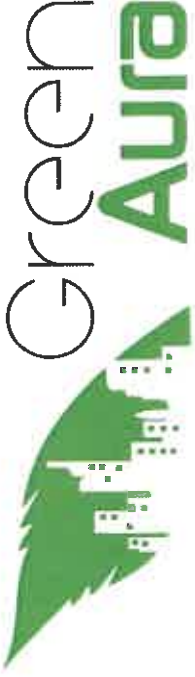


ENERGY AUDIT REPORT | 2023



692F, 12TH A CROSS BEL LAYOUT, BENGALURU - 560091
 (ISO/IEC 17020:2012, ISO 9001:2015, ISO 14001:2015 Certified Organisation &
 Ministry of MSME registered organisation),

Certificate of Energy Audit

THIS CERTIFICATE IS PRESENTED TO

M. S. RAMAIAH UNIVERSITY OF APPLIED SCIENCES

This is to certify that M. S. Ramaiah University of Applied Sciences has successfully undergone 'Energy Audit' on 11th November, 2023 and assessed the electrical energy conservation, energy saving measures, policies and standards in the campus were found to be excellent.

This certificate is valid till 11th November 2024

Ref. No: GA / ENERGY AUDIT / 02 / 11 / 23



Nischay N Gowda

DR NISCHAY N GOWDA

Founder & Director - Green Aura

CERTIFIED ISO EMS-LA, IGBC - AP,
 US GREEN BUILDING COUNCIL - GREEN ASSOCIATE
 GLOBAL DOCTORATE, SWITZERLAND.

[Signature]

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 Bangalore - 560 054



Green Audit Certificate

This certificate is awarded to **M. S. Ramaiah University of Applied Sciences, University House, Gnanagangothri Campus, New BEL Road, MSR Nagar, Bangalore, 560054** in recognition of their commitment and efforts towards environmental sustainability.

As a result of the Green Audit conducted on **7th Nov 2023**, it has been determined that **M. S. Ramaiah University of Applied Sciences** has implemented a range of effective environmental sustainability practices in line with National Building Code 2016 –Part-11.

This certificate is valid for following scope of activities:

Green Audit
Energy Audit
Environment Audit

Audit Date : 7th Nov 2023
Certificate No. : 1B05323B20000160
Issuance Date : 11th Nov 2023



Registrar

M.S. Ramaiah University of Applied Sciences
Bangalore - 560 054



Signature
Maneet Dewan
Director

PQMS Quality Services Private Limited
SCO-21, 4th Floor, Feroze Gandhi Market, Ludhiana-141001 (Punjab)
Email: info@qualityindia.in website: www.qualityindia.in

ENERGY AUDIT REPORT 2023

CONSULTATION REPORT
M. S. Ramaiah University of Applied Sciences
Bengaluru, Karnataka – 560054



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ACKNOWLEDGEMENT

GREEN AURA, Bengaluru, Karnataka takes this opportunity to appreciate & thank the management **M. S. Ramaiah University of Applied Sciences** for giving us an opportunity to conduct energy audit for the buildings of the college.

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

Energy Audit Team

The study team consisted of senior technical executives from Green Aura, and the audit spanned multiple visits from September to November 2023.

- **Dr. Nischay N Gowda**, Founder & Director Green Aura, Bengaluru.
Lead Auditor PQMS Quality Services Pvt Ltd. (IGBC-AP and LEED-Green Associate).
- **Mr. Manish Walecha**, Certified Energy Auditor (EA-34073/23).
- **Mr. Sachin Kumawat**, Certified Energy Manager (EM-300475/23).
- **Mr. Akash Kumar**, Engineer.



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Dr Nischay N Gowda,
Director

EXECUTIVE SUMMARY

The executive summary of the energy audit report furnished in this section briefly gives the identified energy conservation measures in the University.

ENERGY INITIATIVE TAKEN BY UNIVERSITY

☛ SOLAR PHOTOVOLTAIC ROOFTOP PLANT INSTALLATION

University has total installed total 55 KWp grid connected solar roof top system. One is Ganaganagotri campus (20 KWp) and other one is Ramaiah technology campus (35 KWp) Total Solar unit generation is 21,137 KWp from Jan-2023 to Oct-2023 **It's Appreciable.**

☛ LIGHTING SYSTEM

Installation of 100% Energy Efficient LED lighting is one the example of good procurement policy of the management. **It's Appreciable.**

☛ SENSOR BASED LIGHTING SYSTEM IN RTC CAMPUS.

University has installed sensor-based lighting system in university **It's Appreciable.** Details are given in below table

Sr. No	Area Name	Quantity
1	University House (Washroom)	2
2	Faculty of Pharmacy	1
3	Faculty of Management and commerce	1
4	Faculty of Hospitality management and catering technology	1
5	Faculty of Dental Science	1
6	Ramaiah technology campus	5
	Total	11

☛ TIMER CONTROLLED STREET LIGHTS

University has installed "Timer control on high mast and street lighting" in university campus. **It is Appreciable**


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AREAS FOR IMPROVEMENT

POWER FACTOR IMPROVEMENT

The average power factor it was 0.85. It is recommended to maintain the power factor 0.995 or unity.

DEMAND REDUCATION

AT 200 KVA CONNECTION ON RTC BUILDING

At present university contract demand of Ramaiah technology building is 200 KVA. And maximum demand recorded is 31 KVA from jan-2023 to oct-2023. University management has paid **5, 37,375/-** due to demand not utilized in 10 months. There is good potential is demanding reduction 125 KVA If the future expansion is not taken by university management than it should be possible. **Details calculation in chapter-08.**

AT 750 KVA CONNECTION ON RTC BUILDING

At present university contract demand of Ramaiah technology building is 750 KVA. And maximum demand recorded is 314 KVA from jan-2023 to oct-2023. University management has paid **13, 68,000/-** due to demand not utilized in last 10 months. There is good potential is demanding reduction 350 KVA. If the future expansion is not taken by university management than it should be possible. **Details calculation in chapter-08.**

IOT BASED ENERGY MONITORING SYSTEM IN PLACE OF SUB METER: -

- Installation of “Cloud based (IoT based) energy monitoring system” including harmonic measurement (total voltage and current harmonic distortion %) in every building of GG Campus. It will be good initiative for energy monitoring by management.

ENERGY MANAGEMENT WORKSHOP AND TRAINING

- Develop energy management policies for university. Establish a procurement policy that is energy saving and eco-friendly.
- Conduct awareness and training programs for faculty, student and non-teaching staffs. Conduct seminars, workshops and exhibitions on energy management education. Involve All Stakeholders - Encourage involvement of government, founder members, and industry for supporting interdisciplinary research, education, policy formation, and information exchange in energy management system



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CHAPTER-01

INTRODUCTION OF ENERGY AUDIT

1.1 About Energy Audit

An energy audit is a systematic process of evaluating and analyzing the energy consumption and efficiency of a building, facility, or organization to identify opportunities for energy savings and improved energy performance. The primary goal of an energy audit is to assess how energy is used, wasted, or potentially conserved within a given system or operation.

1. **Identify Energy Consumption:** - Determine how and where energy is being used within a facility or organization, including electricity, natural gas, heating oil, water, and other energy sources.
2. **Quantify Energy Efficiency:** - Assess the efficiency of energy-consuming systems and equipment, such as HVAC (heating, ventilation, and air conditioning) systems, lighting, appliances, and industrial processes.
3. **Identify Energy Conservation Measures (ECMs):** - Identify specific opportunities to reduce energy consumption and improve energy efficiency. This may involve upgrading equipment, optimizing operations, or implementing energy-efficient technologies
4. **Estimate Cost Savings:** - Calculate potential energy and cost savings associated with implementing recommended ECMs. This helps organizations prioritize energy-saving initiatives based on return on investment (ROI).
5. **Prioritize Recommendations:** - Present a list of recommendations, along with their associated costs and benefits, to help stakeholders make informed decisions about which energy-saving measures to pursue.
6. **Promote Sustainability:** -Energy audits can contribute to sustainability efforts by reducing greenhouse gas emissions and environmental impact, which is particularly important in the context of climate change mitigation

GREEN AURA, Bangalore Karnataka carried out the energy audit at the site to find loopholes in the energy consumption pattern for M. S. Ramaiah University of Applied Sciences. A technical report has been prepared as per the data basis & need of the requirement of the project.


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1.2 Objectives of Energy Auditing

The primary object of an energy audit is to assess and analyze the energy usage and efficiency of a building, facility, or process. Energy audits are conducted to achieve several specific goals and objectives, including

1. Identify Energy Efficiency Opportunities.
2. Fixing of energy saving potential targets for individual cost centers
3. To reduce operational costs.
4. To reduce energy consumption per unit product output.
5. Improve Energy Performance.
6. Relating energy inputs and production output
7. To find and apply effective planning for more effective use of energy throughout the industry works.
8. Identifying potential areas thermal and electrical energy efficiency.

1.3 Energy Audit Methodology

An energy audit is a systematic process of evaluating and analyzing energy usage in a facility or organization to identify opportunities for energy efficiency improvements. The goal of an energy audit is to reduce energy consumption, lower energy costs, and minimize environmental impacts. There are different levels of energy audits, ranging from a basic walkthrough audit to a comprehensive investment-grade audit.

1. Preparation and Planning

- Define the scope and objectives of the energy audit.
- Gather historical energy consumption data and utility bills.
- Assemble a team of auditors with expertise in energy systems, including HVAC, lighting, electrical, and building envelope.
- Obtain building plans, equipment manuals, and other relevant documentation.
- Schedule the audit and secure necessary permissions and access to facilities

2. Site Assessment

- Conduct a walkthrough of the facility to understand its layout, systems, and operations.
- Identify and document key energy-consuming equipment and systems.
- Collect data on operating hours, temperature settings, and occupancy patterns.
- Note any maintenance issues or equipment malfunctions that may affect energy efficiency.
- Perform basic energy benchmarking to compare the facility's energy performance with industry standards or similar facilities



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3. Data Collection and Analysis

- Install energy monitoring equipment, such as data loggers, to track energy usage in real-time if necessary.
- Collect data on energy consumption for each identified system and equipment.
- Analyze energy bills to determine cost breakdown and seasonal variations.
- Calculate energy consumption and efficiency metrics (e.g., kWh, BTUs, Energy Use Intensity, etc.).
- Identify energy waste, anomalies, or deviations from expected performance.

4. Data Collection and Analysis

- Develop a list of energy-saving recommendations based on the audit findings.
- Prioritize recommendations based on cost-effectiveness, payback period, and potential energy savings.
- Provide detailed specifications for implementing each recommendation, including estimated costs and potential incentives or rebates.
- Consider both low-cost/no-cost measures (behavioral changes, maintenance improvements) and capital-intensive measures (equipment upgrades, retrofits)

5. Reporting and Documentation

- Compile the audit findings, recommendations, and supporting data into a comprehensive audit report.
- Include a summary of potential energy savings, estimated costs, and return on investment (ROI) for each recommendation.
- Present the report to key stakeholders, such as management, facility operators, and decision-makers.

6. Monitoring and Verification

- After implementing energy-saving measures, monitor energy consumption to verify actual savings.
- Adjust operations and maintenance practices as needed to maintain energy efficiency.
- Periodically review and update the energy management plan to ensure continuous improvement.

