



**Energy Audit Report
Maharshi Panini Sanskrit Evam Vedic
Vishwavidyalaya Ujjain (M.P)
Year 2022-23**



ENERGY AUDIT REPORT



MAHARSHI PANINI SANSKRIT EVAM VEDIC VISHWAVIDYALAYA

UJJAIN (M.P)

PREPARED BY

EMPIRICAL EXERGY PRIVATE LIMITED

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(2022-23)



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ACKNOWLEDGEMENT

We would like to thank to **Maharshi Panini Sanskrit Evam Vedic Vishwavidyalaya Ujjain (M.P)**. Our appreciation and gratitude to the management for granting us permission to conduct energy audit for the university.

We are genuinely touched by the helpful attitudes and cooperation displayed by all the faculty members and technical staff involved in the audit. Their valuable assistance and cooperation significantly contributed to the successful execution of the audit.



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(BEE, Ministry of Power, Govt. of India)
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Lead Auditor ISO50001:2011 [EnMS) from FICCI, Delhi
Certified Water Auditor (NPC, Govt. of India)
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CERTIFICATE OF ACCREDITATION

 <p>ENERGY IS LIFE B E E CONSERVE IT</p>	<h2 style="margin: 0;">BUREAU OF ENERGY EFFICIENCY</h2>	
<p>Examination Registration No.: EA- 7271</p> <p>Accreditation Registration No.: AEA-284</p>		
<h3 style="margin: 0;">Certificate of Accreditation</h3>		
<p>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 9th day of May, 2018</p>		
<p>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.</p>		
<p>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.</p>		
<p>On cancellation, the certificate of accreditation shall be surrendered to the Bureau within fifteen days from the date of receipt of order of cancellation.</p>		
<p>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.</p>		
<p>Given under the seal of the Bureau of Energy Efficiency, Ministry of Power, this 5th day of October, 2018</p>		
<p style="margin: 0;">Secretary, Bureau of Energy Efficiency New Delhi</p>		



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ENERGY AUDIT TEAM

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

- ✚ **Mr. Rajesh Kumar Singadiya**[Director & Accredited Energy Auditor AEA-0284]
- ✚ **Mr. Rakesh Pathak,** [Director & Electrical Expert]
- ✚ **Ms. Laxmi Raikwar** [Energy Engineer]
- ✚ **Mr. Ajay Nahra** [Sr.Project Engineer]
- ✚ **Mr. Charchit Pathak** [Sr.Project Engineer]
- ✚ **Mr. Mohan Choudhary** [Electrical Engineer]
- ✚ **Mr. Praveen Punasiya** [Field Engineer]



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EXECUTIVE SUMMARY

The executive summary of the energy audit report presented in this section briefly outlines the identified energy conservation measures and other recommendations proposed during the project. These measures can be implemented in phases to conserve energy and enhance productivity within the university campus. The expected total annual energy saving potential is 15,780 units.

INITIATIVE TAKEN BY THE UNIVERSITY

✚ Lighting System

- The university has energy efficient lighting (LED) within the premises. However, there remains significant potential for further improvement.

ENERGY AUDIT RECOMMENDATION

✚ Lighting System

- ECM-1: There is a good potential to replace 8 numbers FTL-T12 (40W) by LED-T5 (20W). The expected energy saving potential is 544 units per year.

✚ Ceiling and Exhaust Fan

- ECM-2: There is a good potential to replace 74 numbers 60W conventional ceiling fan by 28W BLDC fan. The expected energy saving potential is 4,736 units per year.
- ECM-3: There is a good potential to replace 9 numbers 90W conventional exhaust fan by 40W BLDC fan. The expected energy saving potential is 900 units per year.

✚ Split ACs

- ECM-4: There is a good potential to install Airtron Intelligent Microprocessor Energy saver in 8 numbers of ACs unit. The expected energy saving potential is 9,600 units per year.

✚ Timer-Controller and Motion sensor

- It is recommended to install "Timer Controller and Motion Sensor" in faculty cabins, offices, street lights and non-working areas.



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✚ Energy Monitoring System

- It was observed that there is a requirement of monthly energy consumption monitoring system to find out the annual energy consumption of the university, which should be based on a cloud-based (IoT) energy monitoring system.

✚ Awareness and Training program

- Conduct awareness and training program, poster presentation to promote energy saving activities in the university.

Grid Connected Solar System:

- ✚ There is good potential for installation of solar grid connected roof top System in the university. Based on annual energy consumption for the year 2022-23, it is recommend to install 10 KWp solar System in the campus. The expected annual unit generation from the above plant will be 14,600 Units. Detailed Energy generation from the system is given in Chapter-4



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ENERGY CONSERVATION MEASURES

ECM	Identification	Observation	Recommendation	Annual Energy Saving (kWh)	Annual Cost Saving (Rs.)	Investment (Rs.)	Simple Payback Period (Year)
ECM:1	8 no. Lighting	FTL-T12 (40W)	Replacement by LED-T5 (20W)	544	4570	1,600	0.4
ECM:2	74 no. ceiling fan Lighting	60 W	28 W BLDC energy efficient fan	4,736	88,032	366800	4.2
ECM:3	9 no. Exhaust fan	90 W	40 W BLDC energy efficient fan	900	9450	20700	2.2
ECM:4	8 no. of 1.5 and 2 ton Star rated ACs	In-efficient operation	Installation of Airtron 'intelligent' microprocessor energy saver	9,600	100800	60,000	0.6
				15,780	2,02,852/-	4,49,100/-	2.2

ECM	Identification	Observation	Recommendation	Annual Energy Generation (kWh)	Annual revenue generation (Rs.)	Investment (Rs.)	Simple Payback Period (Year)
ECM:5	100 % Grid Power	Good Potential for Solar Plant	10 KWp Grid Connected Solar Plant	14,600	1,24,100/-	4,50,000/-	3.6



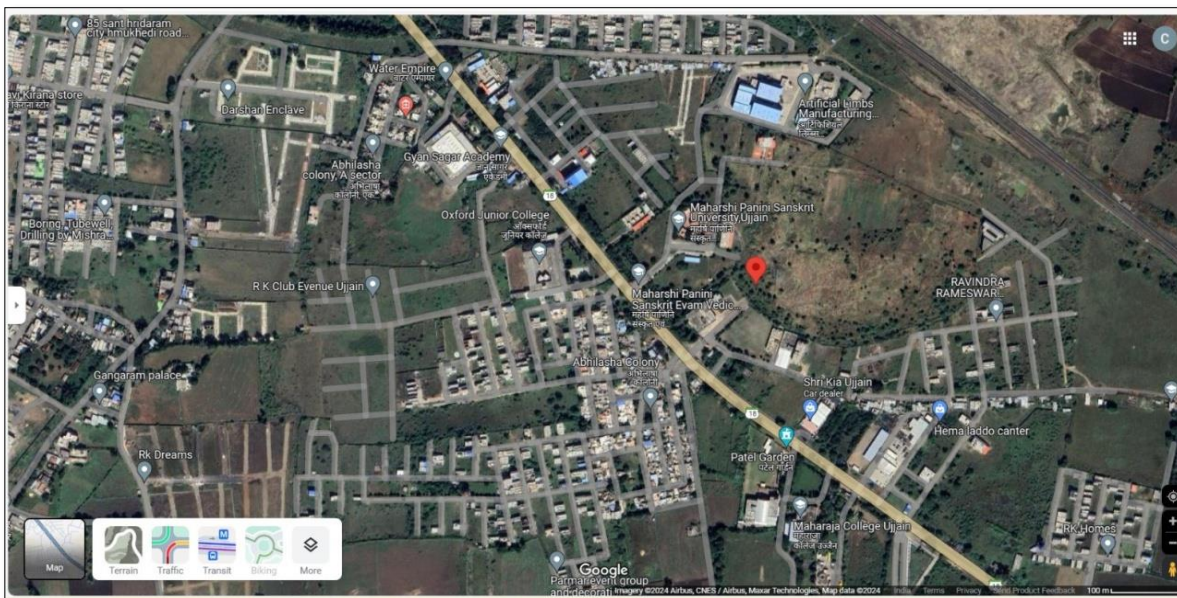
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Chapter-1 INTRODUCTION

1.1 About University

The university expands in a lush green valley area in about 25 acres of land on Dewas road near the famous city of Ujjain. After entering through a grand gate, we enter the first academic campus of the university entitled “Panchavati”. This complex gives the impression of an ancient Gurukul due to the five buildings with a huge platform in the middle and a beautiful fragrant garden. This place provides immense joy and peace to the new visitors. As we walk in the Panchavati along the greenery gradually we come across an elevated path which leads us to Patanjali Hostel. The mesmerizing university campus has foundation lands allotted for a spacious educational building, administrative building, and huge auditorium etc. where buildings are yet to be constructed. As we move towards the hostel complex, we can see a huge ground, where construction of a multipurpose playground, observatory etc. is proposed.



