Green Aura

Built Environment Sustainability & Transformation

ENERGY AUDIT REPORT | 2022

M. S. Ramaiah University of Applied Sciences

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

2022-23

MSME
MICRO, SMALL & MEDIUM ENTERPRISES
सूक्ष्म, लघु एवं मध्यम उद्यम

Green Aura
Built Environment Sustainability & Transformation

692F,12TH A CROSS BEL LAYOUT, BENGALURU- 560091
((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 20th December, 2022 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 20th December, 2023

Ref. No: GA / ENVIRONMENTAL AUDIT / 03 / 12 / 22

DR NISCHAY N GOWDA
Founder & Director - Green Aura
CERTIFIED ISO EMS-LA, IGBC - AP,
US GREEN BUILDING COUNCIL - GREEN ASSOCIATE
GLOBAL DOCTORATE, SWITZERLAND.

ENERGY AUDIT REPORT 2022

CONSULTATION REPORT

M. S. Ramaiah University of Applied Sciences

Bengaluru, Karnataka – 560054

Submitted to:
Registrar,
M. S. Ramaiah University of Applied Sciences
University House, Gnanagangothri Campus
New BEL Road, MSR Nagar, Bangalore – 560054

Audited by:
Green Aura,
692F,12th A cross Bel layout,
Bengaluru- 560091.

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CONTENT

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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 October to December 2022.

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

Dr Nischay N Gowda,
Director

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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 MANAGEMENT

SOLAR PHOTOVOLTAIC ROOFTOP PLANT INSTALLATION

University has total installed total 55 KWp grid connected solar roof top system. One is Gananagangotri campus (20 KWp) and other one is Ramaiah technology campus (35 KWp) **It's Appreciable.**

LIGHTING SYSTEM

The University has been replaced convectional inefficient lighting system by energy efficient LED lighting **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 is was 0.88. It is recommended to maintain the power factor 0.995 or unity.

- **CEILING FAN.**

  It is recommended to replace "conventional ceiling fan (80 Watt)" by energy efficient star rated BLDC based i.e. energy efficient fan (28 Watt) in university building etc. It has great potential for energy saving.

- **AIR CONDITIONER (WINDOW AND SPLIT)**

  Replacement of "Window and Split AC (1500 to 2000 Watt)" by energy efficient 5 star rated AC (750 to 560 Watt) in all building, Guest house, class rooms, and faculties cabin etc. It has great potential of energy saving.

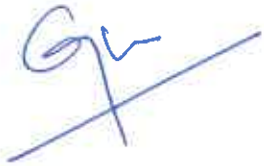
- **IOT BASED ENERGY MONITORING SYSTEM IN PLACE OF SUB METER: -**

  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

The 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.

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.

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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

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.

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- 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 OF UNIVERSITY

2.1 About University

M S Ramaiah University of Applied Sciences (RUAS) is top private University in Bangalore; Karnataka was founded in December 2013, under the Karnataka University Act.

The creation of RUAS brought together several well-established educational institutions of the Ramaiah Group, reorienting them to a changing present and an unpredictable future.

Over the years, RUAS has created a name for itself as a university that is centered on academia, industry, and society; one that works tirelessly to mould the thinkers of tomorrow.

Today, RUAS is proud to offer more than 90+ programs across 13 faculties.

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.

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Our Objectives: -

Every member of the RUAS family is united in achieving the following objectives

- To disseminate knowledge and skills through teaching, training, instruction, seminars, workshops and symposia in a variety of subjects in order to equip students and scholars to meet the needs of industries, businesses, and society.
- To generate knowledge through research in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences to resolve the challenges of the day.
- To promote health and well being through holistic healthcare.
- To provide technical and scientific solutions to the real-life problems faced by industry, business and society in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences.
- To instill the spirit of entrepreneurship in our youth by incubating and nurturing technology product ideas and supporting technology-backed businesses.
- To identify and nurture leadership skills in students, and to help in the development of the future leaders of society.
- To collaborate with universities, industries, businesses, research establishments, NGOs, international organizations, and governmental organizations in India and abroad to enrich the experiences of faculties and students through research and developmental programmers.

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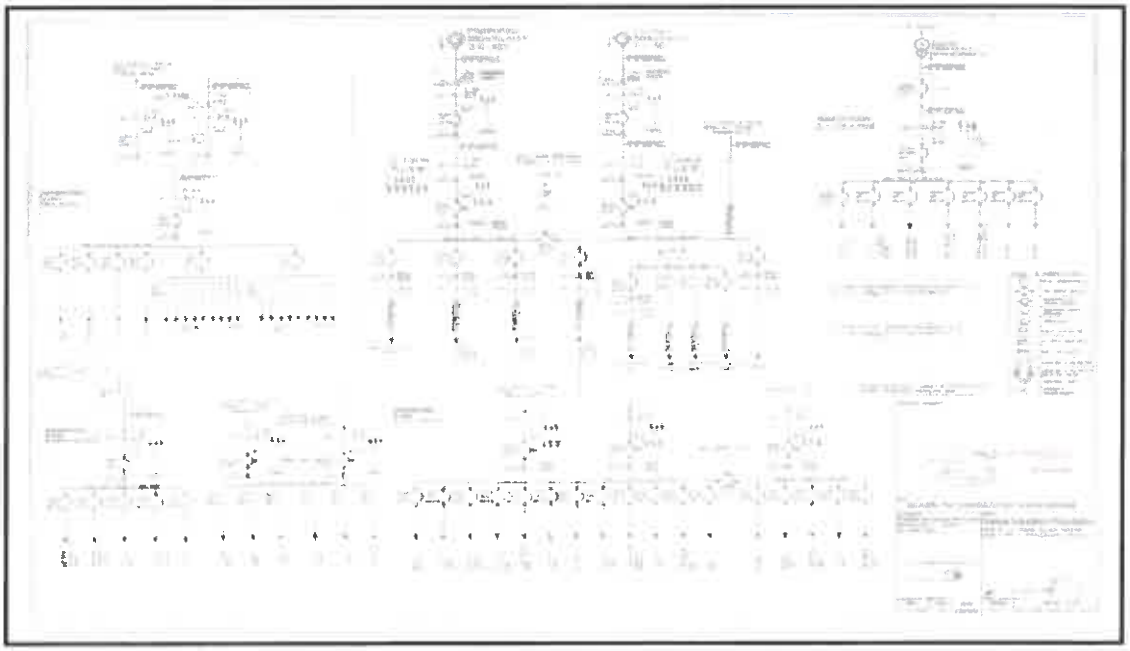
CHAPTER-03
POWER SUPPLY SYSTEM

Part-01 (Gnanagangothri Campus)

3.1 Transformer

There are 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



Single Line 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-01
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

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-22	276	200	6	1.38	33.3
2	Feb-22	348	110	5.9	3.1	18.64
3	Mar-22	180	90	4.4	2	20
4	Apr-22	192	140	5.4	1.3	25
5	May-22	192	165	4.8	1.16	34.3
6	Jun-22	168	150	5.5	1.12	27.27
7	Jul-22	192	150	6.1	1.28	24.59
8	Aug-22	636	285	8.6	2.23	33.1
9	Sep-22	0	0	0	0	0
10	Oct-22	348	170	7	2	24
11	Nov-22	120	105	3.94	1.14	26.9
12	Dec-22	72	95	3.8	0.75	25
Total		**2724**	**1660**	**61.44**	**17.46**	**292.1**

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-22	896	420	9.2	2.1	45.6
2	Feb-22	736	330	7.7	2.2	42.8
3	Mar-22	2224	710	15.2	3.13	46.7
4	Apr-22	1008	380	8.3	2.6	45

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5	May-22	2368	840	14.5	2.8	57.9
6	Jun-22	560	260	6.4	2.15	40.62
7	Jul-22	80	85	3.5	0.94	24
8	Aug-22	1696	560	12.1	3.02	45
9	Sep-22	0	0	0	0	0
10	Oct-22	304	195	5.9	1.55	33
11	Nov-22	1200	395	9.5	3.03	41.5
12	Dec-22	32	100	2.7	0.32	37.03
	Total	**11104**	**4275**	**95**	**23.84**	**459.15**

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.

