Room	Tubelight	2	20	40	120-140
		Computer Room	FTL	2	40	80	120-140
		Exam Control Room	Tubelight	4	20	80	110-130
		Seminar Hall	LED Round	40	12	480	98-114
		Chemistry HOD	Tubelight	10	20	200	160-180
		Chemistry Lab	Tubelight	11	20	220	80-90
		M.Sc. Lab	Tubelight	10	20	200	85-105

		B.Sc. Lab	Tubelight	10	20	200	90-110
		Botany Lab	LED Bulb	14	15	210	126-140
		Botany HOD Room	Tubelight	4	20	80	126-140
		Geography Room	Tubelight	8	20	160	180-225
		Psychology Room	Tubelight	8	20	160	180-225
		Room No. 7	FTL	6	40	240	140-160
		Room No. 8	FTL	6	40	240	120-140
		Room No. 9	FTL	6	40	240	120-140
		Room No. 10	FTL	6	40	240	110-130
		Corridor	Tubelight	3	20	60	110-130
		हिंदी शोध केंद्र	Tubelight	4	20	80	90-110
2	First Floor	Class Room No 11	Tubelight	6	20	120	140-160
		Class Room No 12	Tubelight	6	20	120	140-160
		Class Room No 13	Tubelight	6	20	120	140-160
		Class Room No 14	Tubelight	6	20	120	135-150
		Class Room No 15	Tubelight	6	20	120	135-150
		Class Room No 16	Tubelight	6	20	120	140-160
		Class Room No. 17	FTL	7	40	280	225-250
		Class Room No. 18	Tubelight	6	20	120	40-50
		Class Room No. 19	Tubelight	6	20	120	40-50
		Class Room No. 20	Tubelight	6	20	120	40-50
		Class Room No. 21	FTL	6	40	240	80-120
		Class Room No. 22	FTL	6	40	240	80-120
		Class Room No. 23	FTL	6	40	240	80-120
		Class Room No. 24	FTL	6	40	240	80-120
		Class Room No. 25	FTL	6	40	240	80-120
		Class Room No. 26	FTL	6	40	240	80-120
		Class Room No. 27	FTL	6	40	240	80-120
		Zoology Lab	Tubelight	5	20	100	100-120
		HOD	Tubelight	5	20	100	110-130
		M.sc. Lab	Tubelight	6	20	120	80-100
		B.Sc. Lab	Tubelight	6	20	120	80-100
		B Sc. Lab	LED Bulb	5	15	75	80-100
		Biotech	Tubelight	6	20	120	110-130
		Biotech	LED Bulb	5	15	75	110-130
		IQAC Dept	Tubelight	5	20	100	120-140
		Political Dept	Tubelight	4	20	80	90-115
		Room No. 1	Tubelight	12	20	240	140-160
		Room No. 2	Tubelight	12	20	240	140-160
		Room No. 3	Tubelight	12	20	240	140-160
		Room No. 4	Tubelight	12	20	240	140-160
		Room No. 5	Tubelight	12	20	240	140-160
		Room No. 6	Tubelight	12	20	240	140-160
		LLB College (Room No. 1)	Tubelight	2	20	40	43-60
		Room No. 2	Tubelight	2	20	40	43-60

		Room No. 3	Tubelight	2	20	40	43-60
		Room No. 4	Tubelight	2	20	40	43-60
		Room No. 5	Tubelight	2	20	40	43-60
		Room No. 6	Tubelight	2	20	40	43-60
		Library - Room. No. 1	Tubelight	8	20	160	90-110
		Room No. 2	Tubelight	8	20	160	90-110
		Room No. 3	Tubelight	8	20	160	90-110
		Room No. 4	Tubelight	8	20	160	90-110
		Room No. 5	Tubelight	8	20	160	90-110
		Room No. 6	Tubelight	8	20	160	90-110
		Corridor	Tubelight	3	20	60	85-100
		Sports Academy	Tubelight	24	20	480	120-150
Total Power Consumption in kW			**12.808**				
Total no. of Lighting Fixture			**557**				

4.2 Observations & Comments:

- We **appreciate to use LED Lighting luminaries** at most of location as per site visit.
- We observed during visit, few Lights were FTL 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 **5544 kWh** per year and also will get amount saving approximately **Rs. 5544** 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 **12.80 kW.**
- As per data collection and observation, **Total no. of lighting fixture is 557.**

LED TUBE LIGHT PROPOSAL

Proposal 1

Quotation for replacement of 105 Nos. existing 40 W FTL tube light with Energy efficient Energy Efficient 18 W LED Tube light in College.