Satellite Image of the University



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The university also contains an open auditorium, Nakshatravatika, Navagraha Vatika, Sarovar, Yagyashala, Library, Museum of Vedic Yagya Equipments, Astrology Laboratory, Psychology Laboratory, Language Lab, Sanskrit Gallery, Educational Subhashit Moral & a Fruit Garden. The university also plans to develop its concept of construction of residential houses. In future, this campus will be a center of attraction and inspiration for students, academicians and travelers from India and abroad.

VISION

✚ **भारतीयज्ञानपरम्परायाः निरन्तरप्रवाहाय नवाचाराः**

✚ To integrate the timeless wisdom of ancient Indian knowledge with modern innovation and progress across diverse disciplines

MISSION

✚ **प्राच्यसंस्कृतज्ञानविज्ञानपरम्परां प्रसारयितुं नवाचारैः सह परम्परागतशिक्षणपद्धतिम् अनुसृत्य शिक्षणं शोधकार्यं च कर्तुं दीपशिखारूपेण स्वस्य प्रतिष्ठापनम्।**

✚ To serve as a beacon of Sanskrit heritage, thereby fostering a dynamic learning environment where tradition meets innovation.

✚ Through rigorous scholarship, research excellence and community engagement we aim to be a catalyst for personal growth, cultural enrichment and societal information hence ensuring the enduring relevance of Sanskrit wisdom in the contemporary world



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CORE VALUES

- ✚ **Excellence:** Commitment to high academic standards, rigorous research, and continuous improvement in teaching and learning.
- ✚ **Integrity:** Upholding honesty, ethical behavior, and accountability in all aspects of academic and administrative activities.
- ✚ **Diversity and Inclusion:** Fostering a diverse community of students, faculty, and staff.
- ✚ **Innovation:** Encouraging creativity, curiosity, and entrepreneurship in education, research, and community engagement.
- ✚ **Collaboration:** Emphasizing teamwork, interdisciplinary cooperation, and partnerships within the university and with external stakeholders to advance knowledge and solve global problems.
- ✚ **Service and Social Responsibility:** Engaging in meaningful service to the community, promoting civic engagement, and addressing societal needs through education, research, and outreach.
- ✚ **Freedom of Inquiry and Expression:** Safeguarding academic freedom, intellectual curiosity, and open exchange of ideas as fundamental principles of scholarly pursuit and democratic society.
- ✚ **Global Citizenship:** Cultivating global awareness, cultural competence, and a sense of responsibility towards addressing global issues and promoting peace and justice worldwide.
- ✚ **Student-Centeredness:** Prioritizing the holistic development, well-being, and success of students through personalized support, mentorship, and opportunities for growth and leadership.
- ✚ **Sustainability:** Committing to environmental stewardship, sustainable practices, and responsible resource management in campus operations and educational initiatives.
- ✚ These core values often serve as a compass guiding the university's decisions, actions, and priorities, shaping its identity and contributing to its impact on society.



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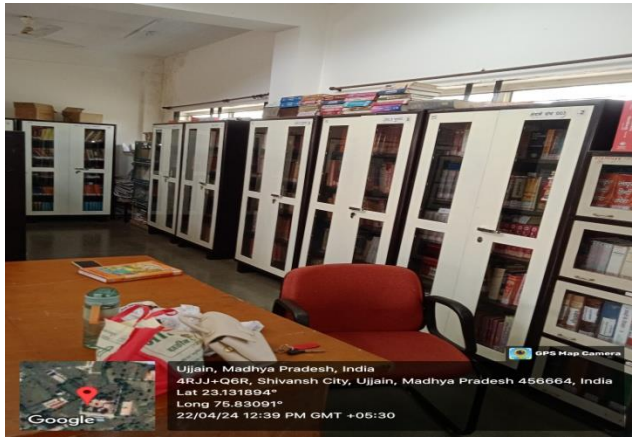
University Infrastructure



VC Cabin



Conference Hall



Library



Classroom



Yoga Bhavan



Classroom



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1.2 About Energy Audit

An energy audit serves to enhance understanding about how energy is utilized within a department, aiding in the identification of areas susceptible to waste and potential areas for improvement. The overall energy efficiency, from generation to the end consumer, stands at 50%. Therefore, conserving one unit by the end user is equivalent to two units produced at the power plant.

An energy audit represents the most effective approach to discerning the strengths and weaknesses of energy management practices, while also offering solutions to existing issues. It embodies a professional means of responsible utilization of economic, financial, social, and natural resources. Energy audits contribute value to management control and serve as an evaluative method for systems.

Empirical Exergy Private Limited (EEPL), based in Indore, Madhya Pradesh, conducted an "Energy Audit" on-site to identify gaps in the energy consumption pattern at Maharshi Panini Sanskrit Evam Vedic Vishwavidyalaya Ujjain (M.P). A technical report has been prepared in accordance with the requirements of the university.

1.3 Objectives of Energy Auditing

Energy auditing provides a critical information foundation for an all-encompassing energy conservation initiative, encompassing energy utilization analysis and the evaluation of energy-saving measures. Its objectives include:

- ✚ Identifying the cost and quality of different energy inputs
- ✚ Evaluating the current energy consumption patterns across various operational cost centers
- ✚ Establishing connections between energy inputs and production outputs.
- ✚ Identifying potential areas for thermal and electrical energy conservation.
- ✚ Pinpointing areas of major wastage.
- ✚ Setting energy-saving targets for individual cost centers.
- ✚ Implementing measures for energy conservation and realizing savings.



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1.4 Methodology

The methodology employed to achieve the designated objectives, encompassing the assessment of current operational status and potential energy savings, encompasses the following steps:

- ✚ Engaging in discussions with relevant officials to identify key areas of focus and related systems.
- ✚ Sending a team of engineers to the site for discussions with concerned officials and supervisors, aiming to gather data and information regarding plant operations and load distribution across the premises. The collected data were analyzed to establish a baseline energy consumption pattern.
- ✚ Utilizing suitable instruments for measurements and monitoring, including continuous and/or time-lapse recording as appropriate, coupled with visual observations to discern energy usage patterns and system losses.
- ✚ Conducting trend analysis for costs and consumption patterns.
- ✚ Carrying out capacity and efficiency tests on major utility equipment, wherever applicable.
- ✚ Estimating various forms of losses.
- ✚ Performing computations and in-depth analysis of the gathered data, utilizing computerized analysis and relevant techniques where appropriate, to derive conclusions and formulate an effective energy conservation plan to enhance and reduce specific energy consumption.



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CHAPTER-2
POWER SUPPLY SYSTEM

2.1 Power supply system

The power supply for the university campus is primarily driven from the grid from LT-connection under tariff class LV2 [LV2.2] by MPPKVVCL.

Grid Power

The university acquires energy in the form of electricity procured from the MPPKVVCL and common power supply feeder for the Maharshi Panini Sanskrit Evam Vedic Vishwavidyalaya Ujjain (M.P). In case of grid power failure an emergency power backup is provided by UPS systems.

Space availability for the Solar System

It was observed that Patanjali Bhavan has a sufficient space for the installation of 10 KWp rooftop solar system.