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:

Solar plant detailed

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

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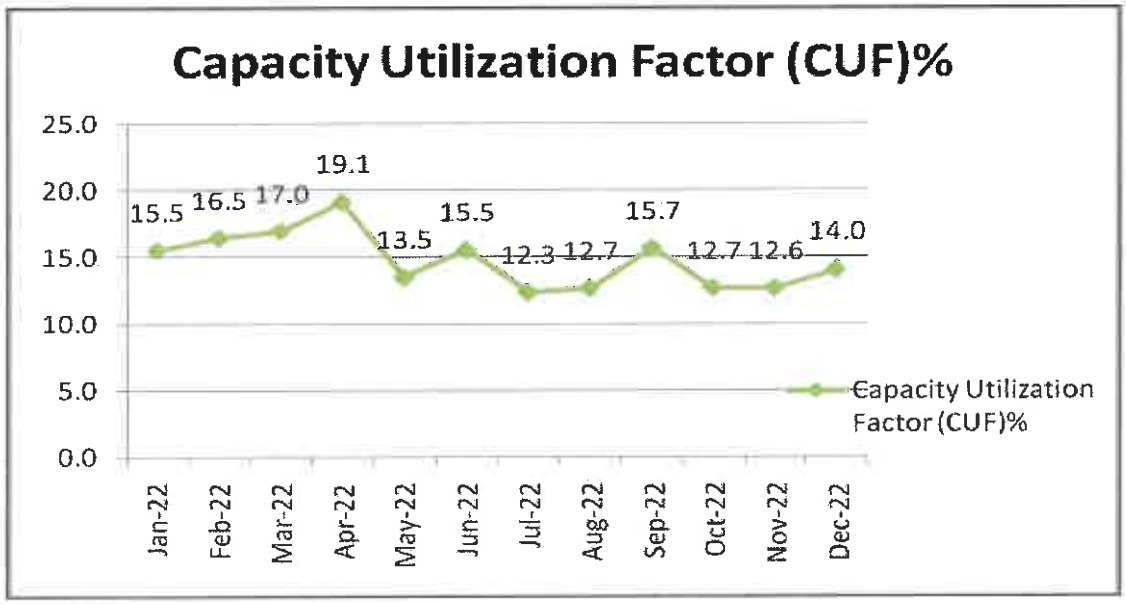
Solar unit generation Year-2022: -

Monthly Solar unit generation Year-2022

Sr. No	Month & Year	Solar Unit (kWh)	No of Days	Capacity Utilization Factor (CUF)%
1	Jan-22	2312	31	15.5
2	Feb-22	2211	28	16.5
3	Mar-22	2526	31	17.0
4	Apr-22	2756	30	19.1
5	May-22	2005	31	13.5
6	Jun-22	2238	30	15.5
7	Jul-22	1835	31	12.3
8	Aug-22	1883	31	12.7
9	Sep-22	2261	30	15.7
10	Oct-22	1885	31	12.7
11	Nov-22	1821	30	12.6
12	Dec-22	2090	31	14.0
	Total	**25823**	**365**	**14.8**



Observation: -

- University has installed 20 KWp solar system on GG Campus buildings.
- Total solar unit generation is 25823 kWh in the year-2022. And CUF is 14. 8 %.

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CHAPTER-04
ENERGY CONSUMPTION ANALYSIS

Energy audit team analysed Electricity bills of last one year- 2022(GG Campus)

Electricity Meter reading at GG Campus for Jan-2022 to Dec-2022							
Sr. No.	Month & Year	UAS	ALC	FDS	FMC	FHMCT	FPH
1	Jan-22	1536	36325	19838	8151	7966	3671
2	Feb-22	1754	37781	20000	7860	6797	4388
3	Mar-22	3372	47517	26423	9000	9396	5227
4	Apr-22	4076	52011	25481	12000	10861	5366
5	May-22	3977	39643	26587	8000	8316	4646
6	Jun-22	3610	43992	34550	10000	9013	4984
7	Jul-22	2214	35094	22113	9000	6222	4132
8	Aug-22	2295	36443	22997	10000	8012	2862
9	Sep-22	2496	44469	26164	12000	7471	228
10	Oct-22	1527	29858	29509	9000	6468	228
11	Nov-22	1630	32915	23669	10000	6800	290
12	Dec-22	1623	34067	21896	9000	6055	285

Electricity Meter reading at GG Campus for Jan-2022 to Dec-2022							
Sr. No.	Month & Year	SOL & SSS	RMC	Nursing	Physiotherapy	Street Light	Total(kWh)
1	Jan-22	8967	19485	2211	1980	1814	1,11,944
2	Feb-22	9236	26614	3096	3648	1754	1,22,928
3	Mar-22	11368	37064	3488	4215	1528	1,58,598
4	Apr-22	11454	29497	2607	2932	1881	1,58,166
5	May-22	10771	28106	2958	3504	1760	1,38,268
6	Jun-22	11320	26728	2304	3210	1765	1,51,476
7	Jul-22	11128	28524	2638	2518	1873	1,25,456
8	Aug-22	11736	25694	2640	2248	1970	1,26,897
9	Sep-22	12332	26320	3343	5647	2029	1,42,499
10	Oct-22	12451	24847	2596	2544	1536	1,20,564
11	Nov-22	13355	22480	2867	2288	1209	1,17,503
12	Dec-22	14536	29105	3072	2195	2114	1,23,948

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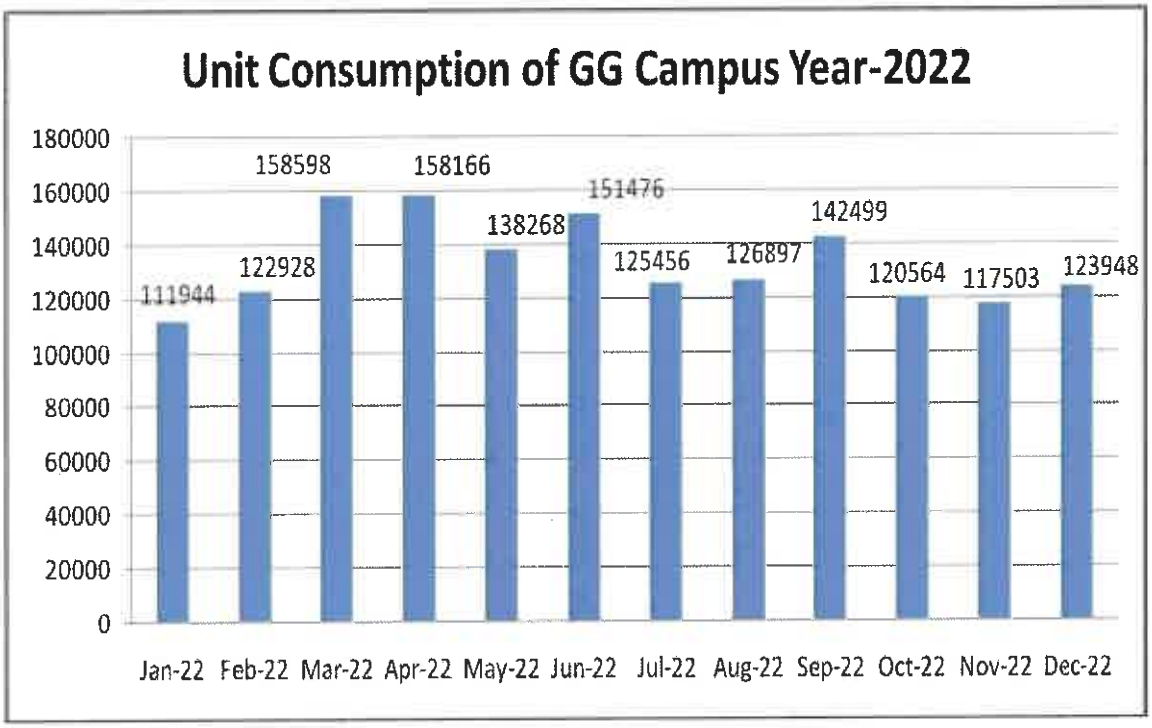

Graphical presentation of Energy consumption of GG campus.