7. Education and Training

- Provide training to facility staff to ensure proper operation and maintenance of energy-efficient systems.
- Raise awareness among occupants about energy conservation practices



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CHAPTER-02

INTRODUCTION

2.1 About University

M. S. Ramaiah University of Applied Sciences (MSRUAS) is a multidisciplinary, innovative, and collaborative Higher Education Institute established as a Private University by an Act of Karnataka State in 2013, with a vision to be student centric, emphasizing on applied research, while maintaining high academic and ethical standards. Initially, the University had Faculties of Engineering and Technology, Art and Design, Management and Commerce, Mathematical and Physical Sciences, Life and Allied Health Sciences, Pharmacy, Dental Sciences and Hospitality Management. The School of Social Sciences and School of Law were added in 2020. M S Ramaiah Medical College, M S Ramaiah Institute of Nursing Education and Research and M S Ramaiah University of Physiotherapy were brought under MSRUAS in 2022. MSRUAS offers Undergraduate, Postgraduate, Vocational and Ph.D. Programmes. The University has a student strength of around 7000+ and 740+ qualified faculty members well trained in pedagogy and constantly striving to impart quality education to address societal challenges. Through adoption of global best practices in curricular, research, co-curricular and extra- curricular activities, MSRUAS ensures all-round development of students. Directorates of Student Affairs, Training and Lifelong Learning, Transferable Skills and Leadership Development, Research, Internal Quality Assurance Cell, Techno-Centre, Entrepreneurship, International Collaborations and Partnership Management, support the academic activities and interaction with Academia, Research Organizations, Industry, and Communities, in India and Abroad. MSRUAS is equipped with modern infrastructure and laboratories including an Advanced Learning Centre supporting initiatives in Research, Advanced Design, Simulation, Testing, Clinical Studies, and Health Care.

2.2 University vision and mission

VISION

RUAS aspires to be the premier university of choice in Asia for student-centric professional education that lays emphasis on applied research while maintaining the highest academic and ethical standards.

MISSION

Our purpose is the creation and dissemination of knowledge. We are committed to creativity, innovation, and excellence in our teaching and research. We inspire critical thinking, personal development and a passion for lifelong learning.

We value integrity, quality, and teamwork in all our endeavors. And we serve the technical, scientific, and economic needs of our society.

**CHAPTER-03
POWER SUPPLY SYSTEM**

Part-01 (Gnanagangothri Campus)

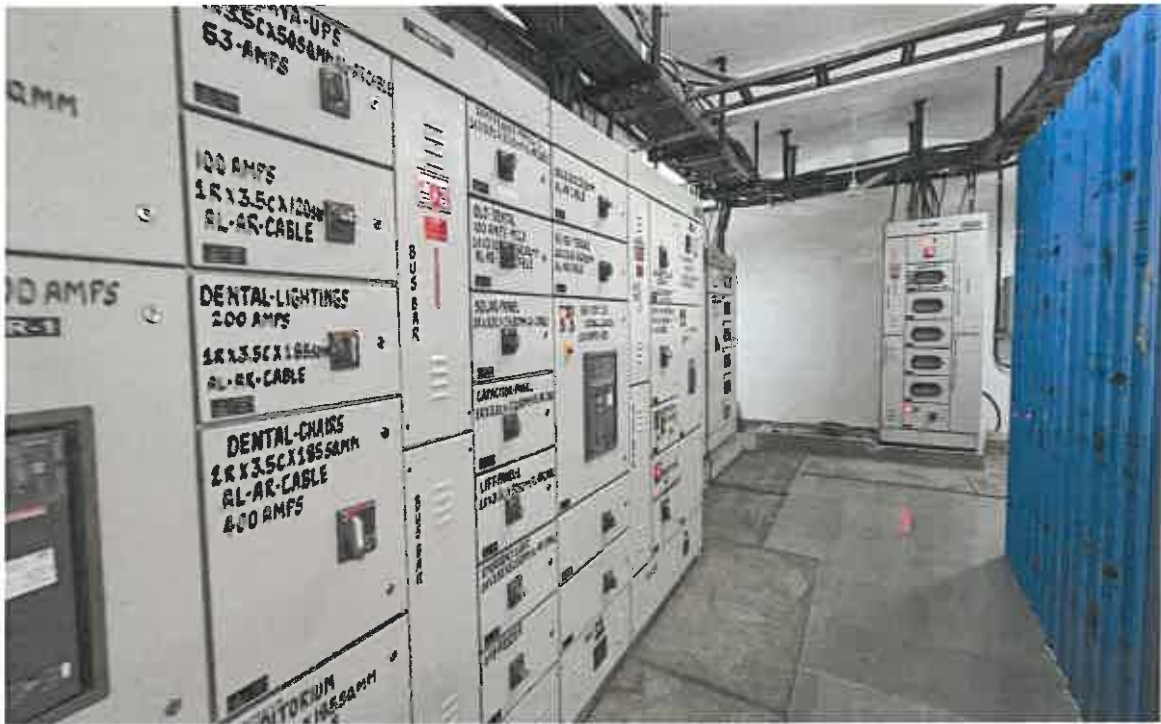
3.1 Transformer

There is one main electricity connection is 2151 KVA (The Register, M.S. Ramaiah Medical College Bangalore) and for each building they have sub meters for reading consumption details. This campus has one transformer details are below

Sr. No.	Items	Technical Details Transformer (TR)
1	Make	(KPRS) Kiran Power Rectification Services (P) Ltd.
2	Location	Gnanagangothri Campus
3	Year	2012
4	Rating (KVA)	1000
5	Voltage (HV/ LV)	11000/433
6	Current Rating (HV/ LV)	52.48/1333.33
7	Frequency (Hz)	50
8	Impedance at 75°C	5.12 %
9	Vector group	Dyn-11
10	Type of cooling	ONAN

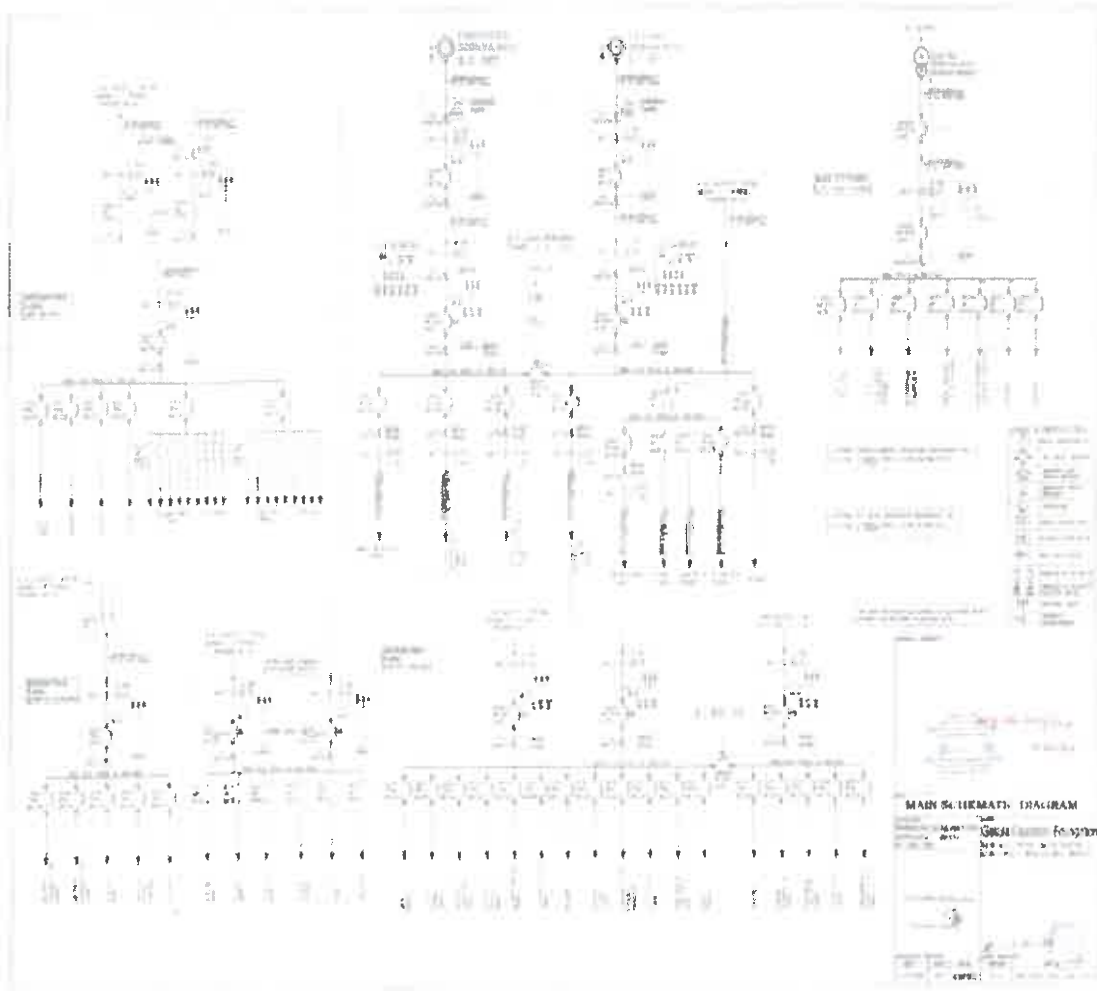


1000 KVA Transformer



Control panel room at Gnanagangothri Campus

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Main schematic diagram of the GG Campus.

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3.2 DG SETS

The GG Campus has 02 Nos. DG sets one is 500 KVA and second is 320 KVA both for supply emergency power during the grid power failure.

Sr. No.	Parameter	Technical Specification DG Set-01	Technical Specification DG Set-02
1	Make	Cummins	Cummins
2	Model No	VTA28	1150G
3	Capacity (KVA)	500	320
4	Rated Voltage	415	415
5	ESN	25166387	25168243
6	Frequency	50	50
7	Phase	3	3



500 KVA DG Set



320 KVA DG Set

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DG unit generation and fuel consumption details.

320 KV DG Sets						
Sr. No	Month & Year	Unit generated (kWh)	Diesel consumption (Litre)	DG run hour	Unit generated (kWh/litre)	Consumption per hour (Litre)
1	Jan-23	204	110	4.8	1.8	22.9
2	Feb-23	72	60	2.9	1.2	24
3	Mar-23	180	100	4.7	1.8	21.27
4	Apr-23	504	160	6.6	3.15	24.2
5	May-23	876	365	11.7	2.4	31.19
6	Jun-23	948	435	13.1	2.17	33.2
7	Jul-23	64	50	3.4	1.28	15
8	Aug-23	456	290	8.7	1.5	33.33
9	Sep-23	96	90	3.7	1.06	24.31
10	Oct-23	72	80	3.3	0.9	22
Total		3472	1740	62.9	17.26	251.4

500 KV DG Sets						
Sr. No.	Month & Year	Unit generated (kWh)	Diesel consumption (Litre)	DG run hour	Unit generated (kWh/litre)	Consumption per hour (Litre)
1	Jan-23	144	150	4.5	0.96	33
2	Feb-23	1168	440	10.1	2.65	43
3	Mar-23	64	70	3.1	0.91	22
4	Apr-23	2960	850	13.7	3.48	62.04
5	May-23	4160	1250	19.1	3.32	65
6	Jun-23	10080	2830	38.9	3.65	72
7	Jul-23	32	60	3.3	0.54	18
8	Aug-23	3632	1280	23.1	2.8	55.4
9	Sep-23	48	80	2.4	0.6	33
10	Oct-23	96	110	3.2	0.8	33
Total		22384	7120	121.4	19.718	436.44

Observation: -

- ✦ DG sets are used whenever grid power failure.
- ✦ Both DG sets kWh/litre is lower side. Which should be within range 3 to 4 kWh/litre


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3.3 GRID CONNECTED SOLAR PHOTOVOLTAIC SYSTEM (20 KWp)

There is a 20 KWp solar photovoltaic rooftop grid-connected system installed on various buildings. System details are given below:

Sr. No	Parameter	Technical Details
1	Make	Tata Power Solar System Ltd.
2	Solar Capacity	20 KWp
3	System Type	On Grid Type
4	No. of Solar Modules	88Nos.
5	Solar Modules Watts	250 Watts

