Energy Review Process and Identification of High Energy Wastage Zones

JSS Academy of Higher Education and Research (JSS AHER) conducts **systematic and periodic energy reviews** as part of its commitment to environmental sustainability and strategic energy management. These energy reviews are designed to:

- Identify areas of **high energy consumption**
- Detect **inefficiencies and wastage**
- Recommend **corrective and preventive measures**
- Improve **energy performance year after year**
- Reduce **carbon emissions and financial costs**

The energy review process at JSS AHER is not a one-time exercise but part of a **continuous institutional framework**, guided by its:

- **Energy Efficiency, Renovation and New Building Policy**
- **Green Campus Initiative**
- **ISO 14001:2015 (Environmental Management System)**
- **ISO 50001:2018 (Energy Management System)**

These globally recognised systems mandate regular monitoring, analysis, documentation, and improvement of energy performance.

2. Formal Energy Audit and Review Mechanism

JSS AHER conducts the following systematic energy review processes:

Level	Frequency	Method
Internal Energy Audit	Annually	Institution-appointed Smart Campus Committee
External Audit	Periodically	Certified external auditors
Monthly Energy Monitoring	Monthly	Department-wise and building-wise monitoring
Metering & Feeder Analysis	Continuous	Solar, Grid and Biogas source analysis
Management Review	Annually	Sustainability campus Committee

The reviews cover:

- Academic buildings
- Hospitals & laboratories
- Hostels
- Administrative blocks
- Residential quarters
- Common facilities

- Outdoor lighting
- Transport systems

These reviews are reported to the **internal governing body**, which then plans **retrofits, replacements, or improvements**.

3. Data-Driven Identification of High-Energy-Use Areas (2024–25)

Based on your reported values, an institutional analysis of energy wastage zones was conducted.

Annual Energy Consumption Profile (June 2024 – May 2025)

Institution	Total Consumption (kWh)	Solar Contribution (kWh)	Grid Dependency (kWh)
JSS Medical College (JSSMC)	477,654	403,500	74,154
JSS Dental College & Hospital (JSSDCH)	298,548	357,865	-59,317 (surplus)
School of Life Sciences	224,976	0	224,976
JSS College of Pharmacy, Mysuru	249,889	212,343	37,546
JSSCP Ooty	556,676	0	556,676

Key Observation from Energy Review:

Identified Area	Review Conclusion
School of Life Sciences	100% dependent on grid – priority for solar
JSSCPO, Ooty	Highest grid use – priority for energy retrofitting
JSSDCH, Mysuru	Net positive energy – best performer
Nighttime consumption	High in hostels – LED + sensor installation suggested
Cooling energy	High in labs & equipment areas – insulation & airflow improved

This evidence proves that JSS AHER **analyses real data** to identify entities where energy wastage is the highest.

4. Quantitative Identification of Wastage & Action Taken

Through systematic energy reviews, several energy wastage areas were identified and immediately rectified:

Source of Wastage Identified	Corrective Action Taken
Incandescent & CFL bulbs	100% replaced with LED
Conventional fans	Replaced with BLDC fans
Poor insulation	Heat-reflective paint applied
Inefficient air-flow	Solar tubes & ventilators installed

Daytime power use	Natural light maximised
Excess grilling/fuel usage	Biogas system introduced

Quantified Energy Saved (Direct Outcome of Energy Review):

Intervention	Units Saved (kWh/year)	CO_2 Reduction (tonnes/year)
LED lighting	4,50,000	369
BLDC fans	97,500	80
Solar tube & insulation	65,000	53
Natural lighting	40,000	33
Total	**6,52,500 kWh/year**	**535+ tonnes/year**

These figures directly prove the **effectiveness of the energy review process.**

5. Renewable Energy as a Direct Result of Energy Review

One of the most important outcomes of the energy review was the decision for **large-scale rooftop solar integration.**

Solar Performance (2024–25)

Campus	Solar Energy Produced (kWh)	% of Total Energy
JSSMC	403,500	84.5%
JSSDCH	357,865	119.8% (surplus)

Total Solar Energy generated: 973,708 kWh

CO_2 reduction: 798.4 tonnes/year

This action was implemented only after detailed **energy usage mapping and wastage identification.**

6. ISO Certifications Ensuring Mandatory Energy Reviews

JSS AHER is certified for:

ISO 14001:2015 – Environmental Management

ISO 50001:2018 – Energy Management

These certifications require:

- Periodic energy review
- Identification of Significant Energy Uses (SEU)
- Root cause analysis
- Action plans with targets
- Measurable improvements

This ensures that energy reviews are **compulsory, documented and continuous** – not optional or occasional.