Observation

- Total energy consumption of the GG Campus is 15, 98, 247 units during period Jan-2022 to Dec-2022.
- 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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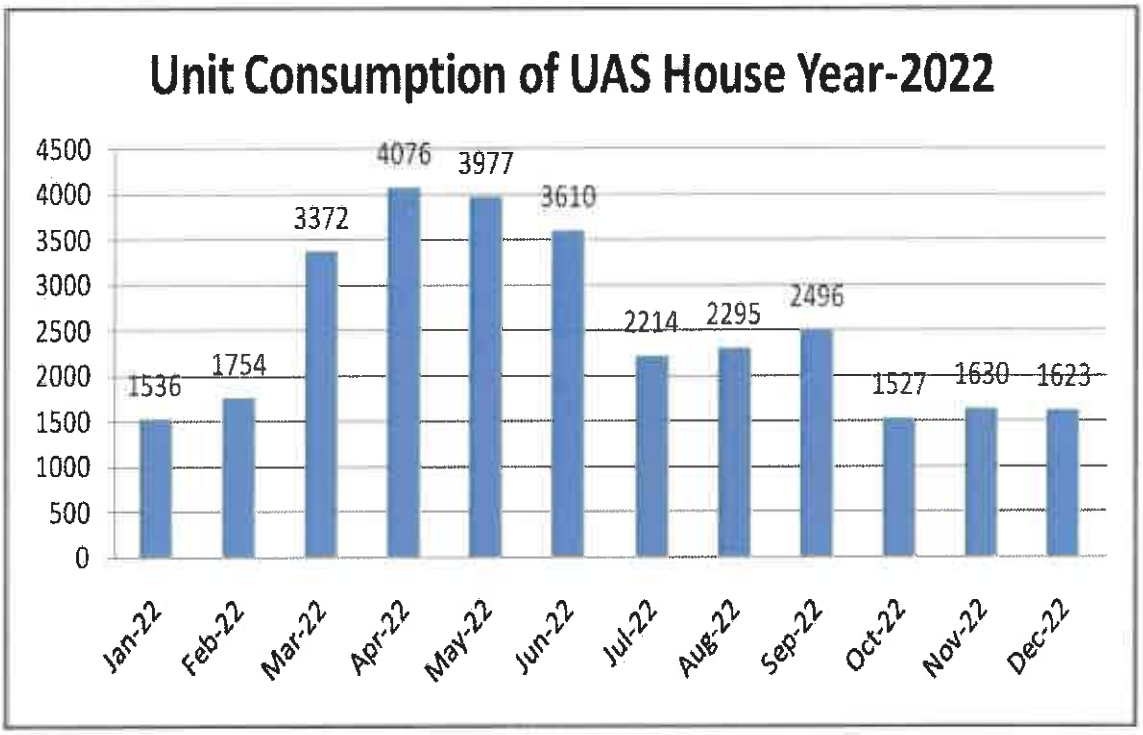
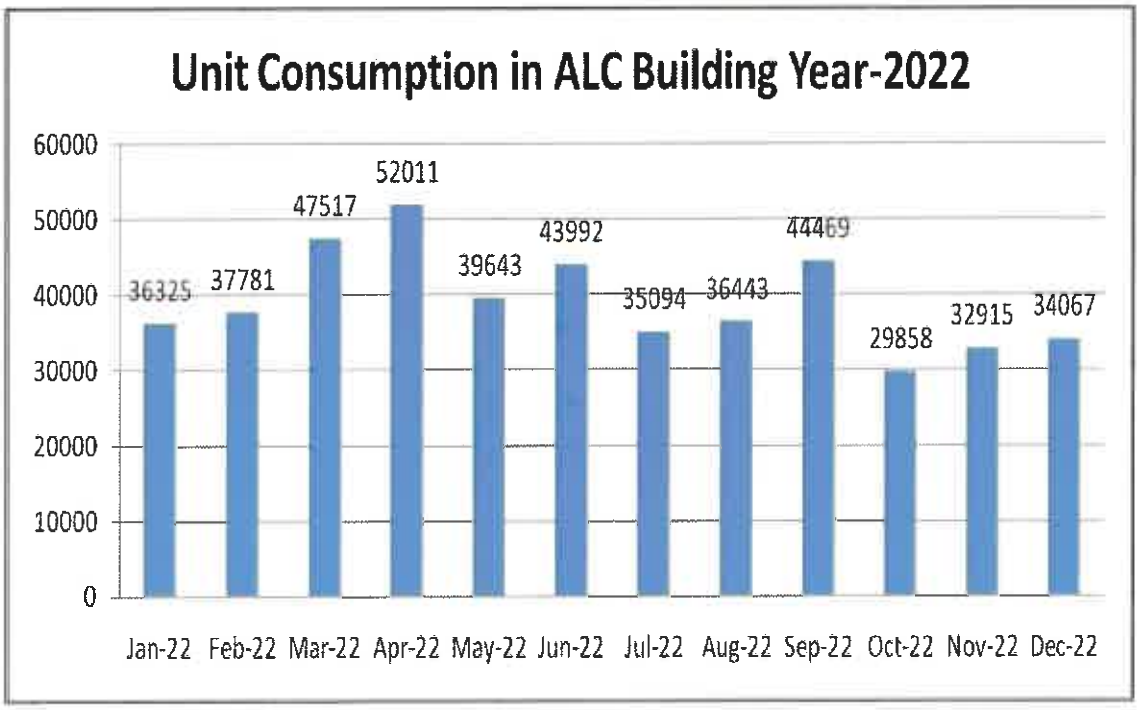
Graphical Presentation of all building unit consumptions is below



Graphical presentation of energy consumption UAS house year-2022



Graphical presentation of energy consumption ALC building year-2022

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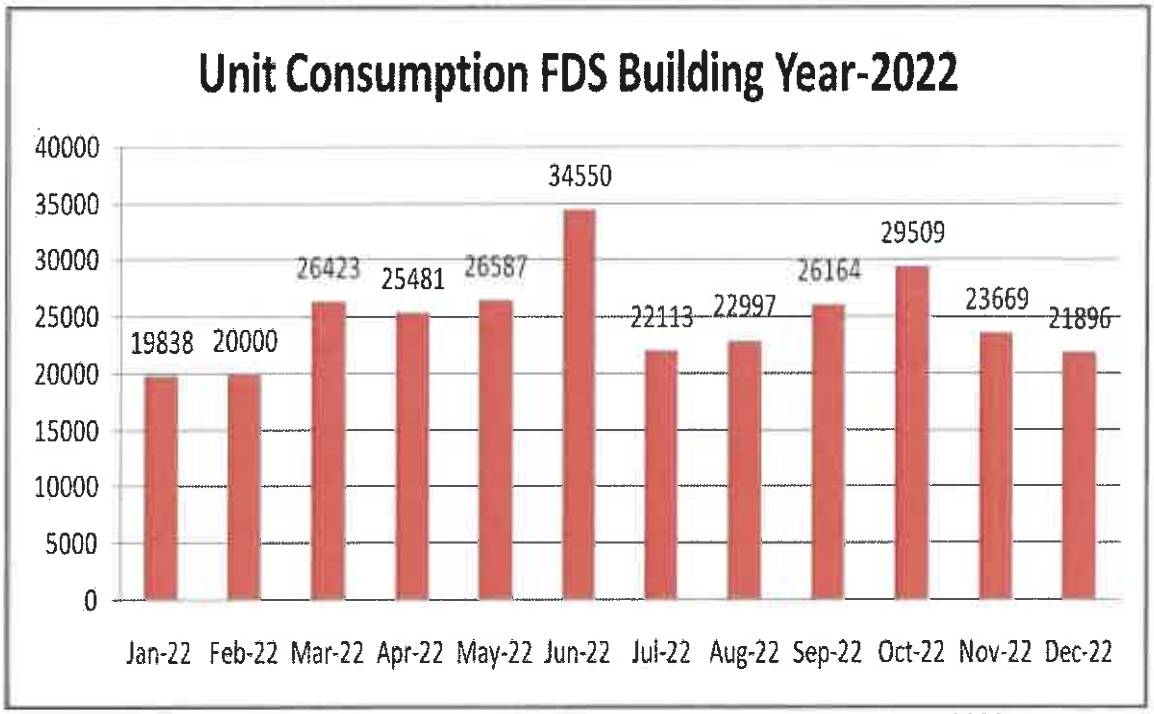
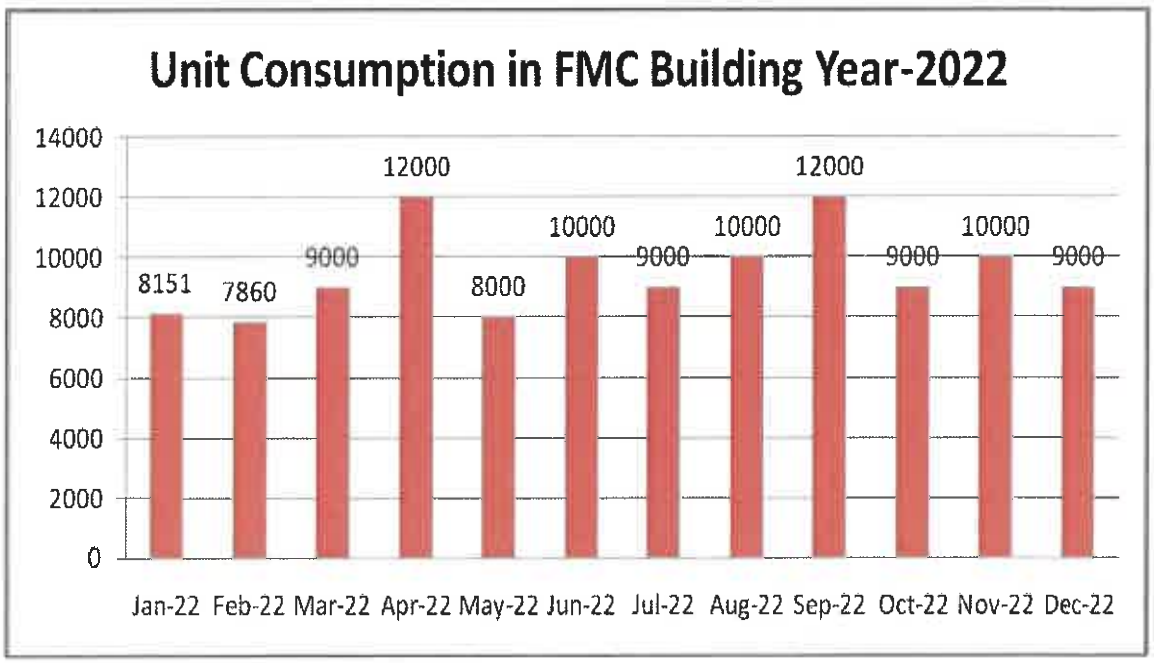