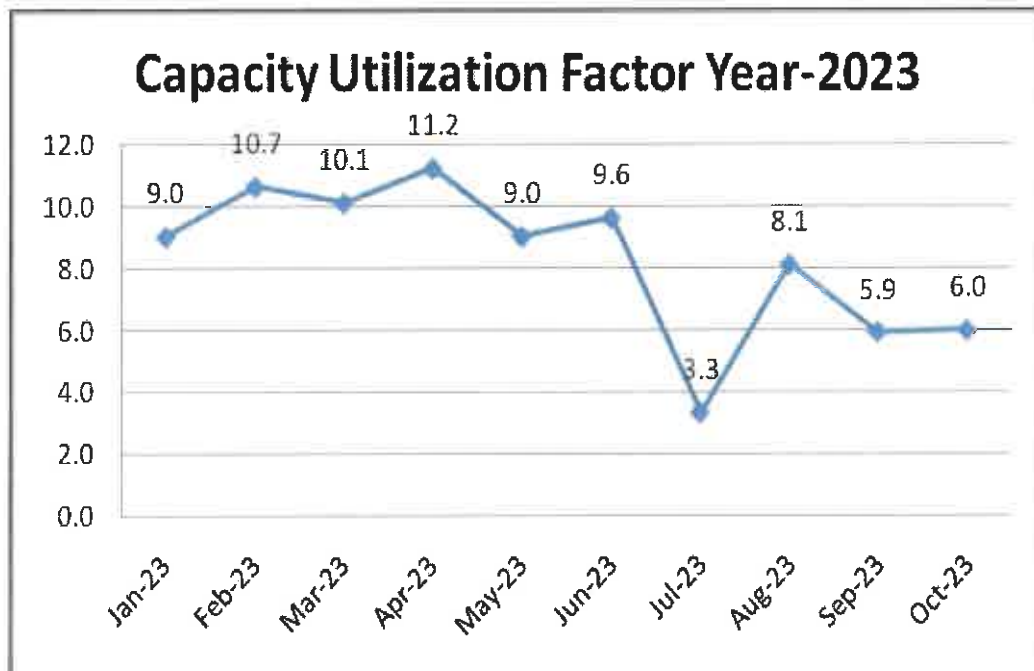


20 KWp Solar System

Solar unit generation Year-2023: -

Monthly Solar unit generation Year-2023

Sr. No.	Month & Year	Solar Unit Generation (KWp)	No of Days	Capacity Utilization Factor (CUF)%
1	Jan-23	2,352	31	9.0
2	Feb-23	2,506	28	10.7
3	Mar-23	2,634	31	10.1
4	Apr-23	2,831	30	11.2
5	May-23	2,351	31	9.0
6	Jun-23	2,427	30	9.6
7	Jul-23	867	31	3.3
8	Aug-23	2,113	31	8.1
9	Sep-23	1,496	30	5.9
10	Oct-23	1,560	31	6.0
Total		21,137	304	8.3



Observation: -

Total unit generation from Jan-2021 to Dec -2021 is 21,137 (KWp) units


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**CHAPTER-04
ENERGY CONSUMPTION ANALYSIS**

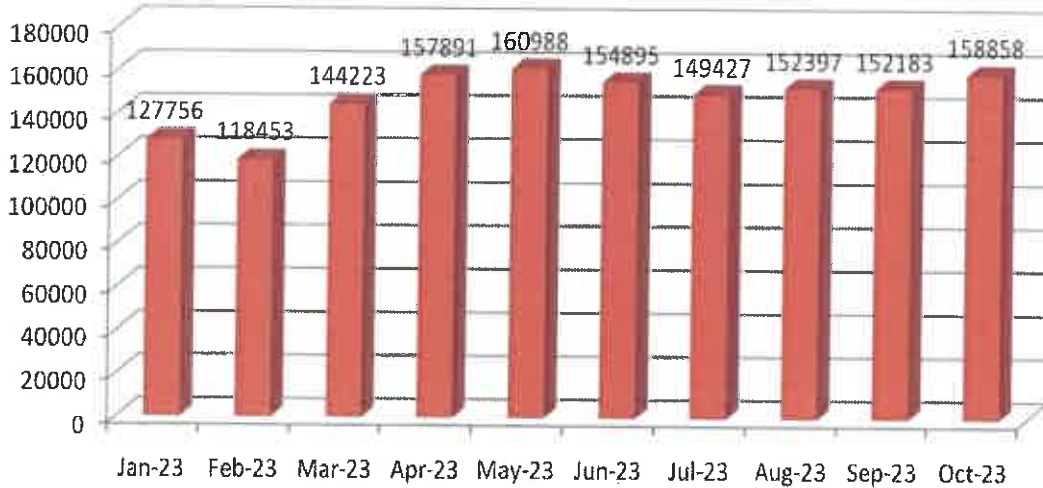
The energy audit team analysed the electricity bills for the GG Campus over the past year (2023)

Electricity Meter reading at GG Campus for Jan-2023 to Oct-2023						
Sr. No.	Month & Year	UAS House	ALC	FDS	FMC	FHMCT
1	Jan-23	1,297	30,686	31,048	9,000	6,925
2	Feb-23	1,800	28,836	19,254	10,000	8,089
3	Mar-23	3,391	34,427	25,365	12,000	9,712
4	Apr-23	5,164	40,956	25,403	13,000	10,876
5	May-23	4,735	34,875	29,132	13,000	10,992
6	Jun-23	4,547	38,128	26,983	13,000	9,338
7	Jul-23	1,947	34,465	35,287	11,000	7,196
8	Aug-23	3,081	40,728	23,231	15,000	9,390
9	Sep-23	3,017	41,309	24,378	14,000	8,369
10	Oct-23	3,882	40,988	23,568	14,000	8,660

Electricity Meter reading at GG Campus for Jan-2023 to Oct-2023								
Sr. No.	Month & Year	FPH	SOL & SSS	RMC	Nursing	Physio	Street	Total (kWh)
						therapy	Light	
1	Jan-23	8,188	12,788	20,994	2,867	1,953	2,010	1,27,756
2	Feb-23	7,604	14,513	20,489	3,060	2,359	2,449	1,18,453
3	Mar-23	6,221	11,094	32,455	3,849	2,892	2,817	1,44,223
4	Apr-23	6,296	13,002	32,464	3,934	4,578	2,218	1,57,891
5	May-23	8,977	13,157	36,477	3,667	4,028	1,948	1,60,988
6	Jun-23	6,802	13,395	33,470	3,804	3,806	1,622	1,54,895
7	Jul-23	5,888	15,983	28,820	3,370	2,600	2,871	1,49,427
8	Aug-23	5,701	16,793	29,130	3,753	3,806	1,784	1,52,397
9	Sep-23	4,995	17,406	30,679	3,587	2,734	1,709	1,52,183
10	Oct-23	5,999	18,687	33,468	3,938	2,812	2,856	1,58,858


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Energy Consumption of GG Campus
(Jan-2023 to Oct-2023)



Graphical presentation of Energy consumption of GG campus.

Observation

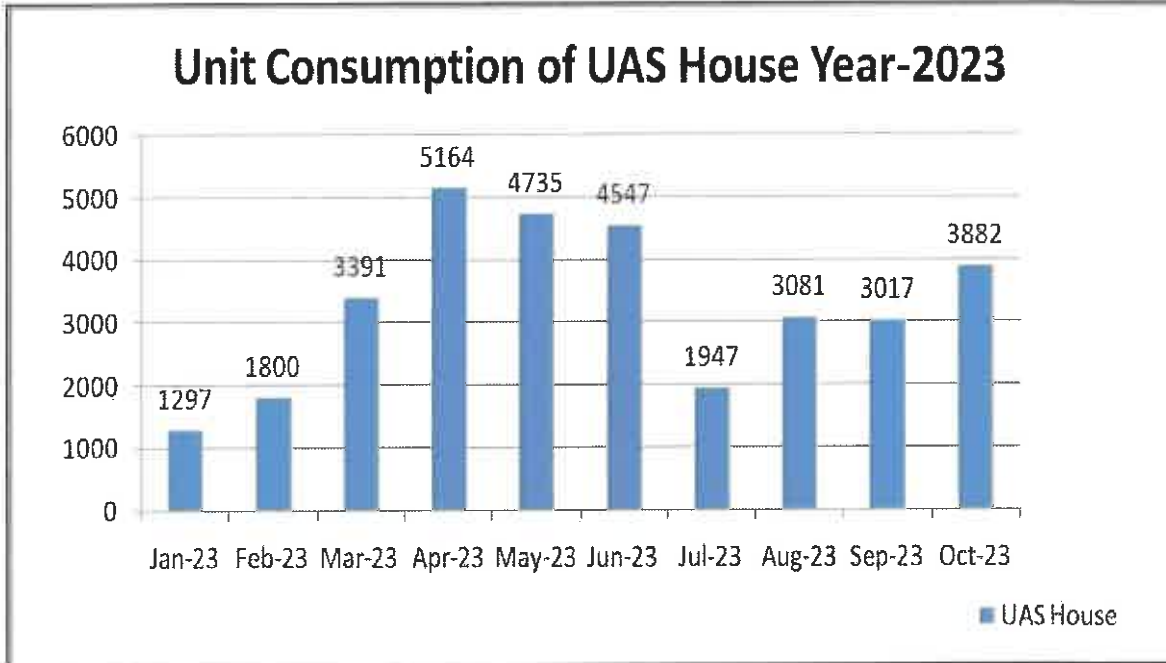
- ✦ Total energy consumption of the GG Campus is 14, 77,071 units during period Jan-2023 to Oct-2023.
- ✦ University has a sub meter for every building in GG Campus

Recommendation:

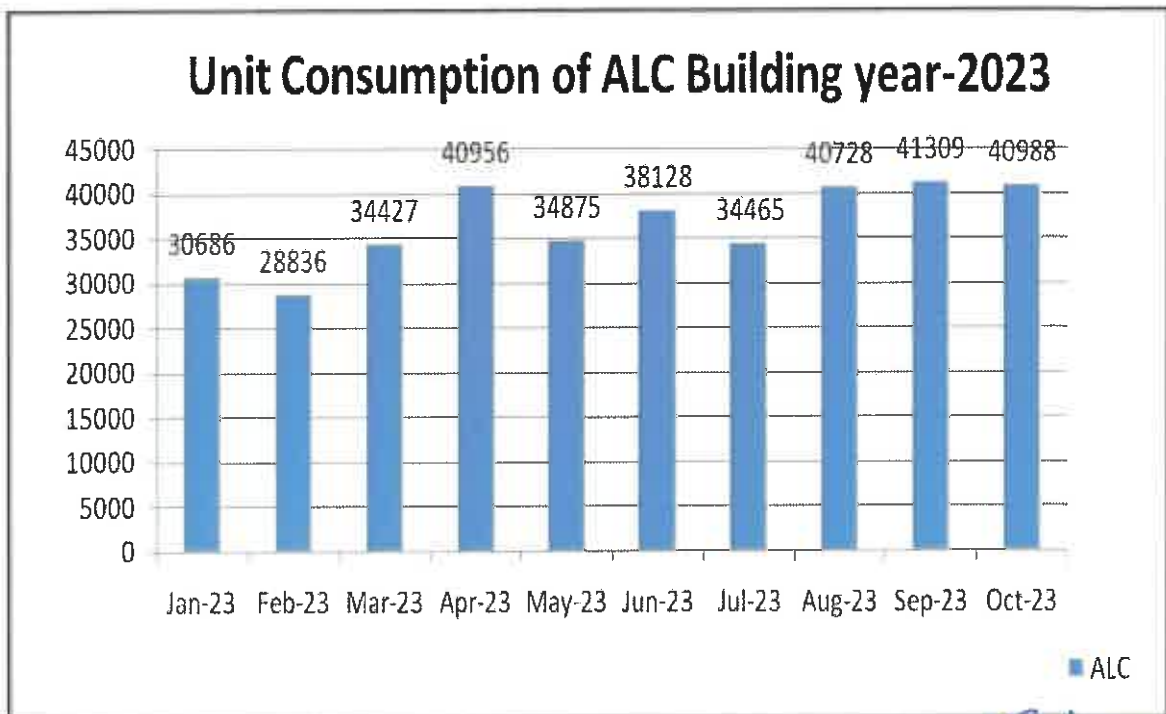
- ✦ Installation of “Cloud based (IoT based) energy monitoring system” including harmonic measurement (total voltage and current harmonic distortion %) every building. It will be good initiative for energy monitoring by university side.