Space available for the solar system on Patanjali Bhavan



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2.2 Electricity Bill Analysis Year 2021-22

Sr. No.	Month	Contract Demand (kW)	Maximum Demand (kW)	Unit Consumption (KWh)	Power Factor	Current Month Billing (Rs.)	Per Unit Charges (Rs./kWh)
1	Jul-21	22	4.5	589	0.90	5,000/-	8.49
2	Aug-21	22	4.1	379	0.90	2,603/-	6.87
3	Sep-21	22	4.8	455	0.90	3,073/-	6.75
4	Oct-21	22	4.2	864	0.90	11,561/-	13.38
5	Nov-21	22	7.5	402	0.90	8,693/-	21.62
6	Dec-21	22	6.1	361	0.90	8,240/-	22.83
7	Jan-22	22	5.5	402	0.98	8,403/-	20.90
8	Feb-22	22	5.5	201	0.98	7,134/-	35.49
9	Mar-22	22	6.7	1354	0.98	15,082/-	11.14
10	Apr-22	22	7.1	1500	0.99	15,608/-	10.41
11	May-22	22	7.6	1379	0.97	14,885/-	10.79
12	Jun-22	22	8	1949	0.99	18,358/-	9.42
Total				9,835	0.941	1,18,640/-	12.10

Observation:

Annual electricity bill is Rs. 1, 18,640/- with respect to annual energy consumption is 9,835 units.



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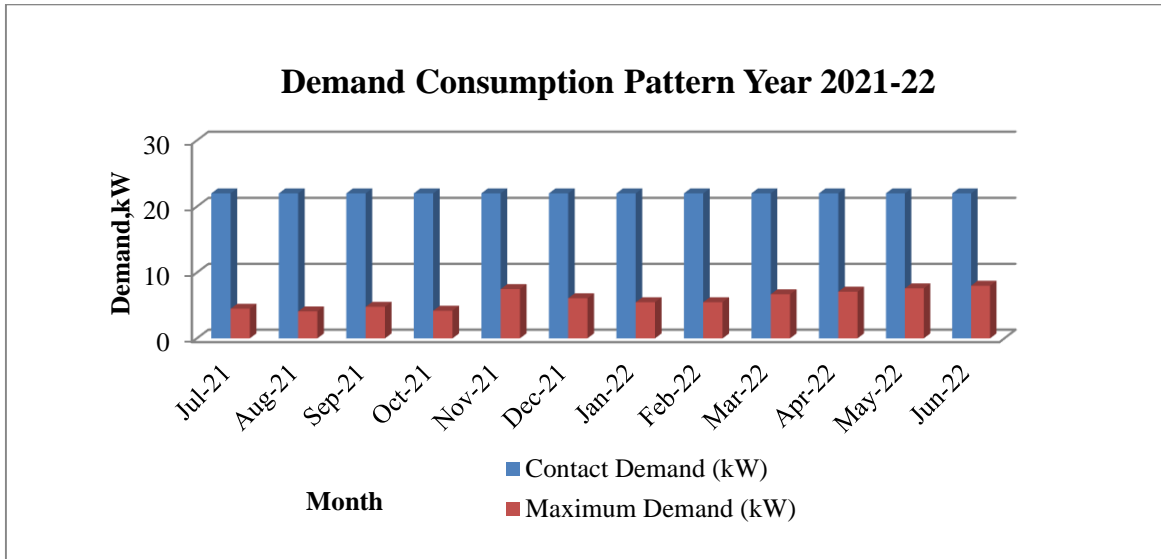


Fig. Demand for the period of July 2021- June 2022

Observation: Contract demand of the University is 22 kW and MD is goes to maximum in the month of June- 22 in summer season.

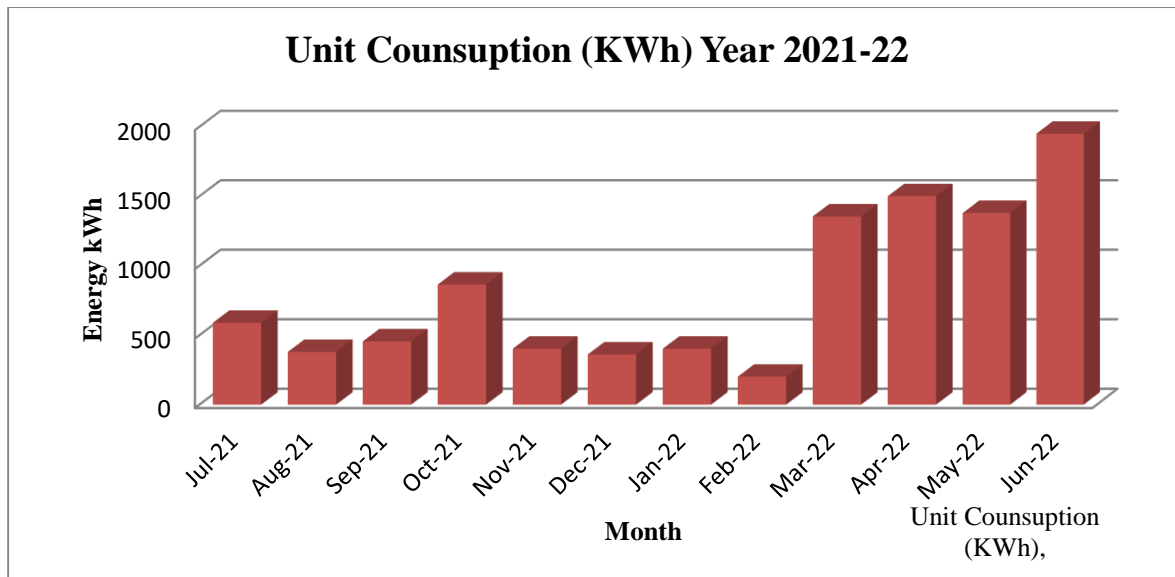


Fig. Monthly (kWh) Unit consumption year 2021-22

Observation: The annual energy consumption of the university is 9,835 units for year 2021-22.



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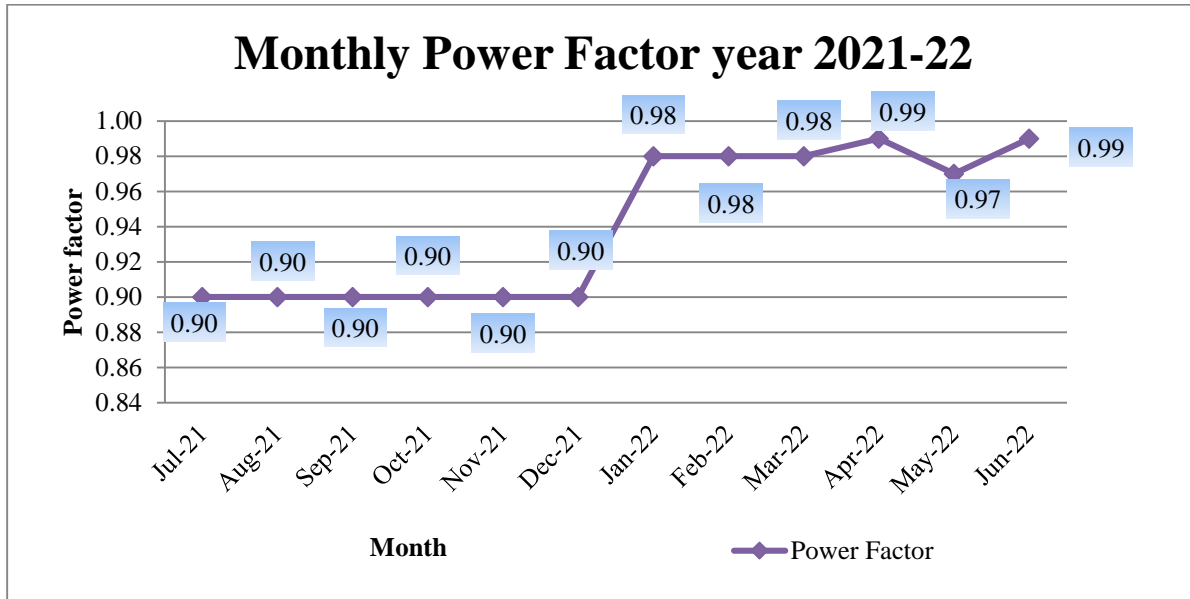


Fig. Monthly power factor year 2021-22

Observation: The Average power factor is 0.941 for the year 2022-23.