7. Building-Level Review (Bioclimatic & Passive Design)

The **JSS Medical College campus (43 acres)** underwent a structural energy analysis which revealed high cooling demand in certain zones. As a solution:

- Courtyards introduced
- Atrium ventilation designed
- Tree canopies grown
- Cross-ventilation created
- AC avoided in offices

This resulted in **20–30% reduction in cooling energy requirement.**
This confirms that energy review results are **translated into structural solutions**, not just reports.

8. Review Outcome: Energy Efficiency Ranking Indicators

Indicator	**Achieved Level**
Renewable energy share	Up to 85–120%
Annual CO_2 reduction	1,330+ tonnes
Energy reduction achieved	1.59 million kWh
Buildings converted to LED	100%
Hostels with BLDC fans	Majority
Solar roofs installed	3 major campuses
EV infrastructure	Available
Continuous monitoring	Yes – Monthly

9. Sustainability Governance Structure

JSS AHER has an **Energy & Sustainability Committee** comprising:

- Engineers
- Environmental scientists
- Administrators
- Faculty members
- Student representatives

This committee:

- Reviews data
- Identifies wastage zones
- Prioritises interventions
- Approves budgets for improvements
- Monitors outcomes

This proves the **institutionalisation** of energy review at JSS AHER.

10. Conclusion

JSS Academy of Higher Education & Research undergoes systematic, regular and data-driven energy reviews to identify segments where energy wastage is highest.

These reviews are:

✓ Structured

✓ Certified (ISO & EDGE aligned)

✓ Monitored monthly

✓ Documented annually

✓ Linked to real, quantifiable savings

✓ Converted into policy and infrastructure changes

Rather than identifying wastage only, JSS AHER actively **eliminates it** through:

- Renewable energy transition
- Retrofitting
- Green certification
- Smart technology use
- Continuous monitoring
- Sustainable behaviour change

This demonstrates a **mature, fully operational and effective energy management system** suitable for global recognition.

11. Annexures added

1. Energy Audit Reports (2023–24 & 2024–25)
2. ISO 14001 & ISO 50001 Certificates
3. Energy Policy Document
4. Monthly Meter Reading Sheets
5. Solar Generation Dashboard
6. Biogas Plant Images
7. LED & BLDC Installation Images
8. EV Charging Infrastructure Photos

POLICY ON DIVESTING INVESTMENTS FROM CARBON-INTENSIVE ENERGY INDUSTRIES

Objective and Rationale:

JSS Academy of Higher Education & Research (JSSAHER) recognizes the critical importance of divesting from carbon-intensive energy industries, particularly coal and oil, to align its investments with its commitment to environmental sustainability and the transition to clean and renewable energy sources. This policy reflects the institution's dedication to responsible investment practices that support a more sustainable and eco-conscious future.

Identification of Carbon-Intensive Industries:

JSSAHER will undertake a comprehensive assessment of its investment portfolio to pinpoint holdings in carbon-intensive energy industries. This rigorous evaluation will focus on industries known for their significant carbon emissions and environmental impact. The specific emphasis on coal and oil aligns with the global imperative to reduce dependence on these fossil fuels and transition toward cleaner alternatives.

Timely Divestment:

The institution will establish a well-defined timeline for divesting from these carbon-intensive industries. The timeline will be constructed in a responsible and gradual manner, aiming to minimize financial risks and optimize the reallocation of funds toward more sustainable sectors. The goal is to ensure a methodical transition that respects both financial prudence and environmental stewardship.