Graphical presentation of energy consumption FDS building year-2022



Graphical presentation of energy consumption FMC building year-2022

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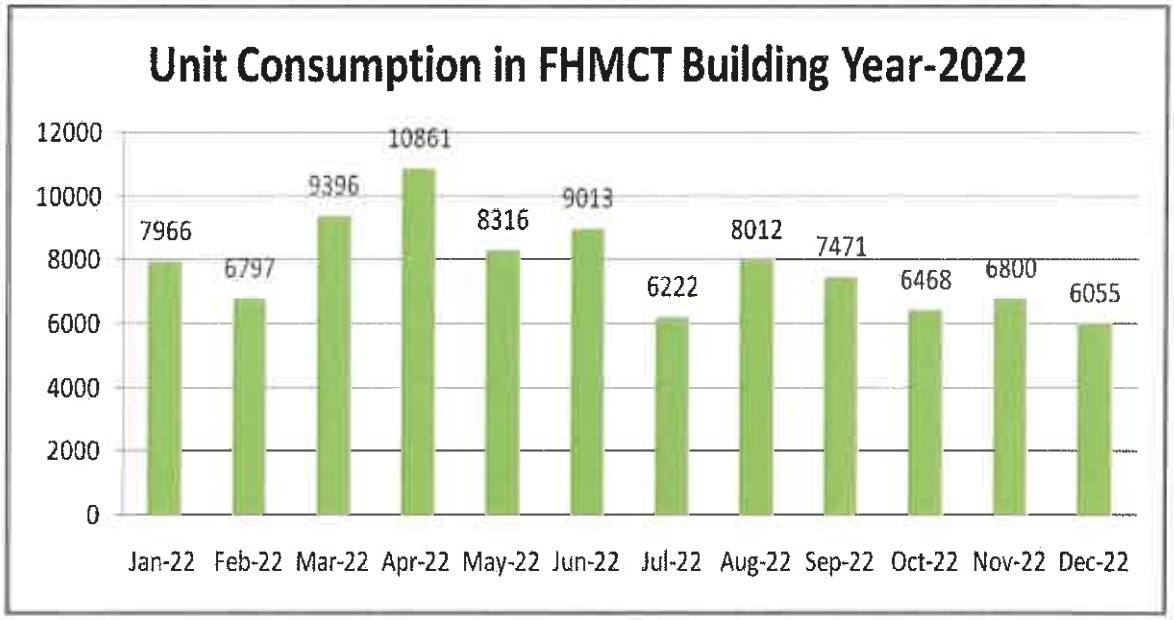
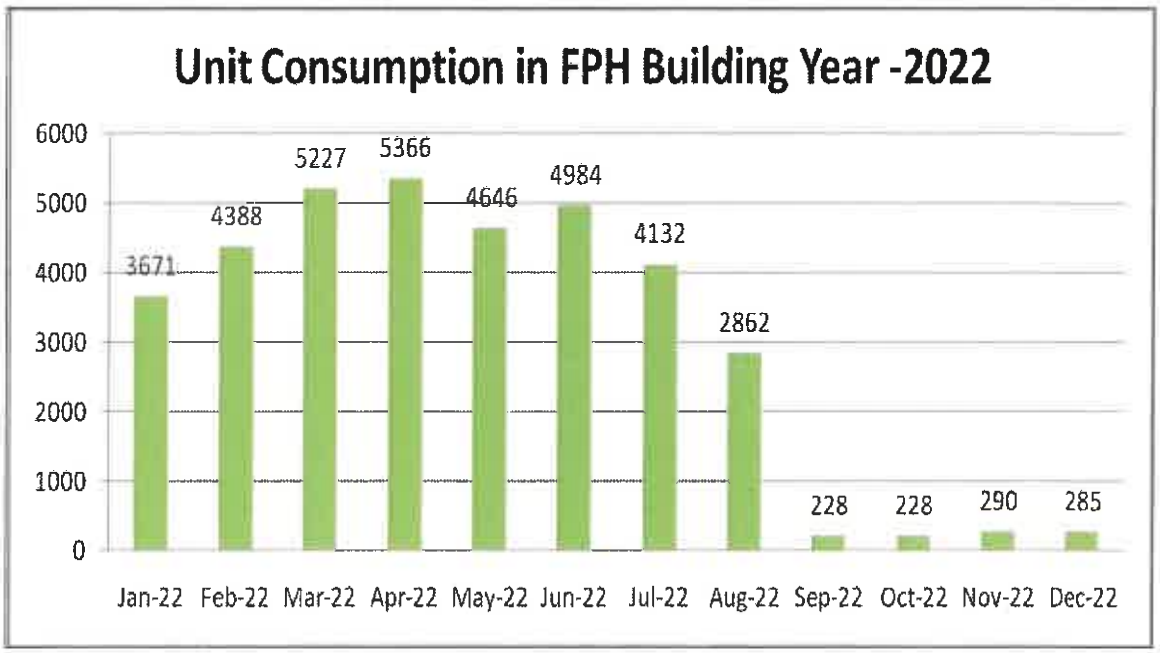