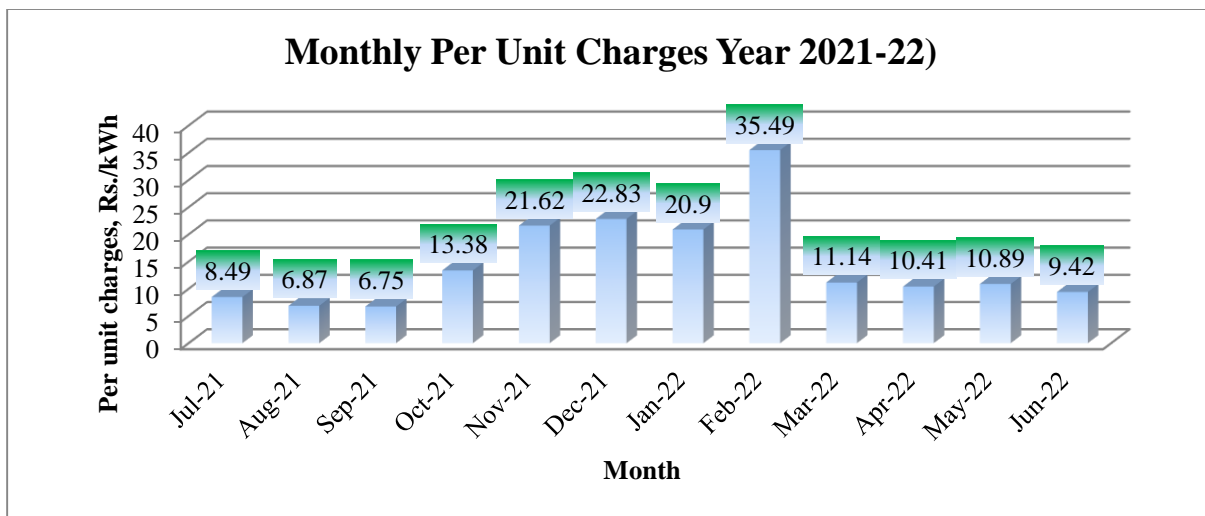


Fig. Monthly per unit charges Year 2021-22

Observation: The monthly average energy charge is Rs.12.10 per unit for year 2021-22.



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2.3 Electricity Bill Analysis Year 2022-23

Sr. No.	Month & Year	Contract Demand (KW)	Maximum Demand (KW)	Unit Consumption (KWh)	Power Factor	Current Month Billing (Rs.)	Per Unit Charges (Rs./kWh)
1	Jul-22	22	3	1454	0.90	14,020/-	9.64
2	Aug-22	22	5	1192	0.90	11,724/-	9.84
3	Sep-22	22	4.2	1585	0.90	15,121/-	9.54
4	Oct-22	22	3.5	1188	0.90	12,685/-	10.68
5	Nov-22	22	3.2	1164	0.90	13,622/-	11.70
6	Dec-22	22	5.2	1158	0.91	13,829/-	11.94
7	Jan-23	22	4.4	1052	0.90	13,197/-	12.54
8	Feb-23	22	5	850	0.90	11,858/-	13.95
9	Mar-23	22	3	968	0.91	12,806/-	13.23
10	Apr-23	22	8.2	1528	0.91	16,852/-	11.03
11	May-23	22	11.3	1750	0.91	18,295/-	10.45
12	Jun-23	22	10.4	1732	0.90	18,412/-	10.63
Total				15,621	0.903	1,72,421/-	11.04

Observation:

✚ Annual electricity bill is Rs. 1, 72,421/- with respect to annual energy consumption is 15,621 units.



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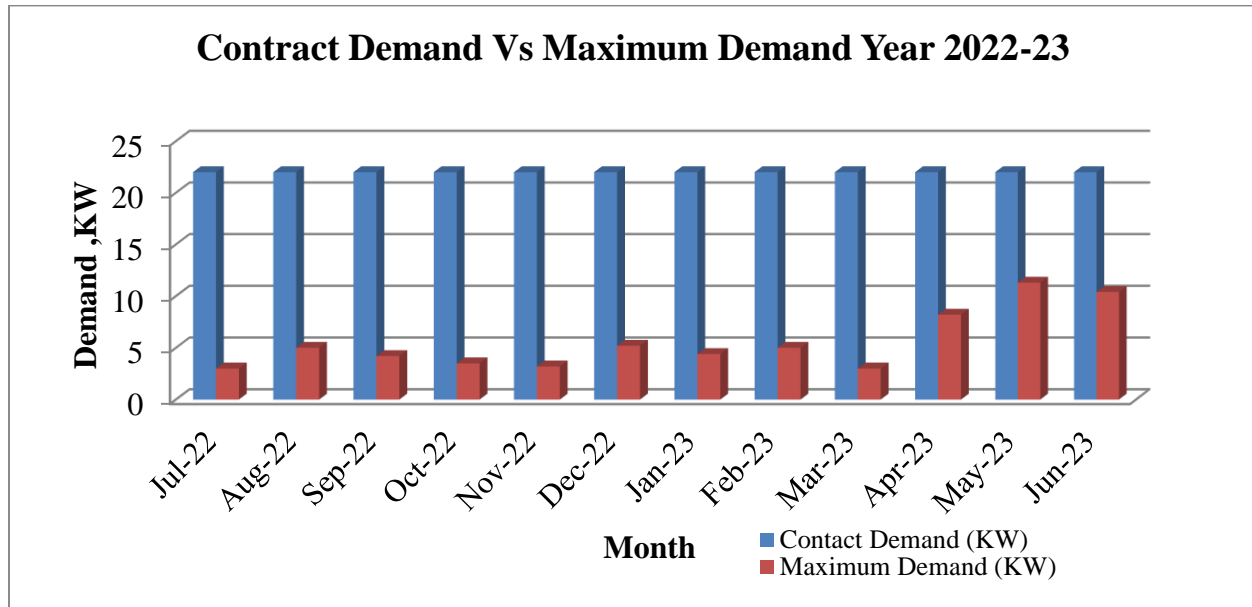


Fig: Graphical Presentation of Demand Consumption Pattern Year 2022-23

Observation: Contract demand of the University is 22 kW and MD is goes to maximum in the month of Many-23 & June- 23 in summer season.

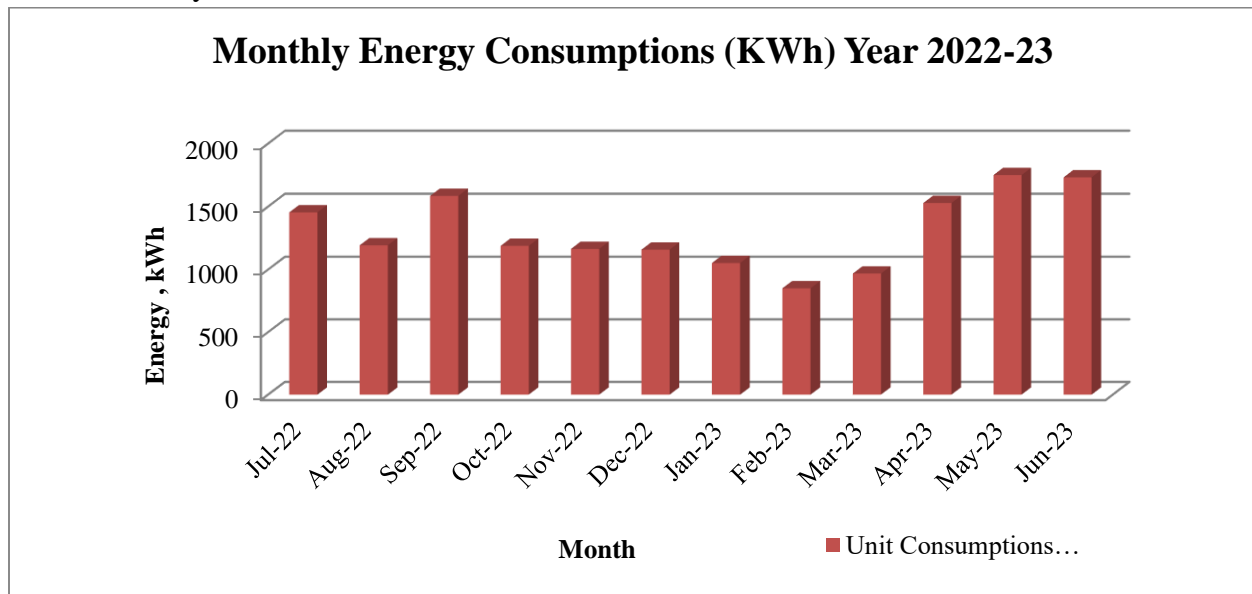


Fig: Graphical Presentation of Month Energy Consumption Year 2022-23

Observation: The annual energy consumption of the university is 15,621 units for year 2022-23.