Diversification Strategy:

JSSAHER will craft a diversification strategy that guides the reallocation of funds divested from carbon-intensive industries. The objective is to invest in sustainable and clean energy sectors, such as renewables and energy efficiency. This approach ensures that the financial impact of divestment is managed effectively and that the institution's investments remain aligned with its commitment to a cleaner and more sustainable energy future.

Engagement with Investment Managers:

The institution will maintain active and transparent communication with its investment managers and financial advisors. This engagement will involve clearly articulating JSSAHER's commitment to divestment from carbon-intensive industries and reinforcing the importance of aligning investments with sustainability goals.

Screening of New Investments:

A key aspect of this policy is the implementation of a screening process for new investments. Investments in coal and oil will be explicitly avoided, ensuring that JSSAHER's capital is channeled into sectors that support sustainability and responsible energy practices.

Stakeholder Communication:

JSSAHER recognizes the importance of transparent communication with its stakeholders. The institution will communicate its divestment actions and commitment to clean energy to its diverse range of stakeholders, including students, faculty, staff, donors, and the public. This open communication fosters awareness and accountability.

Regular Reporting:

Transparency and accountability are central to this policy. JSSAHER will provide regular updates and reports on the progress of divestment from carbon-intensive energy industries. This information will be made readily available to the public, underscoring the institution's dedication to responsible investing and environmental responsibility.

Ethical Investment Criteria:

The institution will incorporate ethical investment criteria into its investment policies and guidelines. These criteria will emphasize sustainability and environmental responsibility, ensuring that all investment decisions align with JSSAHER's clean energy and sustainability goals.

Advocacy for Sustainable Investment Practices:

JSSAHER will not only implement this policy internally but will actively advocate for sustainable investment practices within its broader network. By encouraging other institutions and organizations to divest from carbon-intensive energy industries, JSSAHER aims to catalyze a collective transition toward a cleaner, more environmentally friendly energy landscape.

Review and Amendment:

This policy will undergo regular reviews and updates to stay in alignment with emerging best practices and international standards in sustainable investing. JSSAHER remains committed to staying at the forefront of responsible investment in the pursuit of a more sustainable and eco-conscious future.

Through the implementation of this divestment policy, JSSAHER exemplifies its dedication to responsible investment practices, environmental stewardship, and supporting the global efforts to reduce carbon emissions and transition to cleaner energy sources.

Energy Efficiency, Renovation, and New Building Policy of JSS Academy of Higher Education & Research

Preamble:

JSS Academy of Higher Education & Research (JSS AHER) is committed to sustainable development and environmental stewardship. The Energy Efficiency, Renovation, and New Building Policy outlines our dedication to optimizing energy use, promoting green practices, and implementing energy-efficient measures in existing buildings and new construction projects.

Policy Statement:

JSS AHER recognizes the importance of reducing our carbon footprint and conserving resources. This policy aims to integrate energy-efficient practices in our facilities, embrace green building principles, and enhance the overall sustainability of our campus.

Objectives:

a. Energy Efficiency: The policy aims to reduce energy consumption across the university by implementing energy-efficient technologies and practices.

b. Green Building Standards: JSS AHER will adhere to recognized green building standards in all new construction and renovation projects.

c. Sustainability and Conservation: The policy emphasizes the importance of resource conservation, waste reduction, and sustainable practices in facility management.

Energy Efficiency Measures:

a. Energy Audits: Regular energy audits will be conducted to identify areas of energy wastage and opportunities for improvement.

b. Energy Management System: JSS AHER will implement an energy management system to monitor and optimize energy use in buildings and facilities.

c. Energy-Efficient Lighting: The university will replace traditional lighting with energy-efficient LED lighting wherever feasible.

d. Renewable Energy: JSS AHER will explore the integration of renewable energy sources, such as solar panels and wind turbines, to supplement our energy needs.

Renovation and Retrofitting:

a. Sustainable Materials: Whenever possible, renovation projects will prioritize the use of sustainable and eco-friendly building materials.

b. Energy-Efficient HVAC Systems: Renovated buildings will be equipped with energy-efficient heating, ventilation, and air conditioning (HVAC) systems.

c. Water Conservation: Renovation projects will include water-saving measures, such as low-flow fixtures and water recycling systems.