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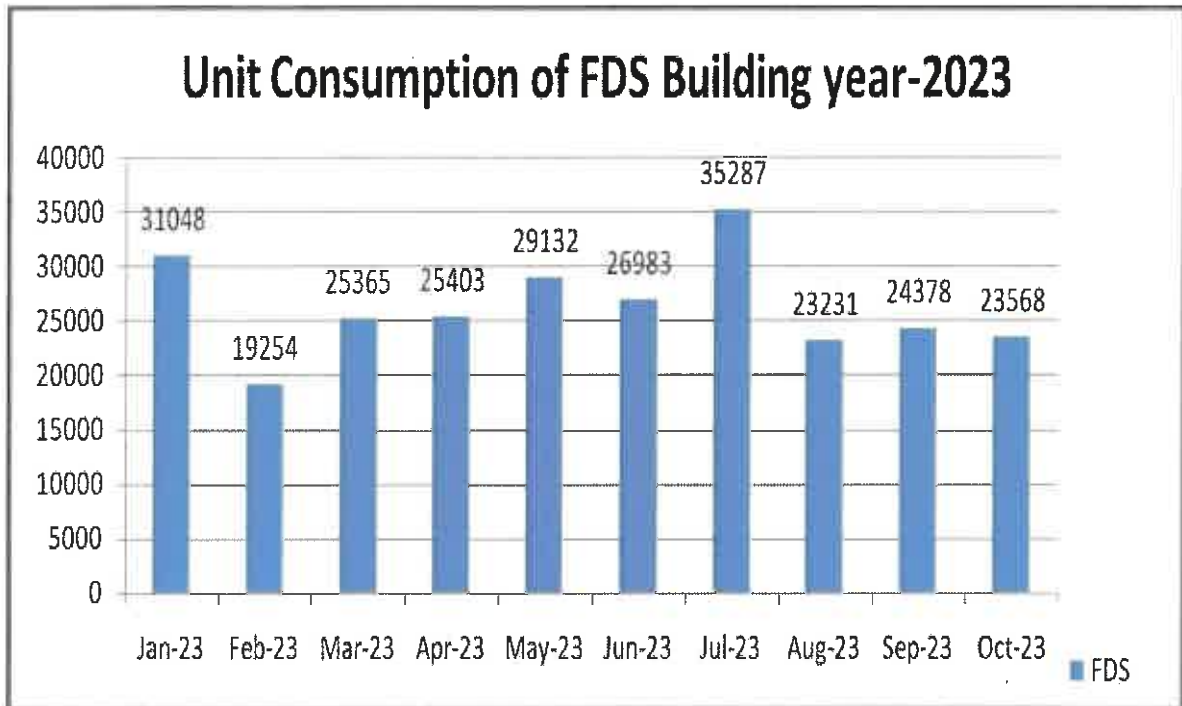
Graphical Presentation of all building unit consumptions is below



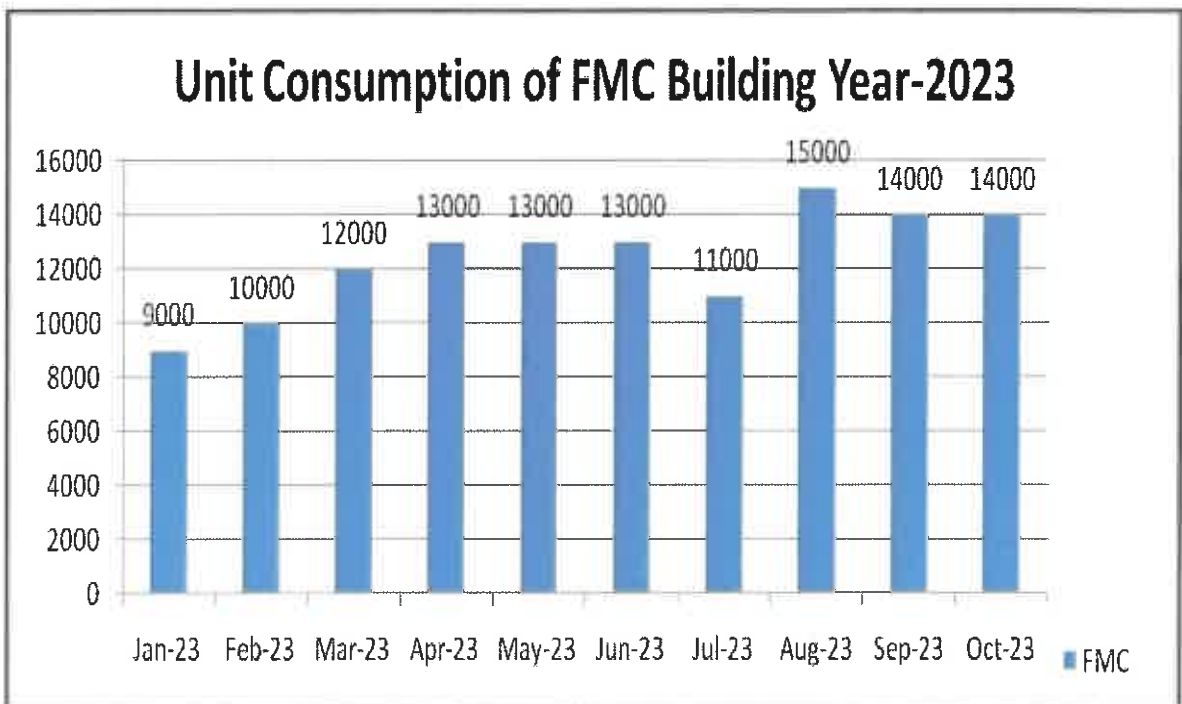
Graphical presentation of energy consumption UAS house year-2023



Graphical presentation of energy consumption ALC building year-2023

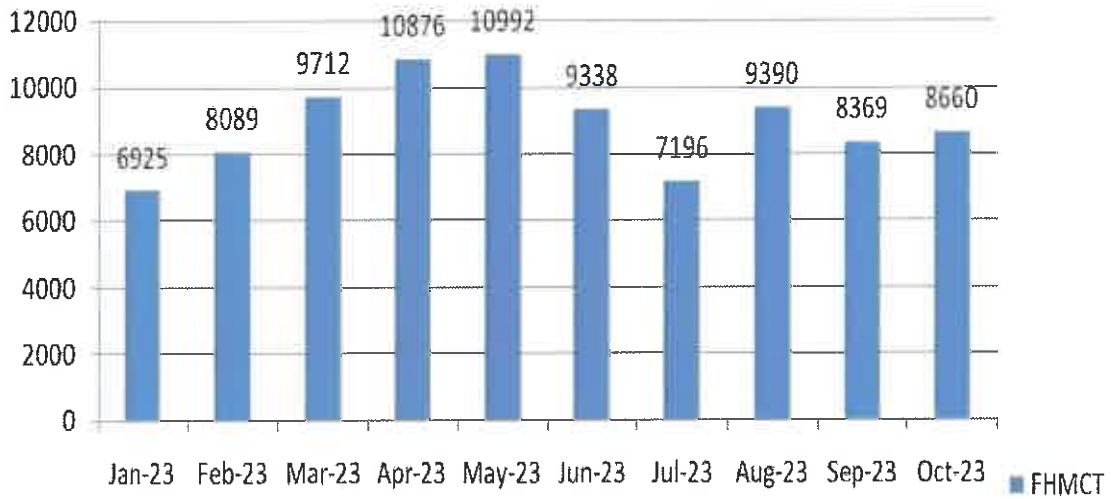


Graphical presentation of energy consumption FDS building year-2023



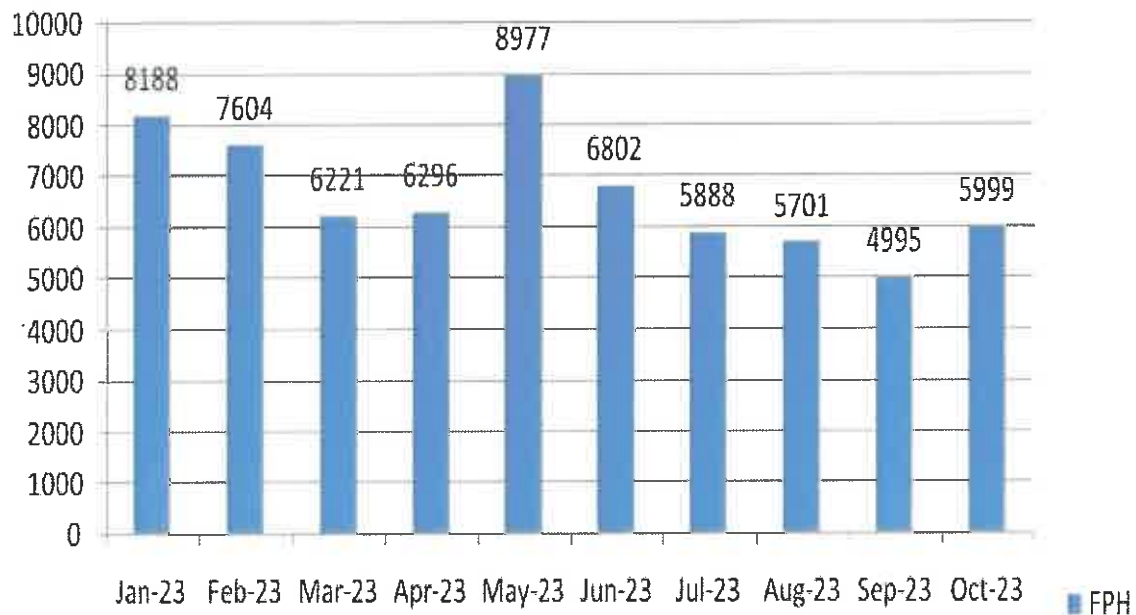
Graphical presentation of energy consumption FMC building year-2023