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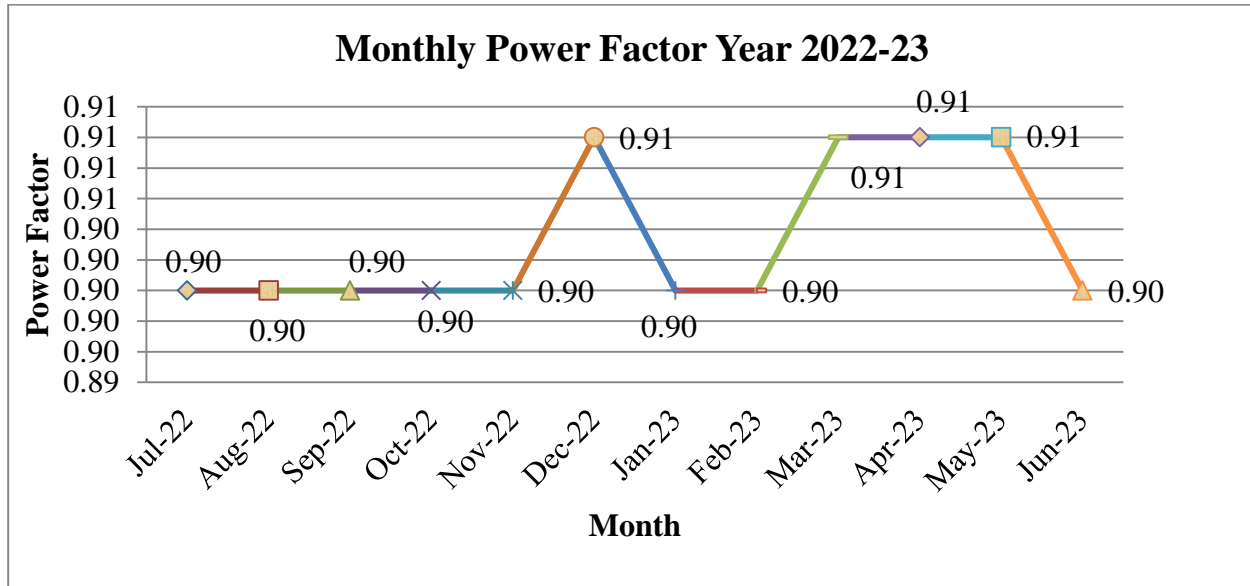


Fig: Graphical Presentation of Month Power Factor Year 2022-23

Observation: The Average power factor is 0.930 for the year 2022-23.

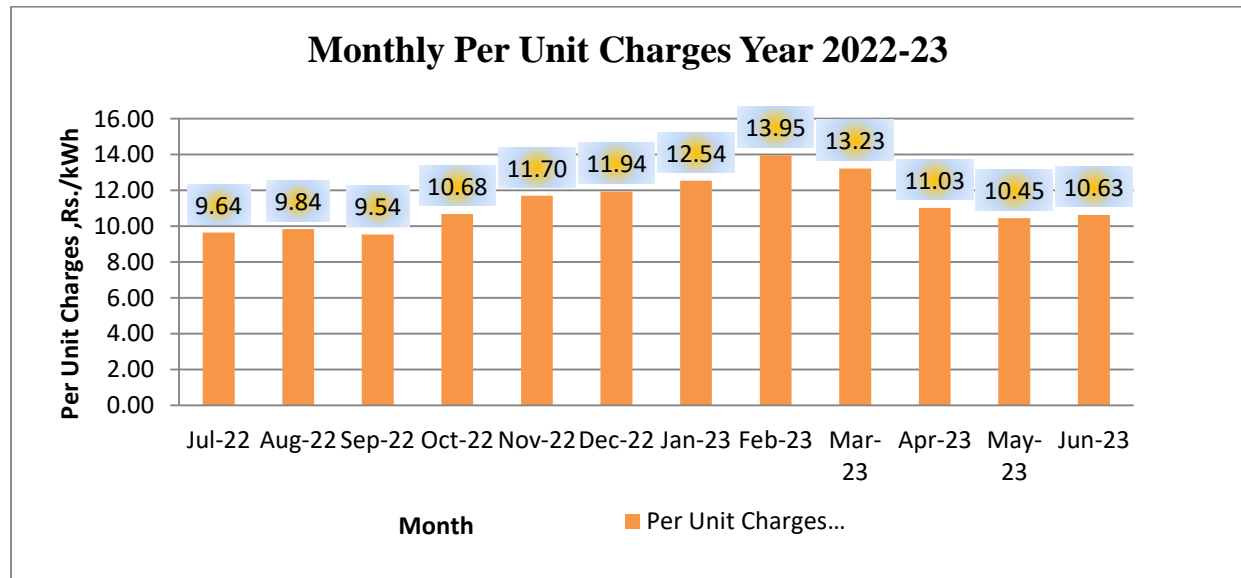


Fig: Graphical Presentation of Month per Unit Charges Year 2022-23

Observation: The monthly average energy charge is Rs.11.04 per unit for year 2022-23.



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CHAPTER-3
CONNECTED LOAD ANALYSIS

3.1 Connected Load

During the energy audit details of the electrical appliances has been verified in the school building. Details of the electrical appliances is given in the table 3.1

Table-3.1 Details of the lighting, cooling and other office load

Sr. No.	Appliances	Unit Power (Watt)	Quantity	Total Power (W)	Load Share (%)
1	LED tube (T-5)	20	86	1720	5.1
2	FTL tube (T-12)	54	8	432	1.3
3	LED light Down lighter	14	53	742	2.2
4	LED Light	9	7	63	0.2
5	Incandescent Bulb	100	1	100	0.3
6	LED light Down lighter	20	31	620	1.8
7	LED Street light	50	33	1650	0.1
7	Ceiling fan	60	74	4440	13.1
8	Wall fan	40	8	320	0.9
9	Computers	75	15	1125	3.3
10	Printer	50	13	650	1.9
11	Photocopy M/c	1550	2	3100	9.1
12	Exhaust Fan	60	9	540	1.6
15	Split AC (1.5 & 2 Ton) 3 star	2510	8	20080	59.2
				35582	100

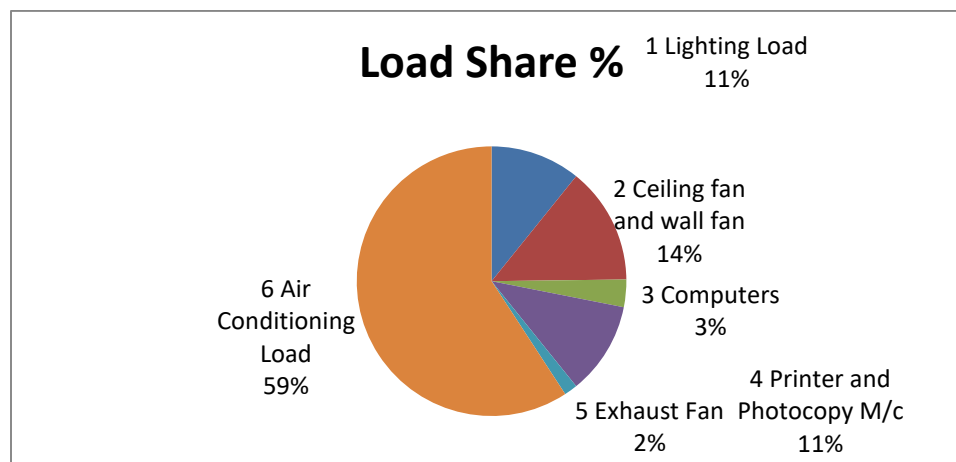


Fig.3.1: Load Share of the University Building

Observation: it is observed that Air Conditioning load is dominated with 59.2% of the total load.