Graphical presentation of energy consumption FHMTC building year-2022



Graphical presentation of energy consumption FPH building year-2022

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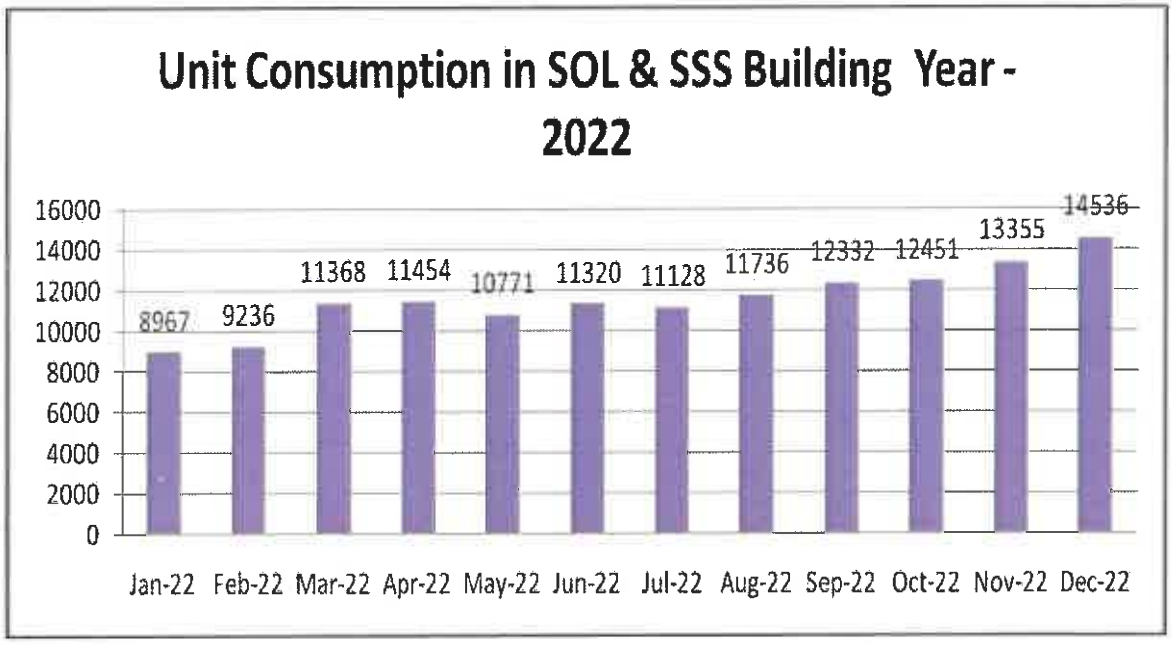
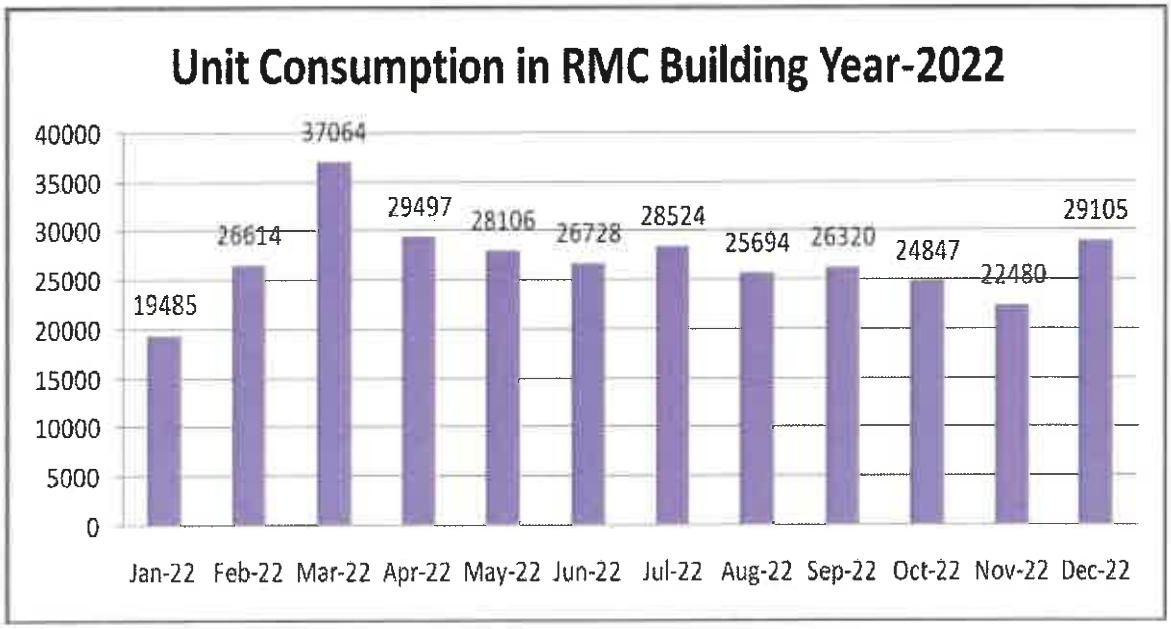


Graphical presentation of energy consumption SOL & SSS building year-2022



Graphical presentation of energy consumption RMC building year-2022

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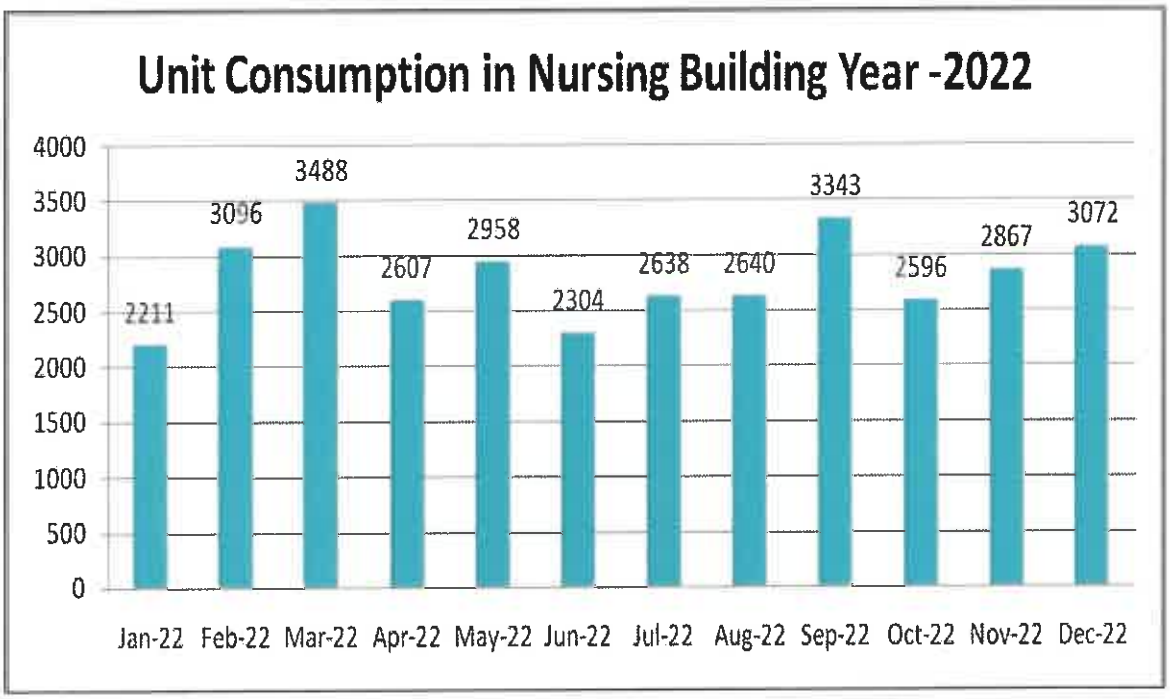
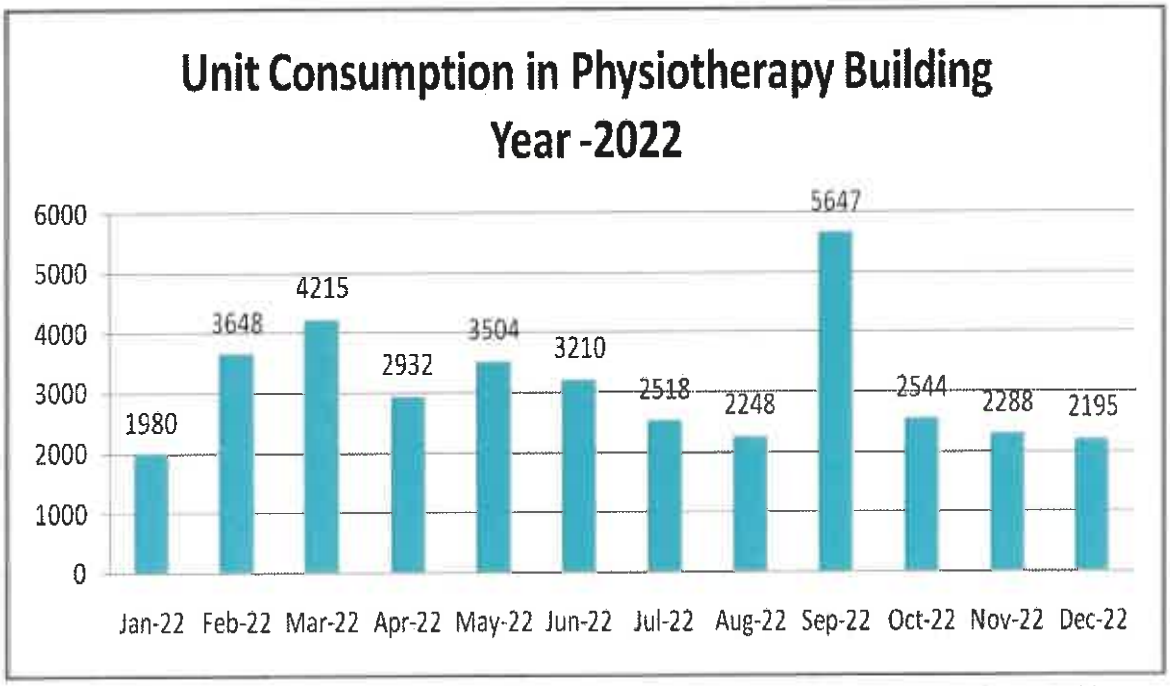