Unit Consumption of FHMCT Building Year-2023

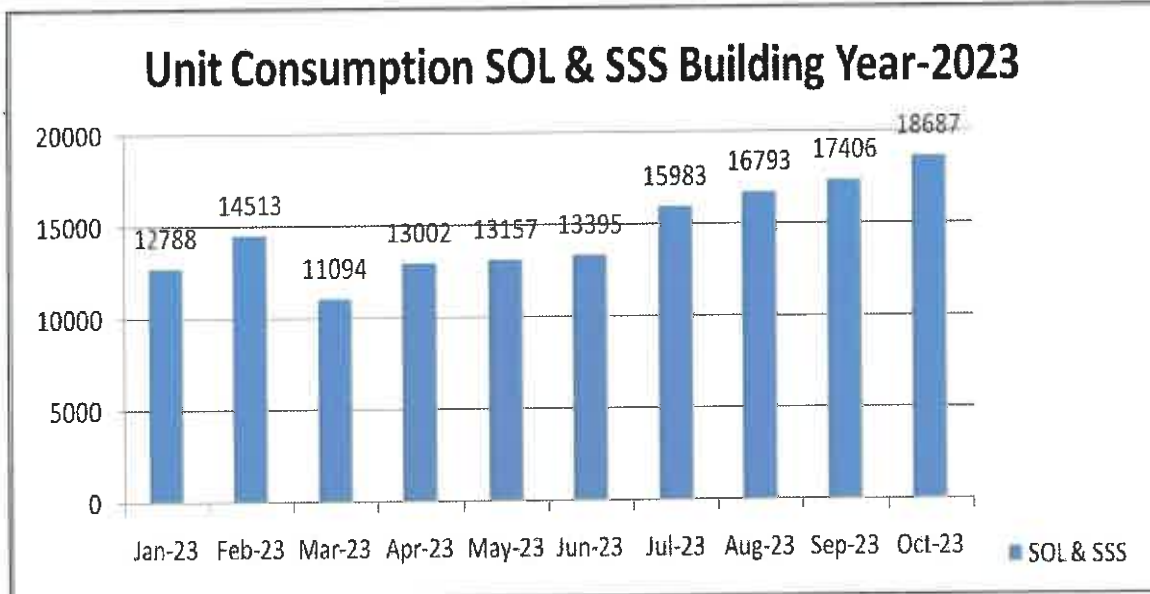


Graphical presentation of energy consumption FHMTC building year-2023

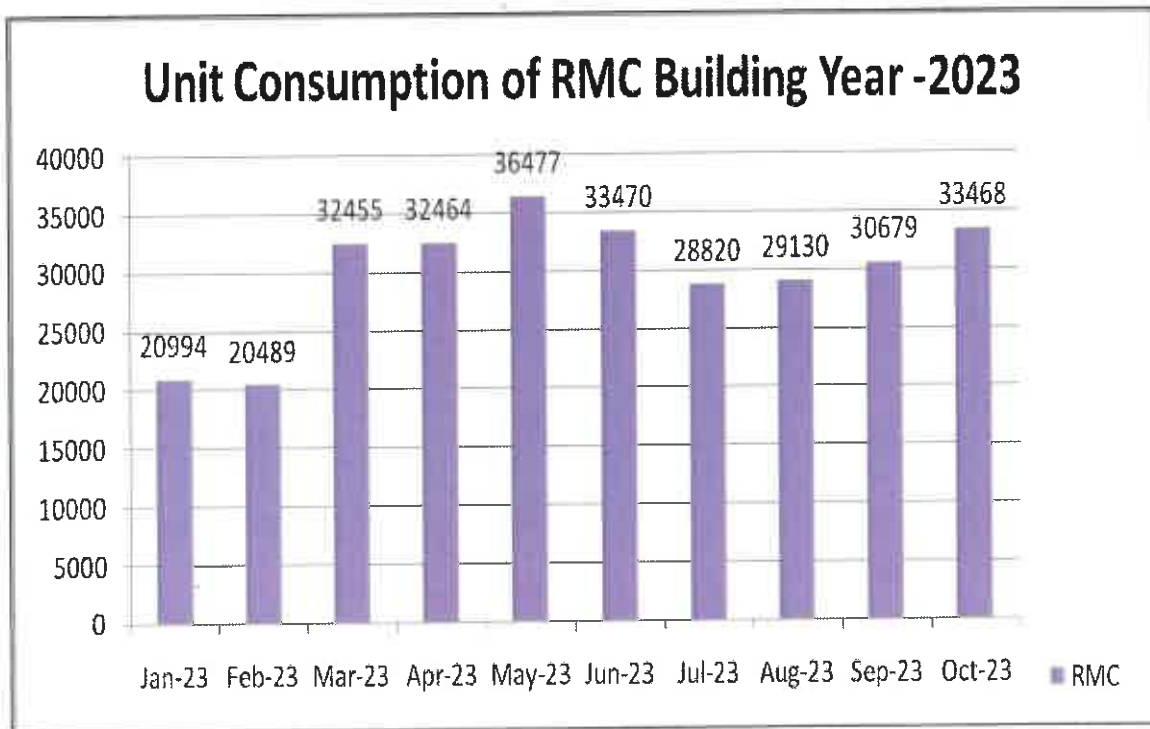
Unit Consumption of FPH Building Year-2023



Graphical presentation of energy consumption FBH building year-2023

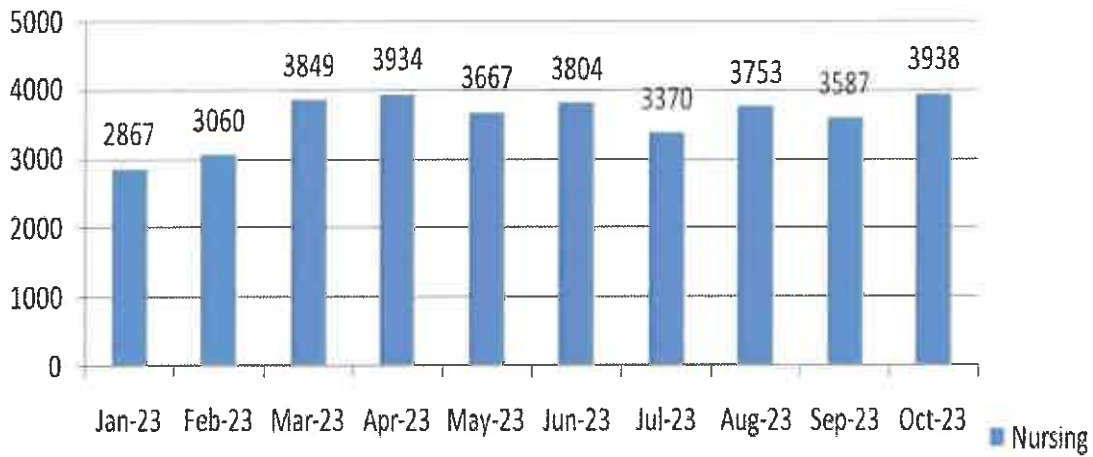


Graphical presentation of energy consumption SOL & SSS building year-2023



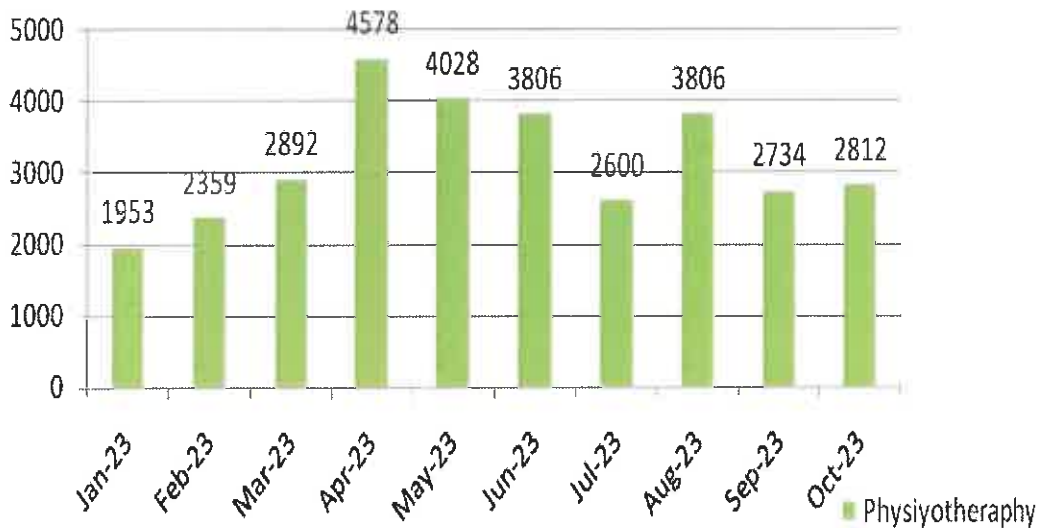
Graphical presentation of energy consumption RMC building year-2023

Unit Consumption of Nursing Building Year-2023

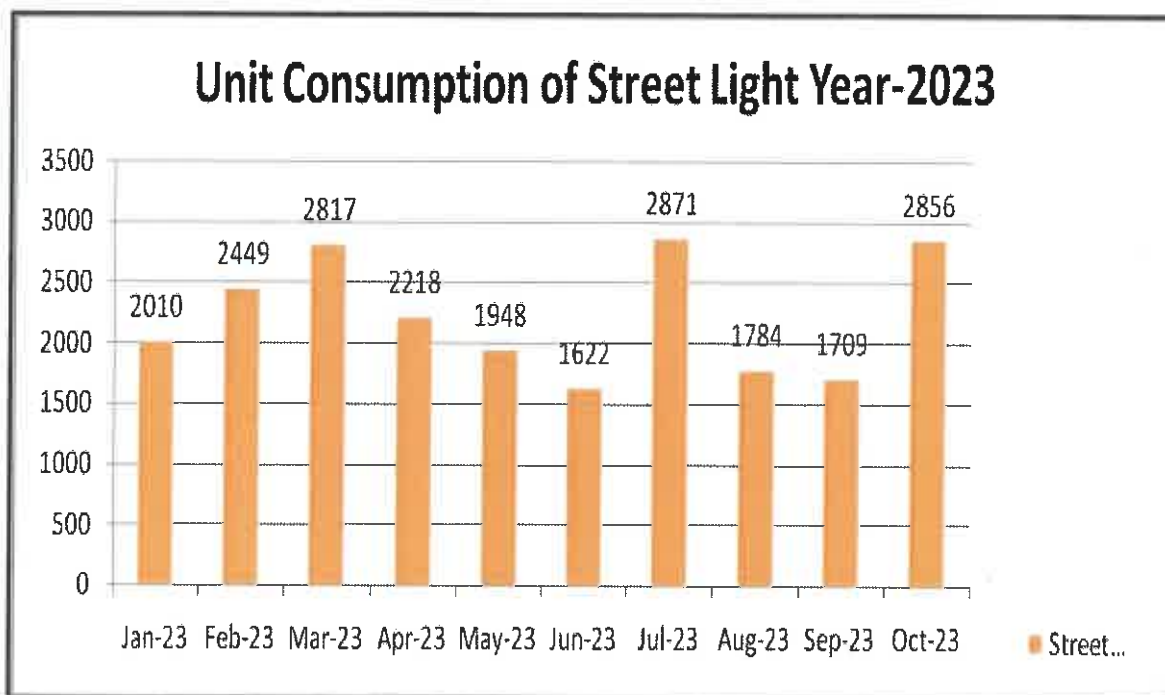


Graphical presentation of energy consumption Nursing building year-2023

Unit Consumption of Physiyotherapy Building Year-2023



Graphical presentation of energy consumption of Physiyotherapy building year-2023



Graphical presentation of energy consumption of street light year-2023

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CHAPTER-05
CONNECTED LOAD SYSTEM

5.1 Lighting Details of the GG Campus are as below

UAS HOUSE												
Sr. No	Item Description	9 W	15 W	18 W	20 W	36 W	Ground floor	1st floor	2nd floor	3rd floor	4th floor	Total
1	2' X 2' LED pannel light	0	0	0	0	36	57	13	83	0	0	153
2	4 Feet LED batten light	0	0	18	0	0	20	0	31	0	0	51
3	1' X 1' LED lights	0	0	0	0	0	0	0	0	0	0	0

FDS												
Sr. No	Item Description	9 W	15 W	18 W	20 W	36 W	GF	1st floor	2nd floor	3rd floor	4th floor	Total
1	2' X 2' LED pannel light	0	0	0	0	36	84	68	65	0	0	217
2	4 Feet LED batten light	0	0	18	0	0	2	0	0	3	0	2
3	1' X 1' LED lights	0	0	0	20	0	13	3	1	10	0	27

Faculty of Management & commerce and FLAHS												
Sr. No	Item Description	9 W	15 W	18 W	20 W	36 W	Ground floor	1st floor	2nd floor	3rd floor	4th floor	Total
1	2' X 2' LED pannel light	0	0	0	0	36	47	44	5	150	0	246
2	4 Feet LED batten light	0	0	18	0	0	127	121	136	6	0	390
3	1' X 1' LED lights	0	0	0	0	0	0	0	0	0	0	0
4	LED lights	9	0	0	0		0	0	6		0	6
5	LED lights	0	15	0	0	0	0	0	36	0	0	36


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Faculty of Pharmacy												
Sr. No	Item Description	9 W	15 W	18 W	20 W	36 W	Ground floor	1st floor	2nd floor	3rd floor	4th floor	Total
1	2' X 2' LED pannel light	0	0	0	0	0	0	0	0	0	0	0
2	4 Feet LED batten light	0	0	18	0	0	28	75	31	0	0	134
3	1' X 1' LED lights	0	0	0	0	0	0	0	0	0	0	0
4	LED lights	0	0	0	0	0	0	0	0	0	0	0
5	LED lights	0	0	0	0	0	0	0	0	0	0	0