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Table 3.2: Details of connected lighting load

Sr. no	Location	LED tube 20 W	FTL 40W	Down lighter LED 14 W	LED 9 W	Bulb 100 W	Down light LED 20 W
1	Kulpati kaksha	3	1	16	2	0	0
2	Pustakalaya	4	3	0	1	0	0
3	Kulsachiv kaksha	3	1	16	2	0	0
4	Pariksha vibhag	5	3	0	0	0	0
5	NCC Office	3	0	0	0	0	0
6	Lekha Vibhag	2	0	0	0	0	0
7	Nirmaan Vibhag	2	0	0	1	0	0
8	Acadmic Vibhag	2	0	0	1	0	0
9	Yoga bhawan	9	0	21	0	0	0
Maharshi Sandipni Bhawan							
10	Staff room	2	0	0	0	0	0
11	Class room 1	2	0	0	0	0	0
12	Class room 2	2	0	0	0	0	0
13	Class room 3	2	0	0	0	0	0
14	Class room 4	2	0	0	0	0	0
15	Class room 5	2	0	0	0	0	0
Patanjali Bhawan							
16	Kaksha 1	2	0	0	0	0	0
17	Annapurna room	6	0	0	0	0	0
18	Sikshan kaksha 3	4	0	0	0	0	0
19	Sikshan kaksha 4	3	0	0	0	0	0
20	Wash room	1	0	0	0	0	0
21	Sikshan kaksha 2	1	0	0	0	1	0



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Sr. no	Location	LED tube 20 W	FTL 40W	Down lighter LED 14 W	LED 9 W	Bulb 100 W	Down light LED 20 W
22	Room 6	1	0	0	0	0	0
23	Wash room 1st floor	1	0	0	0	0	0
24	Room 7	6	0	0	0	0	0
25	Room 8	4	0	0	0	0	0
26	Room 9	4	0	0	0	0	0
27	Room 10	4	0	0	0	0	0
28	Room 11	4	0	0	0	0	0
29	1st floor corridor	0	0	0	0	0	15
30	G Floor Corridor	0	0	0	0	0	16
		86	8	53	7	1	31

Observation:

- ✚ The university has energy efficient lighting (LED) within the premises. However, there remains significant potential for further improvement.



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3.2 Photographs of electrical appliances



FTL



1x1 sq. ft LED



Photocopy Machine



Computer System



Printer



Down lighter



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Table 3.3: Details of Fans and other office load

Sr. no	location	Fan 60W	Computer	Printer	Photocopy M/C	AC	Wall Fan 40W	Exhaust 60W	Fan 100W
1	Kulpati kaksha	5	0	0	0	3	2	0	0
2	Pustakalaya	4	1	1	1	0	1	0	0
3	Kulsachiv kaksha	5	0		0	2	2	0	0
4	Pariksha vibhag	6	5	5	0	0	3	0	0
5	NCC Office	2	0	1	0	0	0	0	0
6	Lekha Vibhag	1	1	1	0	0	0	0	0
7	Nirmaan Vibhag	3	0		0	0	0	0	0
8	Acadmic Vibhag	2	2	2	0	0	0	0	0
9	Yog bhawan	14	0		0	0	0	0	0
Maharshi Sandipni Bhawan									
10	Staff room	2	0	0	0	0	0	0	0
11	Class room 1	2	0	0	0	0	0	0	0
12	Class room 2	2	0	0	0	0	0	0	0
13	Class room 3	2	0	0	0	0	0	0	0
14	Class room 4	2	0	0	0	0	0	0	0
15	Class room 5	2	0	0	0	0	0	0	0
Patanjali Bhawan									
16	Kaksha 1	1	1	1	0	0	0	0	0
17	Annpurna room	4	0	1	0	1	0	0	0
18	Sikshan kaksha 3	2	0	0	0	0	0	0	0
19	Sikshan kaksha 4	2	0	0	0	0	0	0	0
20	Wash room	0	0	0	0	0	0	4	0
21	Sikshan kaksha 2	1	0	0	0	0	0		0



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Sr. no	location	Fan 60W	Computer	Printer	Photocopy M/C	AC	Wall Fan 40W	Exhaust 60W	Fan 100W
22	Room 6	1	0	0	0	1	0	0	0
23	Wash room 1st floor	0	0	0	0	0	0	5	0
24	Room 7	2	0	0	0	0	0	0	0
25	Room 8	1	0	0	0	0	0	0	1
26	Room 9	2	0	0	0	0	0	0	0
27	Room 10	2	5	1	1	1	0	0	0
28	Room 11	2	0	0	0	0	0	0	0
29	1st floor corridor	0	0	0	0	0	0	0	0
30	G Fl Corridor	0	0	0	0	0	0	0	0
		74	15	13	2	8	8	9	1



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Table 3.4: Details air-conditioning load (split AC)

Sr. no	Location	Quantity No.	Make	Cooling capacity (Ton)	Type	Rating Star	Year	ISEER	EER	Input Power kW
1	V C Sir cabin	1	LLOYED	2	Split	3	2024	3.95*	No	2.19
2	V C Sir cabin	1	LLOYED	2	Split	3	2024	3.95*	No	2.19
3	V C Sir cabin	1	MITSUBHISHI	1.5	Split	1	2022	3.36	No	1.59
4	Registrar sir cabin	1	LLOYED	2	Split	3	2024	3.95*	No	2.19
5	Registrar sir cabin	1	MITSUBHISHI	1.5	Split	1	2022	3.36	No	1.59
6	Conference Hall	1	MITSUBHISHI	1.5	Split	1	2022	3.37	No	1.96
7	Room No 6	1	VOLTAS	2	Split	NA	No	No	2.8	2.50
8	Room No 10	1	PANASONIC	2	Split	3	2013	No	10.2	2.17
	Total No Of ACs	8								

Observation: Most of the ACs is 3 star and 4 star rated. **It is appreciably**



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3.3 Photographs of ACs and fan



Wall Fan (50W)



Ceiling fan



Ceiling fan



Exhaust Fan (90W)



Split AC star rated



Inverter





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3.4 On Site Power Measurement at Main Electrical Panel



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Main power panel

Phase	Voltage (V)	Current (A)	Power Factor (Ø)	Input Power (KW)
R	405	9.7	0.94	6.40
Y	410	11.7	0.96	7.98
B	405	19.3	0.95	12.86
Avg.	406.7	13.6	1.0	9.1

Patanjali Bhawan

Phase	Voltage (V)	Current (A)	Power Factor (Ø)	Input Power (KW)
R	405	9.5	0.92	6.13
Y	410	0.3	0.93	0.20
B	405	14.8	0.91	9.45
Avg.	406.7	8.2	0.9	5.3

Yog Bhawan & Sandipni Bhawan

Phase	Voltage (V)	Current (A)	Power Factor (Ø)	Input Power (KW)
R	412	2.2	0.8	1.26
Y	406	0.5	0.35	0.12
B	402	0.7	0.35	0.17
Avg.	406.7	1.1	0.5	0.5



Single Phase power measurement

Location	Voltage (V)	Current (A)	Power Factor (Ø)	Input Power (KW)
VC Room cabin	212	3.1	0.92	0.60
Registrar Cabin	214	2.1	0.9	0.40
Library	220	1.4	0.89	0.27
Lekha vibhag	219	2.3	0.9	0.45

Observation:

- ✚ It was observed that average power factor is Low; it should be maintained up to 0.998 by installation of the capacitor bank.

Note: Detailed of power measurements is given in annexure-I

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CHAPTER-4

ENERGY CONSERVATION MEASURES

This chapter describes the energy conservation measures that can be implemented in a phase manner to optimize energy consumption in the building



ECM: 1 Replacement of conventional FTL (T-12), 40W by LED (T-5) 20W

Sr. No	Items	Parameters	Units
1	Total Power Consumption by Conventional Tube Light	54	Watt
2	No of tubes	8	Nos.
3	Working Hours per Day	8	Hrs./Day
4	Working Days per Year	250	Days/Year
5	Rated Power of Energy Efficient LED	20	W
6	Energy Saving Potential	544	kWh/Year
7	Load Factor	100	%
8	Expected Annual Energy Saving	544	kWh/Year
9	Overall Per Unit Charges for calculation	10.50	Rs./kWh
10	Expected Annual Monetary Saving	5712/-	Rs./Year
11	Cost of LED (T-5)	200/-	Rs./ Piece
12	Investment on New LED Lighting Purchase	1600/-	Rs.
13	Simple Pay Back Period	3.6	Month

ECM: 2 Replacement of old ceiling fan 60W by energy efficient 28W BLDC fan

Sr. No	Item	Parameter	Unit
1	Rated Power of new Ceiling Fan	60	W
2	No. of Fan	74	Nos.
3	Working Hrs./Day	8	Hrs./Day
4	Working Days/Year	250	Days/Year
5	Rated power of Energy Efficient BLDC Fan	28	W
6	Energy Saving Potential	4,736	kWh/Year
7	Load Factor	100	%
8	Expected Annual Energy Saving	4,736	kWh/Year
9	Overall Per Unit Charges for calculation	10.50	Rs/kWh
10	Expected Annual Monetary Saving	88,032/-	Rs./Year
11	Cost of BLDC Ceiling Fan	2,800/-	Rs./Piece
12	Investment on BLDC Fan Purchasing	3,66,800/-	Rs.
13	Simple Pay Back Period	4.2	Year

Note: Details of BLDC fan Product catalog is given in annexure-II

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ECM: 3 Replacement of 90W conventional exhaust fan by 40W BLDC fan.