Energy Saving	
Total no of Approximate 40 W FTL	105
Replacement of 40 Watt FTL with capacity of 18 Watt LED	18
Average daily running time for 40 Watt FTL in hour	8
Total Energy Consumed by 40 W FTL	40
Total Energy Consumed by 105 no. of 40 Watt FTL kWh per day	33.6
Annual Energy Consumed by 40 Watt FTL (300 working Days) kWh	10080
Annual Energy Consumed by 105 no. of 18 Watt LED in kWh	4536
Prospective Annual Energy Savings in kWh	5544
Annual Savings in Rupees (taking Average Rs. 10 Per unit charge for 300 day a year)	55440
Initial investment required for 105 no. of 18 Watt LED (Price for @ 500 per 18 Watt)	52500
Payback Period in months only	11
Life of the project years	15
Depreciation Cost Rs	3500.0
ROI {(Net annual savings – Depreciation cost)/ Investment} x 100%	99

CHAPTER-5

FAN SYSTEM

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

5.1 Details of Different type off fans:

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

Table 8. **Different type of Fan**

Govt. P.G. College, Guna.						
Sr. No.	**Location**	**Location of Fan**	**Types of Fan**	**No.of Fan**	**Power (W)**	**Total Power (W)**
1	Ground Floor	Principle cabin	Ceiling Fan	4	70	280
		Account Section	Ceiling Fan	2	70	140
		Office	Ceiling Fan	3	70	210
		General Physics	Ceiling Fan	4	70	280
		Professor & Head Cabin	Ceiling Fan	2	70	140
		Room No.1	Ceiling Fan	6	70	420
		Corridor	Ceiling Fan	1	70	70
		Hall No. 30	Ceiling Fan	12	70	840
		Store	Ceiling Fan	2	70	140
		Hindi Dept.	Ceiling Fan	2	70	140
		Room No.1	Ceiling Fan	3	70	210
		Room No.2	Ceiling Fan	3	70	210
		Room No.3	Ceiling Fan	3	70	210
		Girls Room.	Ceiling Fan	1	70	70
		Exam Control Room	Celling Fan	6	70	420
		Seminar Hall	Ceiling Fan	8	70	560
		Chemistry HOD	Ceiling Fan	4	70	280
		Chemistry Lab	Ceiling Fan	2	70	140
		Chemistry Lab	Exhaust Fan	2	150	300
		M.Sc. Lab	Ceiling Fan	2	70	140
		B.Sc. Lab	Ceiling Fan	2	70	140
		Botany Lab	Ceiling Fan	3	70	210
		Botany HOD Room	Ceiling Fan	4	70	280
		Geography Room	Ceiling Fan	9	70	630
		Psychology Room	Ceiling Fan	9	70	630
		Room No. 7	Ceiling Fan	6	70	420
		Room No. 8	Ceiling Fan	6	70	420
		Room No. 9	Ceiling Fan	6	70	420
		Room No. 10	Ceiling Fan	6	70	420
		हिंदी शोध केंद्र	Ceiling Fan	9	70	630
		Class Room No 11	Ceiling Fan	6	70	420

		Class Room No 12	Ceiling Fan	6	70	420
		Class Room No 13	Ceiling Fan	6	70	420
		Class Room No 14	Ceiling Fan	6	70	420
		Class Room No 15	Ceiling Fan	6	70	420
		Class Room No 16	Ceiling Fan	6	70	420
		Class Room No. 17	Ceiling Fan	11	70	770
		Class Room No. 18	Ceiling Fan	4	70	280
		Class Room No. 19	Ceiling Fan	4	70	280
		Class Room No. 20	Ceiling Fan	4	70	280
		Class Room No. 21	Ceiling Fan	6	70	420
		Class Room No. 22	Ceiling Fan	6	70	420
		Class Room No. 23	Ceiling Fan	6	70	420
		Class Room No. 24	Ceiling Fan	6	70	420
		Class Room No. 25	Ceiling Fan	6	70	420
		Class Room No. 26	Ceiling Fan	6	70	420
		Class Room No. 27	Ceiling Fan	6	70	420
		Zoology Lab	Ceiling Fan	5	70	350
		HOD	Ceiling Fan	5	70	350
		M.sc. Lab	Ceiling Fan	6	70	420
		B.Sc. Lab	Ceiling Fan	6	70	420
		Biotech	Ceiling Fan	6	70	420
		IQAC Dept	Ceiling Fan	4	70	280
		Political Dept	Ceiling Fan	4	70	280
		Room No. 1	Ceiling Fan	9	70	630
		Room No. 2	Ceiling Fan	9	70	630
		Room No. 3	Ceiling Fan	9	70	630
		Room No. 4	Ceiling Fan	9	70	630
		Room No. 5	Ceiling Fan	9	70	630
		Room No. 6	Ceiling Fan	9	70	630
		LLB College (Room No. 1)	Ceiling Fan	6	70	420
		Room No. 2	Ceiling Fan	6	70	420
		Room No. 3	Ceiling Fan	6	70	420
		Room No. 4	Ceiling Fan	6	70	420
		Room No. 5	ceiling Fan	6	70	420
		Room No. 6	Ceiling Fan	6	70	420
		Library - Room. No. 1	Ceiling Fan	9	70	630
		Room No. 2	Ceiling Fan	9	70	630
		Room No. 3	Ceiling Fan	9	70	630
		Room No. 4	Ceiling Fan	9	70	630
		Room No. 5	Ceiling Fan	9	70	630
		Room No. 6	Ceiling Fan	9	70	630
		Corridor	Ceiling Fan	7	70	490
		Sports Academy	Ceiling Fan	24	70	1680
Total Power Consumption in kW			**31.24**			
Total no. of Fan Fixture			**444**			