Faculty of Hospitality Management & Catering technology													
Sr. No	Item Description	9 W	15 W	18 W	20 W	36 W	Base ment	Ground floor	1st floor	2nd floor	3rd floor	4th floor	To tal
1	2' X 2' LED pannel light	0	0	0	0	36 W	0	0	0	0	0	0	0
2	4 Feet LED batten light	0	0	18 W	0	0	20	13	13	4	0	0	30
3	1' X 1' LED lights	0	0	0	0	0	0	32	16	22	0	0	70
4	LED lights	0	0	0	0	0	0	0	0	0	0	0	0
5	LED lights	0	0	0	0	0	0	0	0	0	0	0	0

Faculty of School of Law & Social sciences													
Sr. No	Item Description	9 W	15 W	18 W	20 W	36 W	Base ment	Ground floor	1st floor	2nd floor	3rd floor	4th floor	To tal
1	2' X 2' LED pannel light	0	0	0	0	36	0	0	0	0	0	0	0
2	4 Feet LED batten light	0	0	18	0	0	20	13	13	4	0	0	30
3	1' X 1' LED lights	0	0	0	0	0	0	32	16	22	0	0	70
4	LED lights	0	0	0	0	0	0	0	0	0	0	0	0
5	LED lights	0	0	0	0	0	0	0	0	0	0	0	0


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A/C Details of GG Campus are as below: -

FDS A/C DETAILS					
Sr. No	Description	Make	Qty	TR	Location
1	2 TR SPLIT A/C	LG	2	2	CC Lab
2	2 TR SPLIT A/C	LG	1	2	Dr. Latha Cabin
3	2 TR Cassette A/C	Blue star	2	2	Board Room 3rd floor
4	1 TR SPLIT A/C	Carrier	1	1	Seminar room
5	2 TR Cassette A/C	Midea	2	2	Aesthetic Department
6	1 TR SPLIT A/C	Carrier	1	1	Dean Office
7	1 TR SPLIT A/C	LG	1	1	OBG
8	1.5 TR SPLIT A/C	Carrier	1	1.5	OBG
9	1 TR SPLIT A/C	Carrier	1	1	Administrative Registrar
Total No of AC			12		

Faculty of Pharmacy A/C DETAILS					
Sr. No	Description	Make	Qty	TR	LOCATION
1	2 TR Cassette A/C	Midea	1	2	G01 Class room
2	1 TR SPLIT A/C	LLOYD	1	1	FLAHS Dean room
3	2 TR SPLIT A/C	LG	1	2	Instrumentation lab
4	2 TR SPLIT A/C	Blue Star	2	2	BT Lab 2nd floor
Total No of AC			5		

Faculty of Pharmacy A/C DETAILS					
Sr. No	Description	Make	Qty	TR	Location
1	1 TR SPLIT A/C	Blue Star	1	1	FBP Faculty room
Total No of AC			1		


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Faculty of Pharmacy A/C DETAILS					
Sr. No	Description	Make	Qty	TR	LOCATION
1	2 TR SPLIT A/C	Carrier	1	2	Dean Cabin
2	2 TR SPLIT A/C	LG	1	2	Bio- Technology Lab
3	2 TR SPLIT A/C	LG	1	2	Instrumentation lab
4	2 TR SPLIT A/C	Blue Star	2	2	Computer Lab
5	2 TR SPLIT A/C	LG	2	2	Seminar Hall
6	2 TR SPLIT A/C	LG	1	2	Instrument lab
7	2.5 TR SPLIT A/C	Blue Star	1	2.5	PG Computer lab
8	1.5 TR Window A/C	LG	2	2	Confrence Room (E Library)
9	2 TR SPLIT A/C	Blue Star	1	2	Bio- Technology Lab
	Total No of AC		12		


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UAS HOUSE A/C DETAILS					
Sr. No	Description	Make	Qty	TR	Location
1	1.5 TR SPLIT A/C	Carrier	1	2	Accounts department (GF)
2	1.5 TR SPLIT A/C	LLOYD	1	2	SPWCA department (GF)
3	2 TR Cassette A/C	LG	2	2	Vice Chancellor office
4	1.5 TR SPLIT A/C	Carrier	1	2	VC' office Dining area
5	2 TR SPLIT A/C	LG	1	2	VC' office Dining area
6	2 TR Cassette A/C	Midea	1	2	VC's Reception
7	2 TR Cassette A/C	Carrier	2	2	VC'S board room
8	2 TR Cassette A/C with 4-star invertors	LG	2	2	Registrar office
9	2 TR SPLIT A/C	LG	1	2	Chief Manager ICT
10	2 TR Cassette A/C	Carrier	2	2	Pro Vice Chancellor office (Research)
11	2 TR SPLIT A/C		1	2	Director Research
12	2 TR Cassette A/C	Carrier	2	2	Research Department
13	2 TR Cassette A/C	Carrier	2	2	Pro Vice Chancellor office (Health Sciences)
14	1.5 TR SPLIT A/C	Carrier	1	2	University Secretariat
15	2 TR SPLIT A/C	Blue Star	1	2	University Secretariat
16	2 TR Cassette A/C	Carrier	2	2	Meeting Hall
17	2 TR SPLIT A/C	Carrier	1	2	HR Manager
18	2 TR Cassette A/C	Carrier	1	2	Pro Vice Chancellor office (Social sciences)
19	8.5 TR Duct A/C	Blue Star	1	9	S18
20	5.5 TR Duct A/C	Blue Star	1	6	S18
21	2 TR Cassette A/C	Mitsubishi	4	2	Board Room S19
22	2 TR SPLIT A/C	Blue Star	1	2	Purchase office
23	2 TR SPLIT A/C	Blue Star	1	2	Ideology department
	Total No of AC		33		

ADVANCED LEARNING CENTER A/C DETAILS						
Sr. No	Description	Qty	TR	M/C Serial No	LOCATION	USAGE PER WEEK
1	8.5 TR DUCATABLE SPLIT	1	8.5	500096731118002000	SIMULATION ROOM - ICU 24	3 DAYS
2	8.5 TR DUCATABLE SPLIT	1	8.5	500096731118003000	SEMINAR ROOM 20	3 DAYS
3	8.5 TR DUCATABLE	1	8.5	500096731118003000	RESEARCH ROOM (CRC Staff room)	7 DAYS
4	8.5 TR DUCATABLE SPLIT	1	8.5	500096731118003000	SIMULATION ROOM	4 DAYS
5	8.5 TR DUCATABLE SPLIT	1	8.5	500096731118003000	DRY BONE LAB	3 DAYS
6	8.5 TR DUCATABLE SPLIT	1	8.5	500096731118003000	CADAVER WORK SHOP	3 DAYS
7	8.5 TR DUCATABLE SPLIT	1	8.5	500096731118003000	SKILLED LAB	5 DAYS
8	8.5 TR DUCATABLE SPLIT	1	8.5	500096731118003000	STORAGE – COLD	7 DAYS
9	8.5 TR DUCATABLE SPLIT	1	8.5	500096731118003000	CADAVER WORK SHOP	3 DAYS
10	5.5 TR DUCTABLE	1	5.5	500182939118002000	MADICINE - CRC	7 DAYS
11	5.5 TR DUCTABLE	1	5.5	500182939118002000	TISSUE BANK	7 DAYS
12	5.5 TR DUCTABLE	1	5.5	500182939118002000	TISSUE BANK	7 DAYS
13	2.0 TR SPLIT A/C	1	2	5002111937118000000	MINOR OT	2 DAYS
14	1.5 TR SPLIT A/C	1	1.5	500170933118021000	CONFERENCE	3 DAYS
15	1.5 TR SPLIT A/C	1	1.5	500170933118021000	CONFERENCE	3 DAYS

Sr. No	Description	Qty	TR	M/C Serial No	LOCATION	USAGE PER WEEK
16	1.5 TR SPLIT A/C	1	1.5	500170933118021000	SERVER ROOM	7 DAYS
17	1.5 TR SPLIT A/C	1	1.5	500198114118008000	SIMULATION LAB-2 29	4 DAYS
18	1.0 TR SPLIT A/C	1	1	NOT VISIBLE	SHAKUNTALA CABIN	7 DAYS
19	1.0 TR SPLIT A/C	1	1	NOT VISIBLE	SHAKUNTALA CABIN SIDE	3 DAYS
20	2.0 TR CASSETE SPLIT	1	2	500150312118000000	SUNDRESH CABIN	
21	2.0 TR CASSETE SPLIT	1	2	500150312118000000	SUNDRESH CABIN SIDE	1 OR 2 DAYS
	Total	21				


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5.2 Street light details of GG campus: -

There is total 25 Nos. of LED in the GG Campus Details are as Follow
 (100 W LED = 17 No's, 50W LED = 8 No's)

UAS HOUSE				
Sr. No	Item Description	100W	50W	Total
1	Street light LED	100W		8
	Total			8

FDS				
Sr. No	Item Description	100W	50W	Total
1	Street light LED	100W		3
2	Street light LED		50W	3
	Total			6

Faculty of Pharmacy				
Sr. No	Item Description	100W	50W	Total
1	Street light LED	100W		4
	Total			4

DG Yard				
Sr. No	Item Description	100W	50W	Total
1	Street light LED		50W	5
	Total			5

Faculty of Hospitality Management & Catering technology				
Sr. No	Item Description	100W	50W	Total
1	Street light LED	100W		2
	Total			2


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**CHAPTER-06
POWER SUPPLY SYSTEM**

Part-02 (Ramaiah Technology Campus)

There are two main electricity connections one is 750 KVA (M/S MSR & SONS INVESTMENTS LTD.) and second is 200 KVA (M/S Brindavan Alloys Limited).

This campus has one transformer details are below

Sr. No.	Items	Technical Details Transformer (TR)
1	Make	(KPRS) Kiran Power Rectification Services (P) Ltd.
2	Location	Ramaiah Technology Campus
3	Year	2010
4	Rating (KVA)	1000
5	Voltage (HV/ LV)	11000/433
6	Current Rating (HV/ LV)	52.24/1391.20
7	Frequency (Hz)	50
8	Impedance at 75°C	5.48 %
9	Vector group	Dyn-11
10	Type of cooling	ONAN



Transformer at RT Campus



Control panel room at RT campus



Sub station at RT Campus

6.2 DG Sets

The GG Campus has 03 Nos. DG sets one is 100 KVA for workshop block and 2 is 250 KVA respectively for main buildings to supply emergency power during the grid power failure.