Sr. No	Item	Parameter	Unit
1	Rated Power of Exhaust Fan	90	W
2	No. of Fan	9	Nos.
3	Working Hrs./Day	8	Hrs./Day
4	Working Days/Year	250	Days/Year
5	Energy Efficient BLDC Fan Rated power	40	W
6	Energy Saving Potential	900	kWh/Year
7	Load Factor	100	%
8	Expected Annual Energy Saving	900	kWh/Year
9	Per Unit Charges	10.50	Rs/kWh
10	Expected Money Saving	9,450/-	Rs./Year
11	Cost of New BLDC Exhaust Fan	2,300/-	Rs./Pieces
12	Investment on New Fan Purchasing	20,700/-	Rs.
13	Simple Pay Back Period	2.2	Year

Note: Details of BLDC fan Product catalog is given in annexure-II

ECM: 4 Installation of Airtron 'intelligent' microprocessor energy saver

Sr. No	Items	Parameters	Units
1	Average power consumption of 2 ton AC star rated	2500	Watt
2	No. of AC	8	Nos.
3	Working Hrs./Day	8	Hrs./Day
4	Working Days/Year	200	Days/Year
5	Expected saving @ 30% of power consumption of AC	750	W
8	Expected Annual Energy Saving	9600	kWh/Year
9	Overall, Per Unit Charges	10.50	Rs./kWh
10	Expected Money Saving	1,00,800/-	Rs./Year
11	Cost of Airtron 'Intelligent' Microprocessor energy saver	7,500/-	Rs./ Pieces
12	Total Investment on energy saver	60,000/-	Rs.
13	Simple Pay Back Period	7.1	Months

Note: Details of intelligent microprocessor energy saver product catalog is given in annexure-III

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ECM: 5 Installation of Grid Connected Solar System

Sr. No	Parameter	Value	Unit
1	Expected solar plant potential capacity (As per unit consumption Year-2022-23)	10	KWp
2	Expected solar unit generation @4 unit/day/KWp	40	kWh/Day
3	Expected Annual solar unit generation of the Solar Plant	14,600	KWh/Year
4	Annual unit consumption of college (Year 2022-23)	15,621	kWh/Year
Payback Period Calculation			
1	Total solar unit generation of the system(10 KWp)	14600	kWh/ year
2	Overall energy charges per unit as per Electricity bill	8.50	Rs/kWh
3	Expected revenue generation	1,24,100/-	Rs./year
4	Expected cost of 1kw solar plant @Rs.45/- per watt	45,000/-	Rs./KWp
5	Expected total investment	4,50,000/-	Rs.
6	Simple payback period of the project	3.6	year



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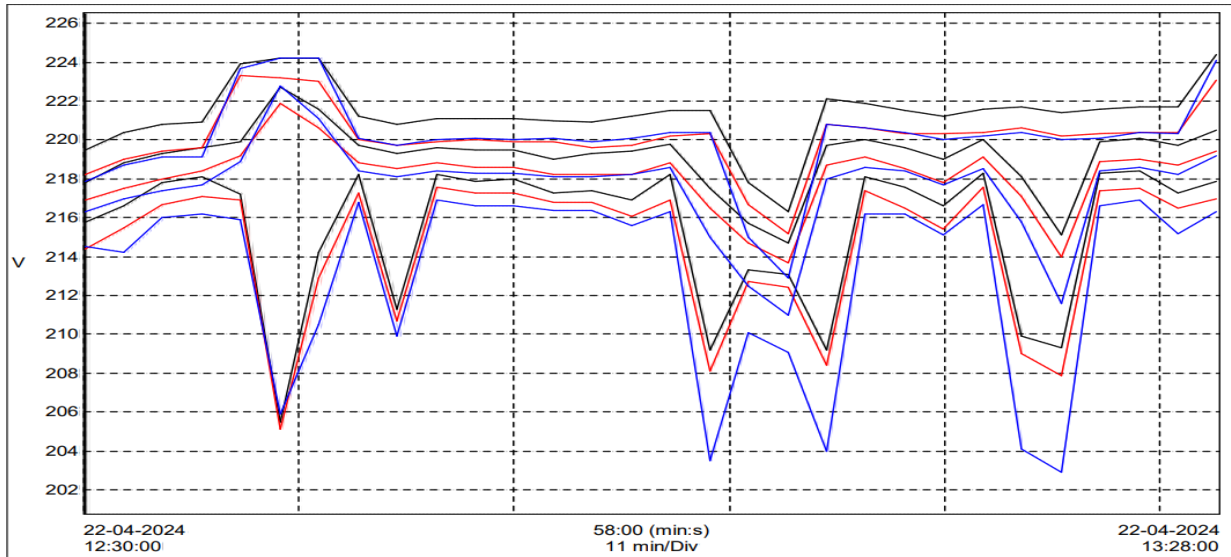
Year 2022-23



ANNEXURE-I: Details of power measurement by ALM-31 power Analyzer

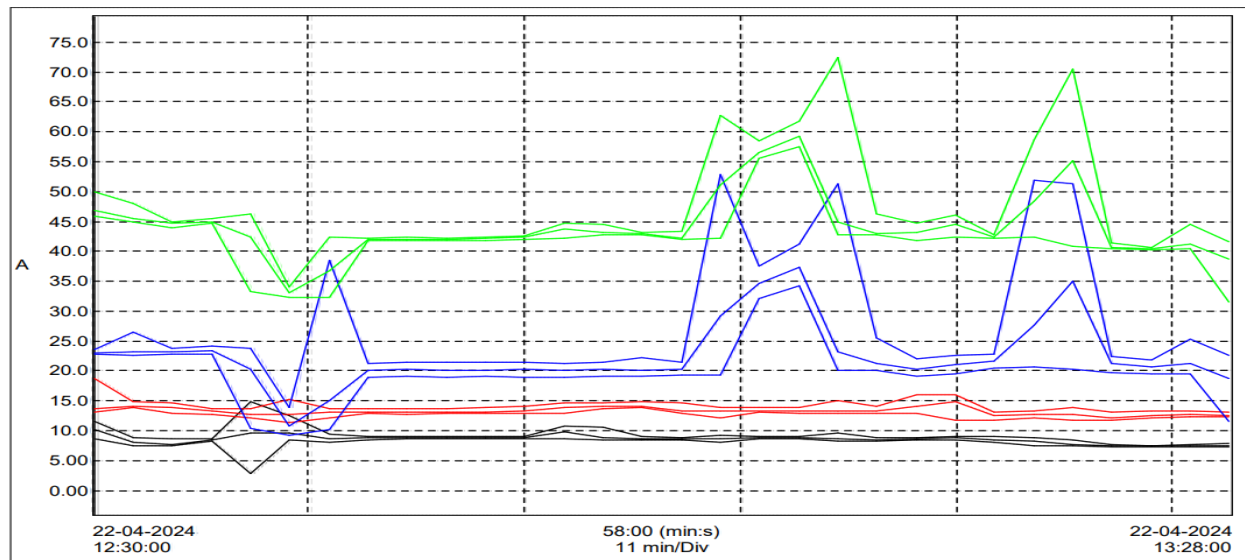
Voltage Measurement

Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
V1-N rms	22-04-2024	12:30:00	219.2	205.5	224.4	V	1:00:00	(h:min:s)
V2-N rms	22-04-2024	12:30:00	218.2	205.1	223.3	V	1:00:00	(h:min:s)
V3-N rms	22-04-2024	12:30:00	217.6	202.9	224.2	V	1:00:00	(h:min:s)