Graphical presentation of energy consumption Nursing building year-2022



Graphical presentation of energy consumption of Physiyotheraphy building year-2022

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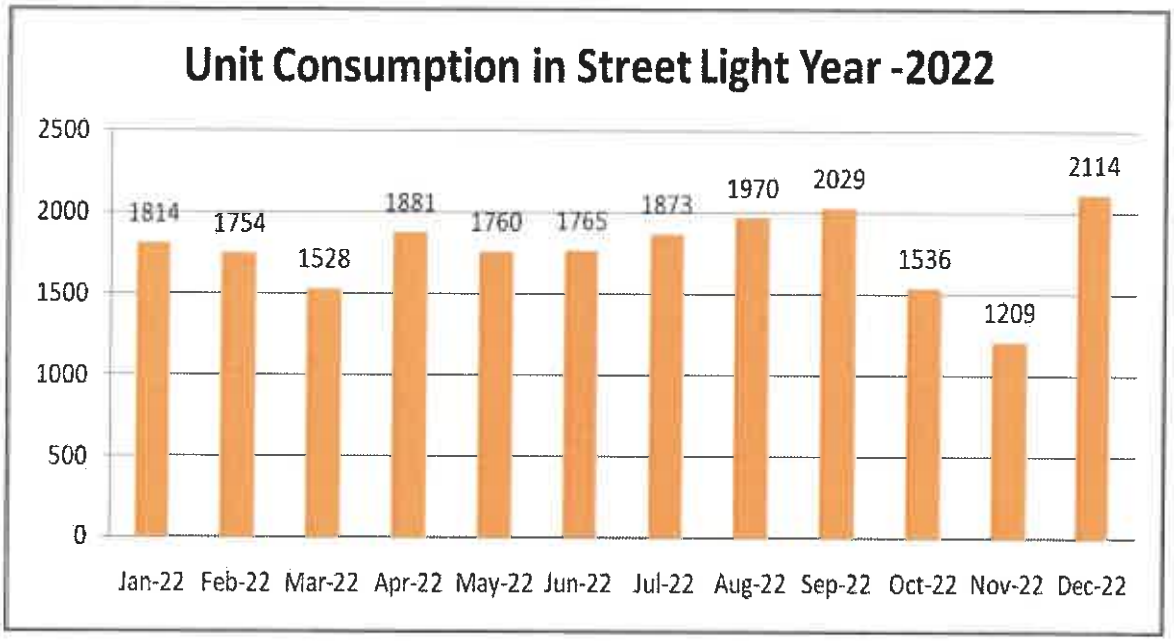

Graphical presentation of energy consumption of street light year-2022

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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	Base ment	Ground floor	1st floor	2nd floor	3rd floor	4th floor	Total
1	2' X 2' LED pannel light	0	0	0	0	36	0	57	13	83	0	0	153
2	4 Feet LED batten light	0	0	18	0	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	0

FDS													
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	Total
1	2' X 2' LED pannel light	0	0	0	0	36	0	84	68	65	0	0	217
2	4 Feet LED batten light	0	0	18	0	0	0	2	0	0	3	0	2
3	1' X 1' LED lights	0	0	0	20	0	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	Base ment	Ground floor	1st floor	2nd floor	3rd floor	4th floor	Total
1	2' X 2' LED panel light	0	0	0	0	36	0	47	44	5	150	0	246
2	4 Feet LED batten light	0	0	18	0	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	0
4	LED lights	9	0	0	0		0	0	0	6		0	6
5	LED lights	0	15	0	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	Base ment	Ground floor	1st floor	2nd floor	3rd floor	4th floor	Total
1	2' X 2' LED panel light	0	0	0	0	0	0	0	0	0	0	0	0
2	4 Feet LED batten light	0	0	18	0	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	0
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 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	Total
1	2' X 2' LED panel 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

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	Total
1	2' X 2' LED panel 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	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**		

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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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

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Sr. No	Description	Qty	TR	M/C Serial No	LOCATION	USAGE PER WEEK
16	1.5 TR SPLIT A/C	1	1.5	5001709331180 21000	SERVER ROOM	7 DAYS
17	1.5 TR SPLIT A/C	1	1.5	5001981141180 08000	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	5001503121180 00000	SUNDRESH CABIN	-
21	2.0 TR CASSETE SPLIT	1	2	5001503121180 00000	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 INVSTMENTS 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

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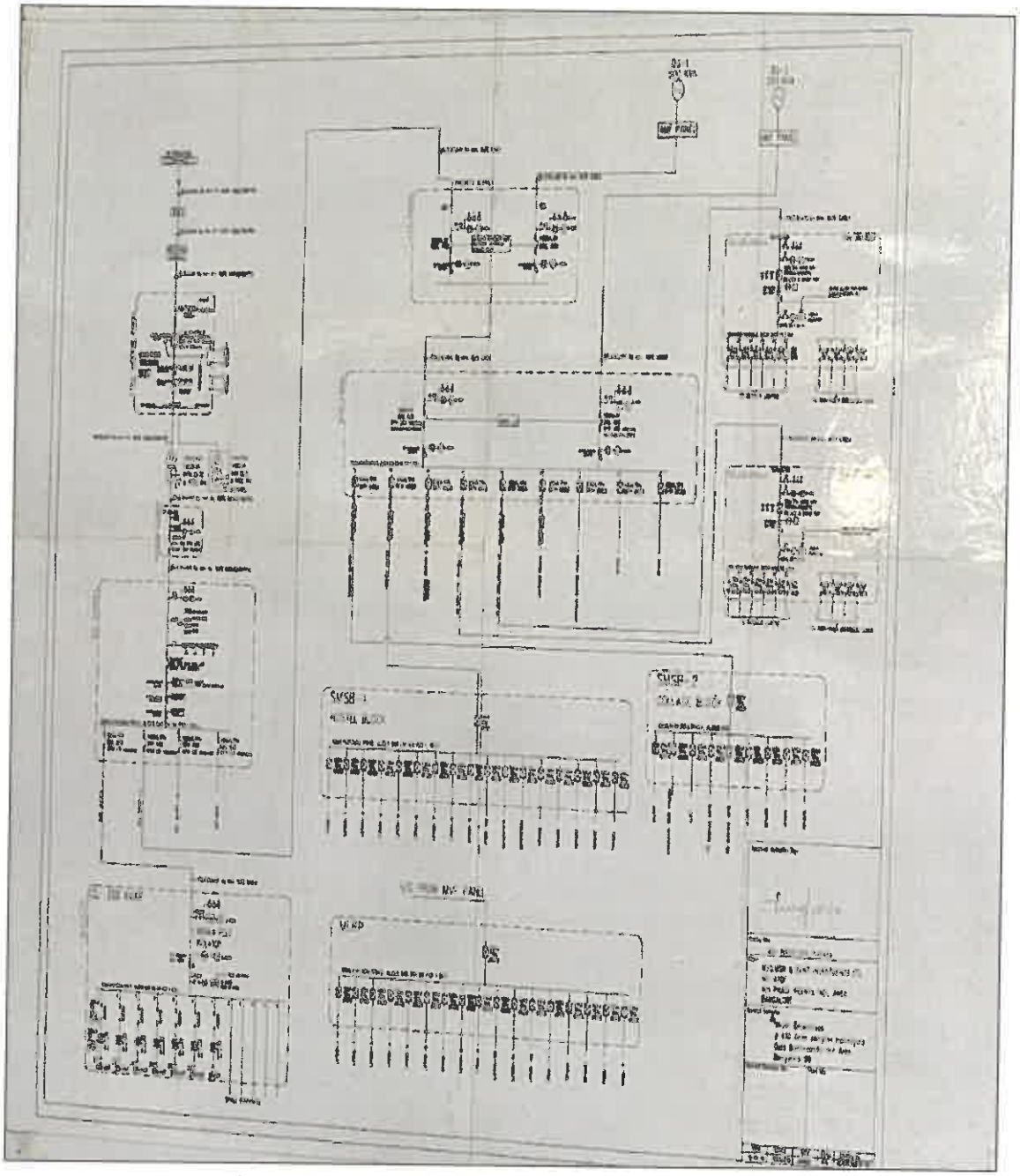
Single line diagram of Electrical Circuit.