DG 1 and 2



DG Control Panel



DG Room

6.3 Grid Connected Solar Photovoltaic System (35 KWp)

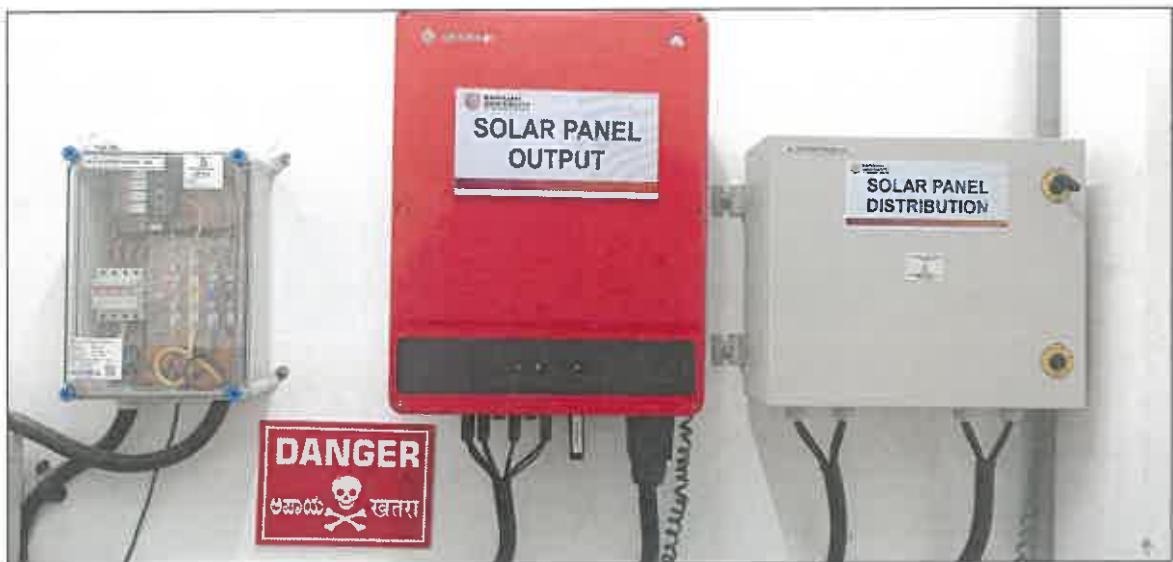
There is a 35 KWp solar photovoltaic rooftop grid-connected system installed on various buildings. System details are given below:

Solar plant detailed

Sr. No	Parameter	Technical Details
1	Make	Tata Power Solar
2	Solar Capacity	35 KWp
3	Type	On Grid Type
4	Nos. of PV Modules	66Nos.
5	Solar Inverter	30 KWp (Goodwe)



Solar plant



Solar Plant 35KWp and solar System

6.4 UPS System

University has used UPS system for emergency power supply. Details are given below.

Sr.No.	Location	Capacity (KVA)
1	Incubation Centre	40
2	A Block	160
3	B Block	120
4	C & D Block	80
5	Workshop Block	35
6	Techno Centre Block	20
	Total	455

Power Source UPS – A Block

In A block total UPS capacity is 180 KVA Details are below: -



80 KVA UPS (A Block)



40 KVA UPS (A Block)



60 KVA UPS (A Block)



A Block UPS Room

Power Source UPS – B Block

In B block total UPS capacity is 120 KVA Details are below: -



60 KVA Dubas UPS with Isolation Transformer (B Block)



60 KVA Dubas UPS (B Block)



UPS Room (B Block)



UPS Power Panel

Power Source UPS – C& D Block

In B block total UPS capacity is 80 KVA Details are below: -



C & D Block 80 KVA Dubas UPS



C & D Block Control Panel



C & D Block UPS Room

Power Source UPS – Techno Centre Block

In Techno Centre block total UPS capacity is 20 KVA Details are below: -



Techno Block UPS Room & Control Panel



20 KVA UPS (Techno Centre Block)


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CHAPTER-07
ELECTRICITY BILL ANALYSIS

Energy audit team has analysed Electricity bills of last one year- 2023(Ramaiah Technology Campus).

7.1 BILL ANALYSIS OF 200 KVA CONNECTIONS.

Sr. No.	Month & Year	Contract Demand (KVA)	Billing Demand (KVA)	Maximum Demand (KVA)
1	Jan-23	200	170	25
2	Feb-23	200	170	23
3	Mar-23	200	170	25
4	Apr-23	200	170	27
5	May-23	200	170	27
6	Jun-23	200	170	31
7	Jul-23	200	170	24
8	Aug-23	200	170	29
9	Sep-23	200	170	29
10	Oct-23	200	170	27
		Minimum Demand (KVA)		23
		Maximum Demand (KVA)		31
		Average Demand (KVA)		26.7

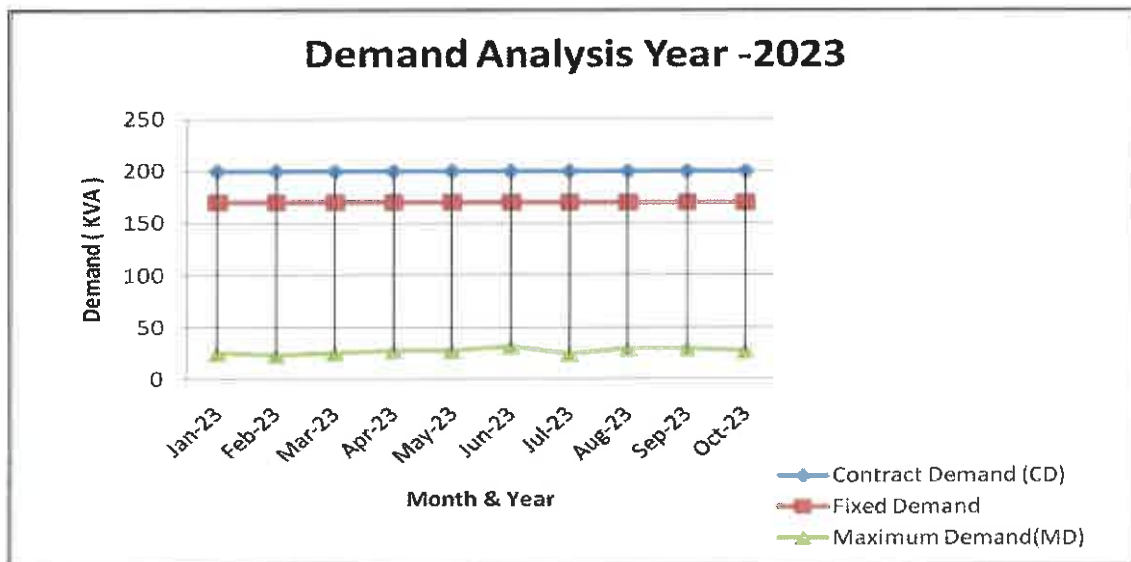


Figure: - Graphical Presentation of Demand analysis year-2023

Observation:

It was observed that the contract demand of the campus is 200 KVA. There is a variation in maximum demand. It is a maximum of 31 KVA in the Month of Jun-2023 and a minimum of 23 KVA in Feb- 2023

7.2 Monthly Power factor analysis Year-2023

Sr. No.	Month & Year	Power Factor
1	Jan-23	0.82
2	Feb-23	0.82
3	Mar-23	0.83
4	Apr-23	0.87
5	May-23	0.85
6	Jun-23	0.86
7	Jul-23	0.85
8	Aug-23	0.86
9	Sep-23	0.85
10	Oct-23	0.86
	Total	0.85

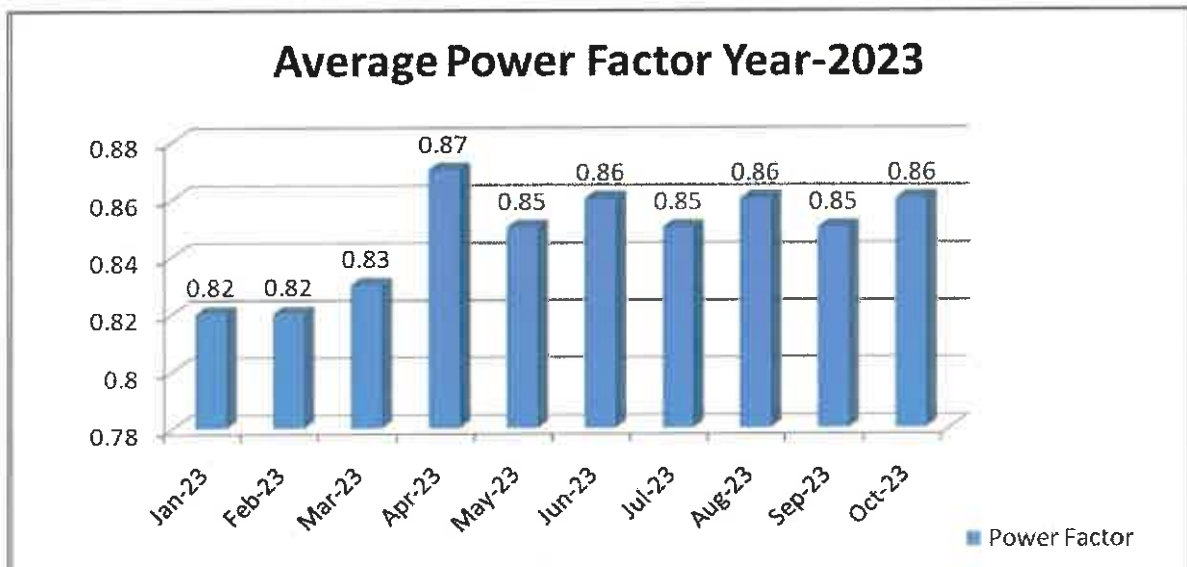


Figure Graphical presentation of average power factor year 2023

Observation:

The average power factor was 0.85 form Jan -2023 to Oct -2023. It is recommended to maintain power factor unity or 0.995

7.3 Monthly electrical energy consumption 2023

The monthly electrical consumption for the university is given in the table.

Sr. No.	Month & Year	Unit Consumption (kWh)	Amount (Rs.)	Overall, per unit charges (Rs. / kWh)
1	Jan-23	5,020	104,379/-	20.79
2	Feb-23	4,790	101,522/-	21.19
3	Mar-23	5,430	107,872/-	19.87
4	Apr-23	6,110	114,421/-	18.73
5	May-23	6,370	133,126/-	20.90
6	Jun-23	6,010	134,415/-	22.37
7	Jul-23	6,030	138,362/-	22.95
8	Aug-23	6,339	136,450/-	21.53
9	Sep-23	6,199	134,292/-	21.66
10	Oct-23	6,150	129,643/-	21.08
Total		58,448	12,34,482/-	21.11

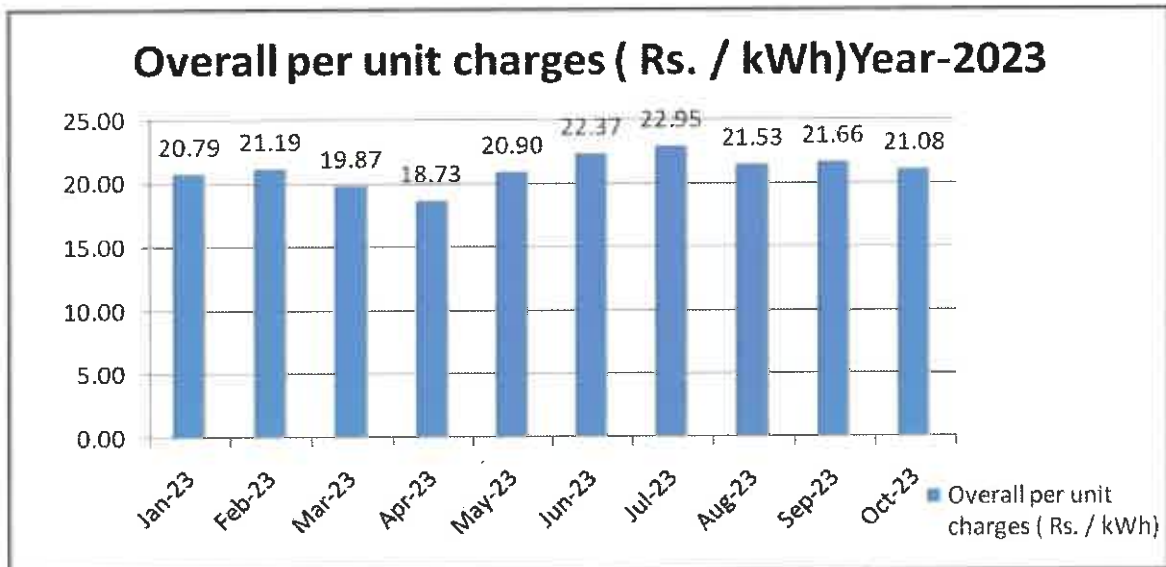


Figure: - Graphical presentation of actual per-unit charges for the year -2023

Observation:

It was found that total energy consumption in the last 10 months was 58,448 units. The average annual energy charge is Rs 21.11 /kWh. It is higher side due to demand not utilized.