5.2 Observations & Comments:

- We observed that most of the Fans installed in campus were conventional.
- We are recommended to **replace 444 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 **44755 kWh** per year and also will get amount saving approximately **Rs. 447552.00** per year by replacing conventional Fan with new energy efficient BLDC fan.
- The total load for Ceiling Fan is **31.24 kW**.
- Total No. of Fan fixtures are **444.**

CEILING FAN PROPOSAL

Proposal 1

Replacement of 444 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 444	444
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 444 no. of 70 Watt Ceiling Fan kWh per day	248.64
Annual Energy Consumed by 70 Watt Ceiling Fan (300 working Days) kWh	74592
Annual Energy Consumed by 444 no. of 28 Watt Ceiling Fan in kWh	29837
Prospective Annual Energy Savings in kWh	44755
Annual Savings in Rupees (taking Average Rs. 10 Per unit charge for 300 day a year)	447552
Initial investment required for 267no. of 28 Watt Ceiling Fan(Price for BLDC Fan @ 2800 per 28 Watt BLDC Fan)	1243200
Payback Period in months only	33
Life of the project years	15
Depreciation Cost Rs	82880
ROI {(Net annual savings – Depreciation cost)/ Investment} x 100%	29

CHAPTER - 6

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.

6.1 Different Type Other Equipment's

Table 9. Different type of equipment system

Other equipments location wise Govt. P.G. College, Guna.						
Sr. No.	**Location**	**Location of Product**	**Type of Product**	**Number of Product**	**Power (Watts)**	**Total Power (Watts)**
1			PC	61	100	6100
			Printer	6	650	3900
			Fridge	3	350	1050
			Photocopier	3	550	1650
			Water cooler	4	575	2300
			LED TV	2	66	132
			Air Cooler	4	500	2000
			Projector	1	575	575
		Total Power in kW				17.7

6.2 Observations & Comments:

- Total Connected load **17.74 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 -7

PUMPING SYSTEM

7.1 Submersible Pumps

There is 1 no. of 3 HP capacity of submersible pump installed within college campus for drinking water, Flushing and gardening purpose.

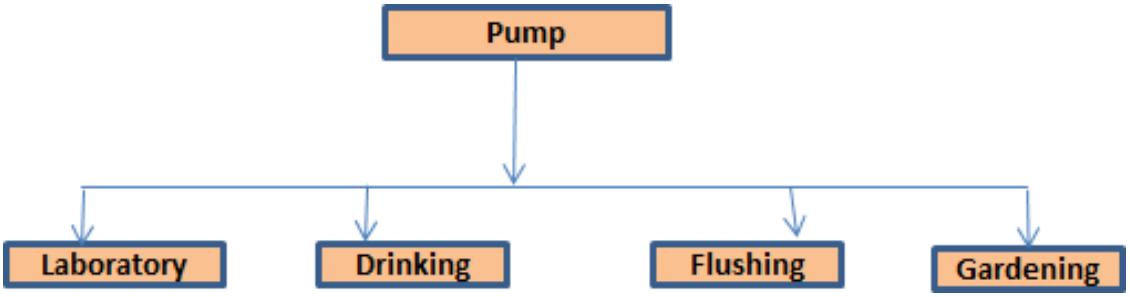

Table 10. Major usage area of pump

Pumps Details:

Pump Details Govt. Girls College, Indore.						
Sr. No.	**Location**	**Location of Pump**	**Types of Pumps**	**No. of Pump**	**Power (HP)**	**Total Power (KW)**
1	College Campus	Back side	Submersible Pump	1	3	4.50
Total Power in kW						4.50

7.2 Observation and Comments:

- We observed during Energy Audit and site visit**, 1 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.

CHAPTER-08
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°Cincreaseinmotoroperatingtemperatureoverrecommendedpeak,themotorlifeis 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 ,in candescent.
- 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 back ground 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 than1MW

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 etc.
- 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 rest rooms.
- 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.
- Verify the water meter readings.(You'd be amazed how long a meter reading can be estimated after 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 hand 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

AIRTRON

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