Current Measurement

Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
A1 rms	22-04-2024	12:30:00	8.621	2.810	14.88	A	1:00:00	(h:min:s)
A2 rms	22-04-2024	12:30:00	13.29	11.41	18.82	A	1:00:00	(h:min:s)
A3 rms	22-04-2024	12:30:00	23.09	9.230	52.94	A	1:00:00	(h:min:s)
AN rms	22-04-2024	12:30:00	44.55	31.57	72.46	A	1:00:00	(h:min:s)





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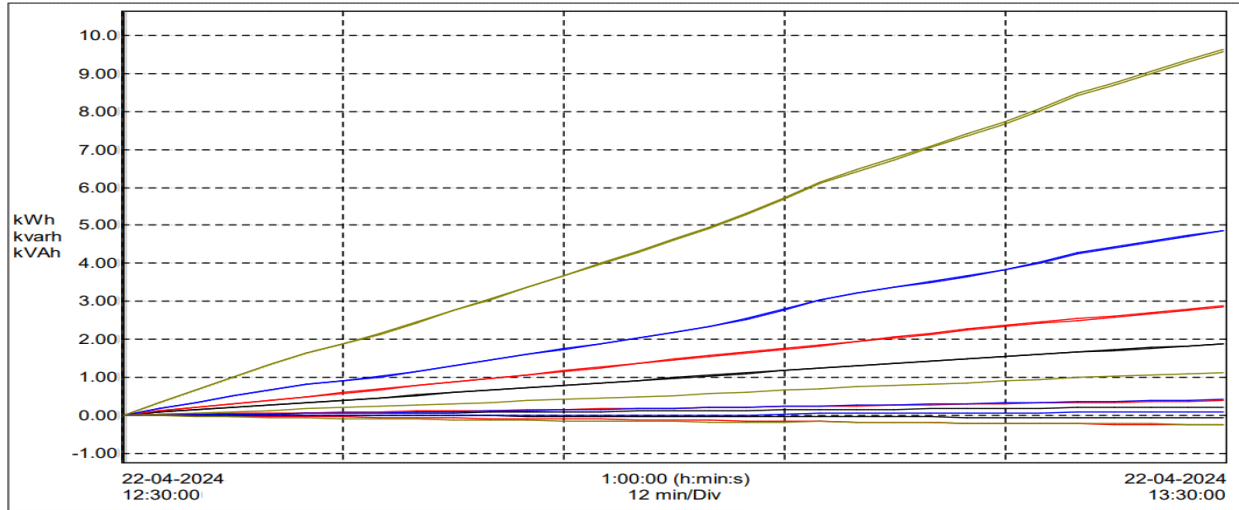
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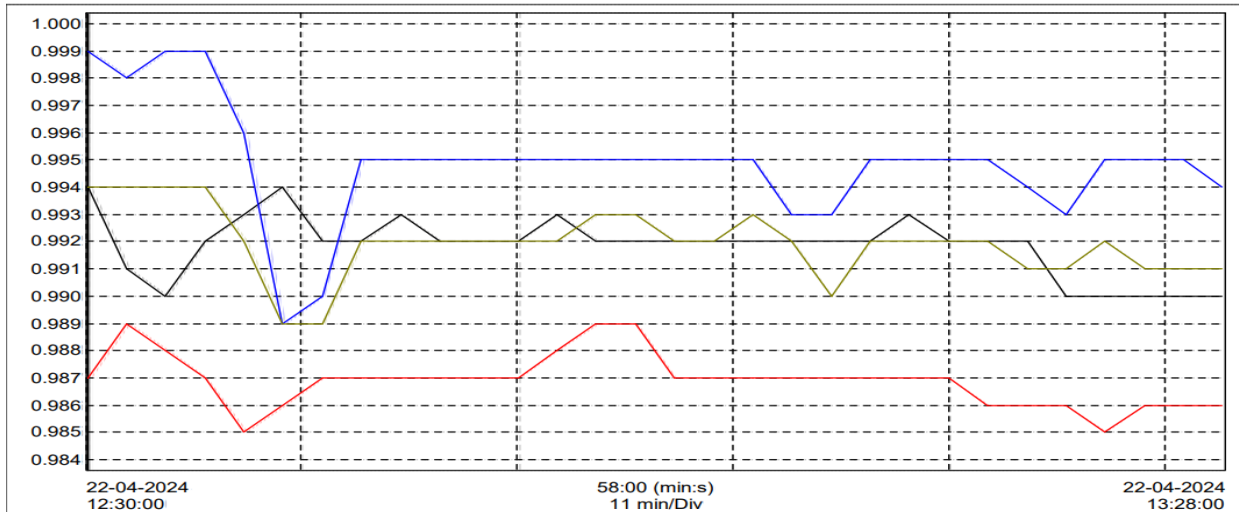
Total Power Measurement

Name	Date	Time	MAX	Units	Duration	Units
D1 (varh)	22-04-2024	12:30:00	217.5	varh	1:00:00	(h:min:s)
D2 (varh)	22-04-2024	12:30:00	372.8	varh	1:00:00	(h:min:s)
D3 (varh)	22-04-2024	12:30:00	402.7	varh	1:00:00	(h:min:s)
DT (varh)	22-04-2024	12:30:00	1.128k	varh	1:00:00	(h:min:s)
P1 (Wh)	22-04-2024	12:30:00	1.870k	Wh	1:00:00	(h:min:s)
P2 (Wh)	22-04-2024	12:30:00	2.860k	Wh	1:00:00	(h:min:s)
P3 (Wh)	22-04-2024	12:30:00	4.849k	Wh	1:00:00	(h:min:s)
PT (Wh)	22-04-2024	12:30:00	9.580k	Wh	1:00:00	(h:min:s)



Power factor measurement

Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
PF1	22-04-2024	12:30:00	0.992	0.990	0.994		1:00:00	(h:min:s)
PF2	22-04-2024	12:30:00	0.987	0.985	0.989		1:00:00	(h:min:s)
PF3	22-04-2024	12:30:00	0.995	0.989	0.999		1:00:00	(h:min:s)
PFT	22-04-2024	12:30:00	0.992	0.989	0.994		1:00:00	(h:min:s)





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Annexure-II: BLDC ceiling and exhaust fan product catalog

EFFICIO

2+1* year on-site warranty

SAVES UP TO
₹ 1500 IN A YEAR

RUNS 3X LONGER
ON INVERTER

White

Matte Black*

Matte Brown

Ivory

	BLDC Motor Compact and Powerful	65% Electricity Saving	Sweep (mm)	Power (W)	Input Voltage (V)	RPM	Air Delivery CMM (m ³ /min)	Power Factor	Service Value (CMM/W)	MRP (₹)
	Toggle Operation to Control Speed	Smart Remote Control	900	28	140-285	470	157	0.99	5.6	3590
			1050	32	140-285	430	235	0.99	7.4	3690
			1200	28	140-285	340	235	0.99	8.4	3690
			1400	32	140-285	275	270	0.99	8.4	4090



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Annexure-III: Airtron intelligent microprocessor energy saver product catalog

PATENT PUBLISHED

AIRTRON

CUTs your AC Bills by Upto 35%
Payback 4-6 months

National Award CII "INNOVATIVE ENERGY SAVING PRODUCT"

**I. CII - GBC CERTIFIED SAVINGS OF :
35% IN CONVENTIONAL AC'S.
25% IN INVERTER AC'S**

**II. EESL (MINISTRY OF POWER) CERTIFIED SAVINGS OF :
33% & 44% IN 2 SEPARATE TRIALS.**

III. LG: Certified 25% savings on inverter AC.

- **World's first & only programmable AC saver to guarantee savings without increasing the room temp.**
Airtron's unique "Temperature Lock" feature offers additional Savings upto 30%, over and above the operational Savings.
- **The Airtron offers all the controls of a "Precision AC" to maintain Set Temp accurately & substantially increases life of your compressor!**
- **Displays Room & Coil temperature.**
- **Automatically adapts AC to changes in Ambient temperature & climates!**
- **APPLICABLE on ALL AC'S, Windows, Splits, Ductables, Cassettes, Multi-Splits, etc**
- **SAVES on Inverters & 5-Star/1-Star AC's, upto 20 TR.**