Single line diagram of Ramaiah Technology Campus

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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.

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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)

Photographs of Solar Plant: -

Solar Plant 35KWp and solar System

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6.4 UPS System

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

Sr.No.	Location	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**

Photograph of Sensor Based Lighting System

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CHAPTER-07
ELECTRICITY BILL ANALYSIS

7.1 BILL ANALYSIS OF 750 KVA CONNECTIONS.

Energy audit team was analysed Electricity bills of last one year- 2022 (Ramaiah Technology Campus).

Sr. No.	Month & Year	Contract Demand (KVA)	Fixed Demand (KVA)	Maximum Demand (KVA)
1	Jan-22	750	638	241
2	Feb-22	750	638	250
3	Mar-22	750	638	280
4	Apr-22	750	638	318
5	May-22	750	638	320
6	Jun-22	750	638	302
7	Jul-22	750	638	264
8	Aug-22	750	638	259
9	Sep-22	750	638	266
10	Oct-22	750	638	237
11	Nov-22	750	638	252
12	Dec-22	750	638	211
	Minimum Demand (KVA)			211
	Maximum Demand (KVA)			320
	Average Demand (KVA)			266.67

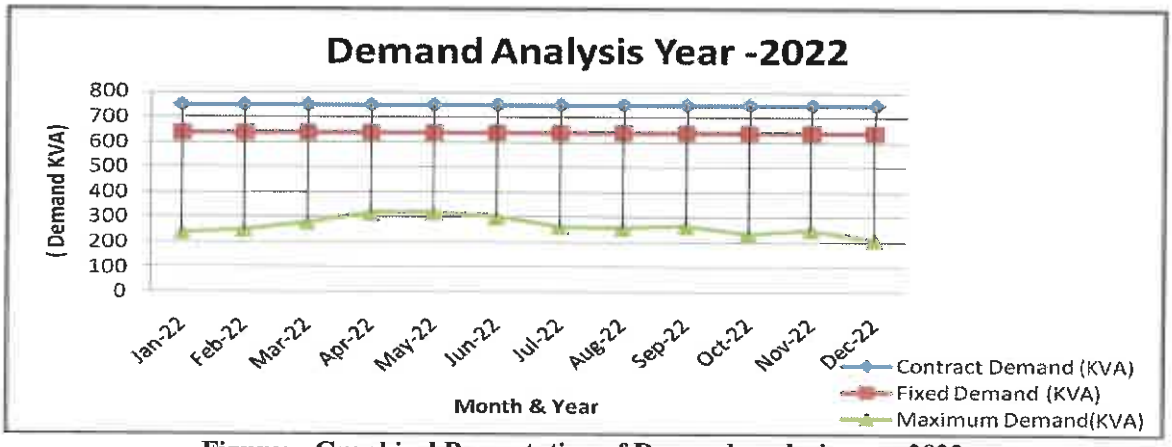

Figure: - Graphical Presentation of Demand analysis year-2022

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 320 KVA in the Month of Jun-2022 and a minimum of 211 KVA in Dec – 2022

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7.2 Monthly Power factor analysis Year-2022

Sr. No.	Month & Year	Power Factor
1	Jan-22	0.92
2	Feb-22	0.92
3	Mar-22	0.91
4	Apr-22	0.95
5	May-22	0.95
6	Jun-22	0.95
7	Jul-22	0.94
8	Aug-22	0.93
9	Sep-22	0.93
10	Oct-22	0.92
11	Nov-22	0.93
12	Dec-22	0.94
Total		**0.93**

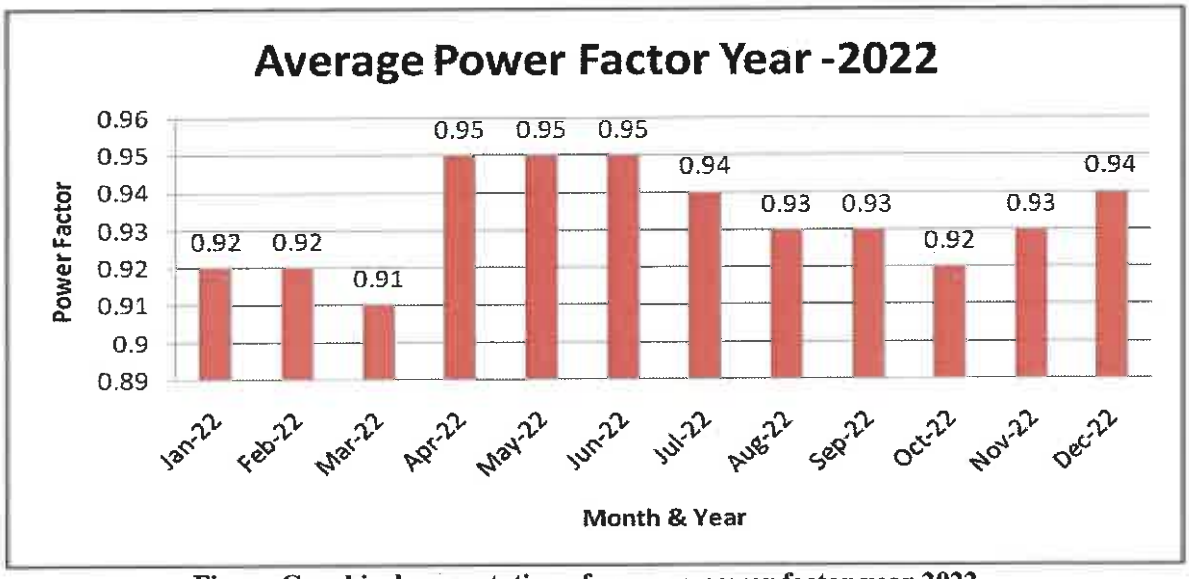

Figure Graphical presentation of average power factor year 2022

Observation:

The average power factor was 0.93 form Jan -2022 to Dec -2022. It is recommended to maintain power factor unity or 0.995.

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7.3 Monthly electrical energy consumption year 2022

The monthly electrical consumption for the RTC campus is given in the table.

Sr. No.	Month & Year	Unit Consumption (kWh)	Amount (Rs.)	Overall per unit charges (Rs. / kWh)
1	Jan-22	75,040	9,21,077/-	12.27
2	Feb-22	80,280	9,75,636/-	12.15
3	Mar-22	82,321	9,92,091/-	12.05
4	Apr-22	1,07,080	11,90,126/-	11.11
5	May-22	1,05,400	12,51,612/-	11.87
6	Jun-22	98,000	12,08,722/-	12.33
7	Jul-22	89,560	11,27,133/-	12.59
8	Aug-22	88,040	11,12,377/-	12.63
9	Sep-22	87,880	11,49,957/-	13.09
10	Oct-22	71,240	9,66,377/-	13.57
11	Nov-22	72,440	9,90,944/-	13.68
12	Dec-22	77,640	9,82,375/-	12.65
		10,34,921	**1,28,68,427/-**	**12.50**

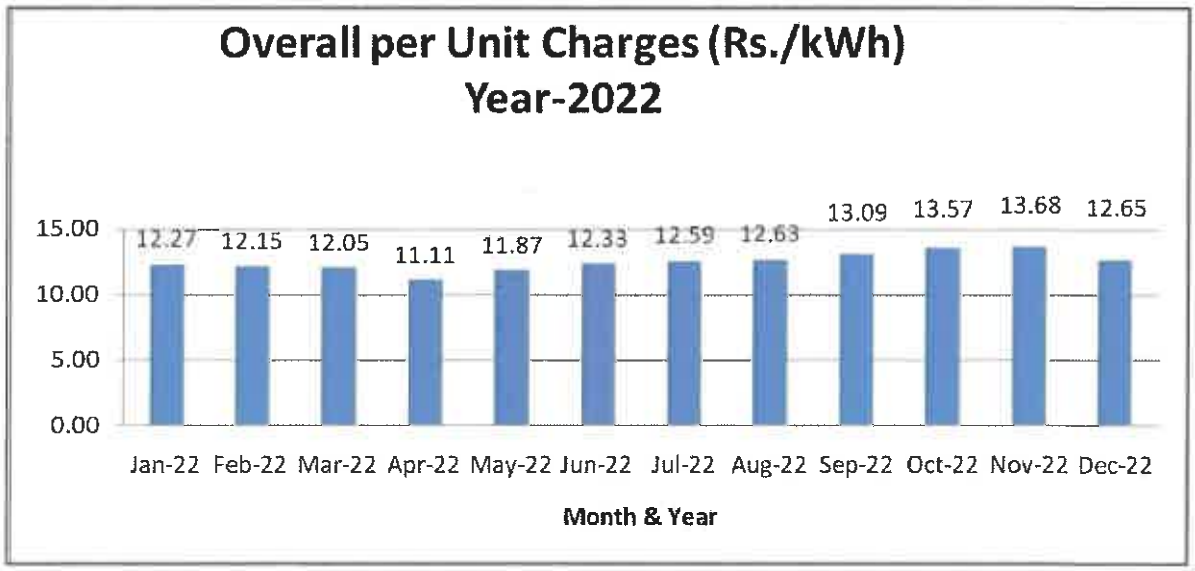

Figure: - Graphical presentation of actual per-unit charges for the year -2022

Observation:

It was found that total energy consumption in the last one year was 10, 34,921 units. The average annual energy charge is Rs 12.50 /kWh.