7.4 BILL ANALYSIS OF 750 KVA KVA CONNECTIONS.

Energy audit team was analysed Electricity bills of last one year- 2023(Ramaiah Technology Campus). The details of sanctioned load 750 KVA are as below

Sr. No.	Month & Year	Contract Demand (KVA)	Fixed Demand (KVA)	Maximum Demand (KVA)
1	Jan-23	750	638	211
2	Feb-23	750	638	264
3	Mar-23	750	638	301
4	Apr-23	750	638	314
5	May-23	750	638	295
6	Jun-23	750	638	260
7	Jul-23	750	638	232
8	Aug-23	750	638	288
9	Sep-23	750	638	267
10	Oct-23	750	638	300
	Minimum Demand (KVA)			211
	Maximum Demand (KVA)			314
	Average Demand (KVA)			273.2

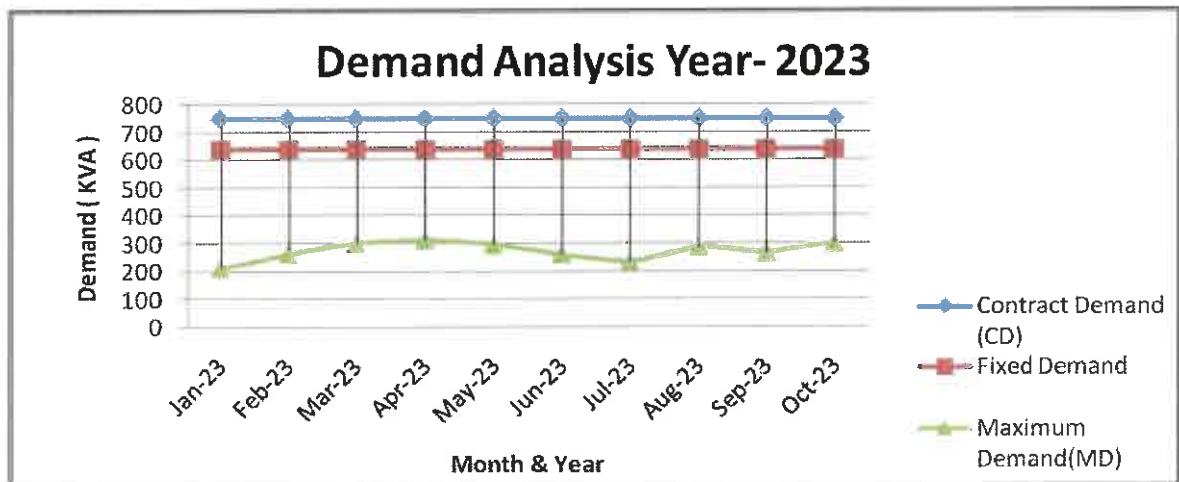


Figure: - Graphical Presentation of Demand analysis year-2023

Observation:

It was observed that the contract demand of the campus is 750 KVA. There is a variation in maximum demand. It is a maximum of 314 KVA in the Month of Apr-2023 and a minimum of 211 KVA in Jan - 2023

7.5 Monthly Power factor analysis Year-2023


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Sr.No.	Month & Year	Power Factor
1	Jan-23	0.94
2	Feb-23	0.94
3	Mar-23	0.92
4	Apr-23	0.92
5	May-23	0.91
6	Jun-23	0.9
7	Jul-23	0.88
8	Aug-23	0.90
9	Sep-23	0.90
10	Oct-23	0.92
Total		0.91

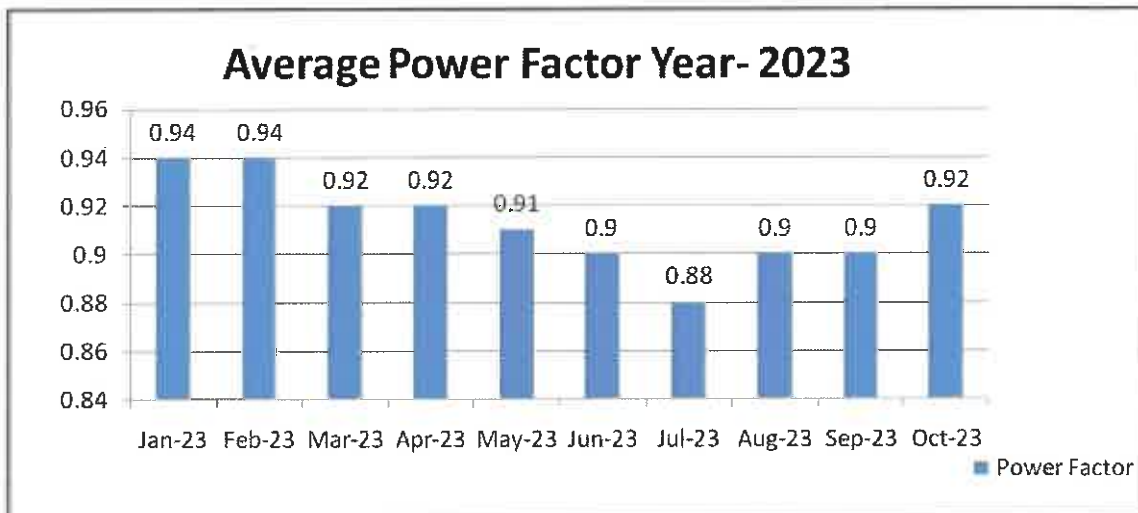


Figure Graphical presentation of average power factor year 2023

Observation:

The average power factor was 0.91 form Jan -2023 to Oct -2023. It is recommended to maintain power factor unity or 0.995


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7.6 Monthly electrical energy consumption 2023

The monthly electrical consumption for the Campus is given in the table.

Sr. No.	Month & Year	Unit Consumption (kWh)	Amount (Rs.)	Overall, per unit charges (Rs. / kWh)
1	Jan-23	77,640	9,82,375/-	12.65
2	Feb-23	87,800	10,92,289/-	12.44
3	Mar-23	98,360	11,90,850/-	12.11
4	Apr-23	98,760	11,74,074/-	11.89
5	May-23	91,720	11,89,899/-	12.97
6	Jun-23	79,520	11,60,978/-	14.60
7	Jul-23	75,760	11,63,054/-	15.35
8	Aug-23	89,359	12,44,244/-	13.92
9	Sep-23	82,879	11,61,174/-	14.01
10	Oct-23	97,680	12,60,904/-	12.91
Total		8,79,478	1,16,19,841/-	13.29

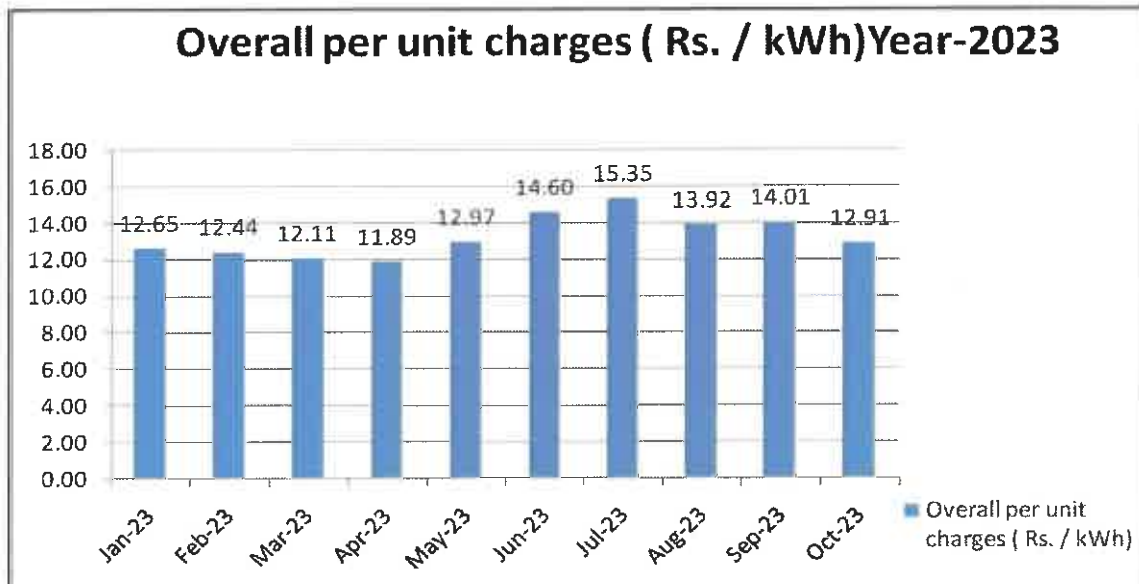


Figure: - Graphical presentation of actual per-unit charges for the year -2023


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Observation:

It was found that total energy consumption in the last 10 months was 8, 79,478 units. The average annual energy charge is Rs 13.29 /kWh. It is higher side due to demand not utilized.

**CHAPTER- 8
ENERGY CONSERVATION MEASURES**

Case Study No: 1

Reduce the contract demand from 200 KVA to 75 KVA.

Observation: -

- Existing contract demand = 200 KVA
- Billing demand @ 85 % of CD= 170 KVA
- Demand Charge per KVA= 375 /KVA

Sr. No.	Month & Year	Contract Demand (KVA)	Billing Demand (KVA)	Maximum Demand (KVA)	Non utilized Demand (KVA)	Extra Amount pay due to Demand Not utilized
1	Jan-23	200	170	25	145	54,375
2	Feb-23	200	170	23	147	55,125
3	Mar-23	200	170	25	145	54,375
4	Apr-23	200	170	27	143	53,625
5	May-23	200	170	27	143	53,625
6	Jun-23	200	170	31	139	52,125
7	Jul-23	200	170	24	146	54,750
8	Aug-23	200	170	29	141	52,875
9	Sep-23	200	170	29	141	52,875
10	Oct-23	200	170	27	143	53,625
	Minimum Demand (KVA)			23	Total	5,37,375
	Maximum Demand (KVA)			31		
	Average Demand (KVA)			26.7		

Recommendation: -

Reduced the Maximum demand = 125 KVA

New Contract demand = 75 KVA

New Billing demand = 75 X 0.85 =64 KVA

Total Monthly saving per month = 125 X 375 = Rs. 46,875/ month

Total monthly saving per year = 46,875 X 12 = 5, 62,500 / Year

Total Investment: - Nil


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Case Study No: 2

Reduce the contract demand from 750 KVA to 400 KVA.

Observation: -

- Existing contract demand = 750 KVA
- Billing demand @ 85 % of CD= 638 KVA
- Demand Charge per KVA= 375 /KVA

Sr. No.	Month & Year	Contract Demand (KVA)	Billing Demand (KVA)	Maximum Demand (KVA)	Non utilized Demand (KVA)	Extra Amount pay due to Demand Not utilized
1	Jan-23	750	638	211	427	1,60,125/-
2	Feb-23	750	638	264	374	1,40,250/-
3	Mar-23	750	638	301	337	1,26,375/-
4	Apr-23	750	638	314	324	1,21,500/-
5	May-23	750	638	295	343	1,28,625/-
6	Jun-23	750	638	260	378	1,41,750/-
7	Jul-23	750	638	232	406	1,52,250/-
8	Aug-23	750	638	288	350	1,31,250/-
9	Sep-23	750	638	267	371	1,39,125/-
10	Oct-23	750	638	300	338	1,26,750/-
	Minimum Demand (KVA)			211	Total	13,68,000/-
	Maximum Demand (KVA)			314		
	Average Demand (KVA)			273.2		

Recommendation: -

Reduced the Maximum demand = 350 KVA

New Contract demand = 400 KVA

New Billing demand = 400 X 0.85 = 340 KVA

Total Monthly saving per month = 340 X 375 = Rs. 1, 27,500/ month

Total monthly saving per year = 1, 27,500 X 12 = 15, 30,000 / Year

Total Investment: - Nil


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Built Environment Sustainability & Transformation

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