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7.4 BILL ANALYSIS OF 200 KVA KVA CONNECTIONS.

Energy audit team was analysed Electricity bills of last one year- 2022(Ramaiah Technology Campus). The details of sanctioned load 200 KVA are as below

Sr. No.	Month & Year	Contract Demand (KVA)	Fixed Demand (KVA)	Maximum Demand (KVA)
1	Jan-22	200	170	22
2	Feb-22	200	170	25
3	Mar-22	200	170	27
4	Apr-22	200	170	32
5	May-22	200	170	30
6	Jun-22	200	170	41
7	Jul-22	200	170	24
8	Aug-22	200	170	26
9	Sep-22	200	170	36
10	Oct-22	200	170	21
11	Nov-22	200	170	21
12	Dec-22	200	170	25
	Minimum Demand (KVA)			21
	Maximum Demand (KVA)			41
	Average Demand (KVA)			27.50

Figure: - Graphical Presentation of Demand analysis year-2022

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 41 KVA in the Month of Jun -2022 and a minimum of 21 KVA in Oct & Nov - 2022

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7.5 Monthly Power factor analysis Year-2022

Sr. No.	Month & Year	Power Factor
1	Jan-22	0.82
2	Feb-22	0.81
3	Mar-22	0.85
4	Apr-22	0.89
5	May-22	0.85
6	Jun-22	0.86
7	Jul-22	0.84
8	Aug-22	0.83
9	Sep-22	0.86
10	Oct-22	0.84
11	Nov-22	0.84
12	Dec-22	0.82
Total		**0.84**

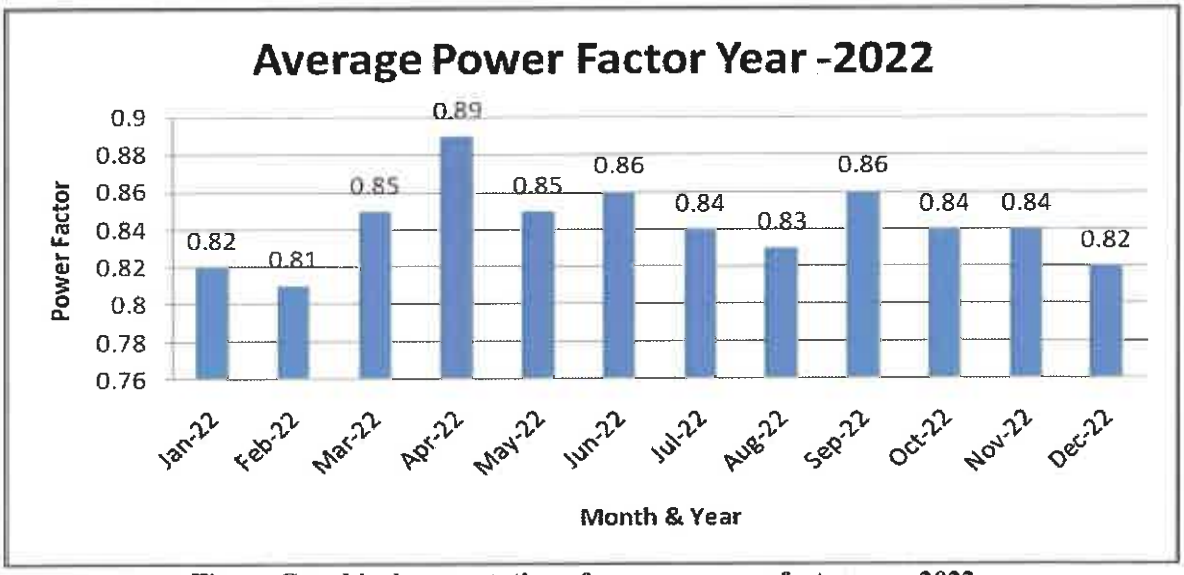

Figure Graphical presentation of average power factor year 2022

Observation:

The average power factor was 0.84 form Jan -2022 to Dec -2022. It is recommended to maintain power factor unity or 0.995

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7.6 Monthly electrical energy consumption 2022

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-22	4,470	92,694 /-	20.74
2	Feb-22	4,400	91,979/-	20.90
3	Mar-22	4,520	90,127/-	19.94
4	Apr-22	7,100	1,11,704/-	15.73
5	May-22	6,210	1,15,325/-	18.57
6	Jun-22	5,980	1,14,739/-	19.19
7	Jul-22	5,140	1,06,210/-	20.66
8	Aug-22	5,090	1,05,936/-	20.81
9	Sep-22	5,650	1,13,946/-	20.17
10	Oct-22	4,880	1,05,545/-	21.63
11	Nov-22	5,200	1,09,134/-	20.99
12	Dec-22	5,020	1,04,379/-	20.79
Total		**63,660**	**12,61,718/-**	**20.01**

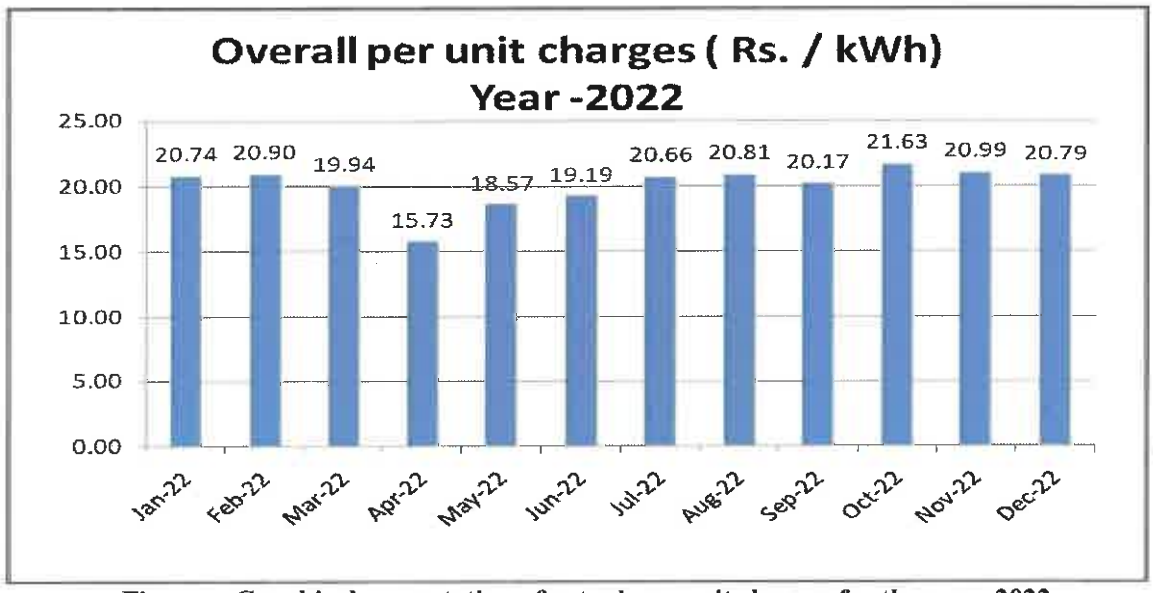

Figure: - Graphical presentation of actual per-unit charges for the year -2022

Observation:

It was found that total energy consumption in the last one-year months was 63,660 units. The average annual energy charge is Rs 20.01 /kWh. It is higher side due to demand not utilized.

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