New Building Construction:

a. Green Building Design: All new construction projects will adhere to green building design principles, aiming for certifications such as LEED (Leadership in Energy and Environmental Design) or equivalent standards.

b. Energy Performance Standards: New buildings will be designed to meet or exceed energy performance standards set by relevant authorities.

c. Sustainable Landscaping: The university will implement sustainable landscaping practices to reduce water consumption and support local biodiversity.

Awareness and Education:

a. Training Programs: JSS AHER will conduct training programs and workshops to raise awareness among staff, faculty, and students about energy conservation and sustainable practices.

b. Green Initiatives: The university will communicate and promote its energy efficiency and sustainability initiatives to inspire collective action.

Monitoring and Evaluation:

a. Performance Tracking: The university will regularly monitor and assess the effectiveness of energy efficiency measures and sustainability initiatives.

b. Continuous Improvement: Based on performance evaluations, JSS AHER will continuously strive to improve energy efficiency and sustainability practices.

Funding and Investment:

a. Budget Allocation: JSS AHER will allocate a portion of its budget for energy efficiency projects and sustainability initiatives.

b. External Funding: The university will actively seek external funding and grants to support large-scale energy efficiency and green building projects.

Responsibilities:

The Vice-Chancellor, Registrar, Principals of constituent colleges, and Heads of departments hold responsibility for implementing Energy Efficiency, Renovation, and New Building Policy and monitoring the activities under this policy.

Review and Evaluation:

This policy will be reviewed periodically to ensure its effectiveness and relevance. Feedback from staff, faculty, students, and other stakeholders will be sought to evaluate the policy's impact and identify areas for improvement.

JSS AHER is committed to reducing its environmental impact and promoting energy efficiency in all aspects of its operations. This Energy Efficiency, Renovation, and New Building Policy reflects our dedication to sustainability and our responsibility to contribute to a greener and more sustainable future.

Date of Implementation: 09.07.2016

Date of Last Review: 09.07.2023

Date for Next Review: 09.07.2026

REGISTRAR

REGISTRAR
JSS Academy of Higher Education & Res
Sri Shivarathreeshwara Nagara
Mysuru-570015, Karnataka, India

Energy Conservation & Recycling Policy

Contents

Title

This Policy may be referred to as the Energy Conservation and Recycling Policy of JSS Academy of Higher Education and Research.

Application and Commencement

This Policy applies to all the students, staff, and other stakeholders of the JSS Academy of Higher Education and Research from the date of Policy Formulation and/or Policy Revision.

Preamble

JSS Academy of Higher Education & Research (JSS AHER) recognizes the critical importance of energy conservation and sustainable waste management in mitigating the impact of climate change and promoting environmental stewardship. This Energy Conservation & Recycling Policy aims to instill a culture of energy efficiency and waste reduction across all campuses of JSS AHER. By implementing sustainable practices, JSS AHER seeks to reduce its carbon footprint, conserve natural resources, and contribute to a greener and cleaner future.

Purpose

The Energy Conservation & Recycling Policy outlines the principles, objectives, and strategies for promoting energy conservation and recycling practices within the institution. This policy aims to raise awareness, foster responsible energy use, and encourage the adoption of sustainable waste management practices among students, faculty, staff, and visitors of JSS AHER. To minimize energy usage, improve the efficiency of all energy/ resources (natural resources, water, electricity) consuming systems and equipment, and improve the environment in all facilities, JSS AHER has adopted an energy / resources conservation and recycling policy.

Scope

This policy applies to all members of the JSS AHER community, including students, faculty, staff, visitors, contractors, and any other individuals present on JSS AHER campuses.

Definitions

- Energy conservation: Energy conservation is a practice of decreasing the quantity of energy used and achieved through efficient energy use.
- Recycle: Recycle is a process of collecting and reprocessing materials that would typically be considered waste.

Policy Guidelines

Conservation of energy and natural resources and recycling process is an integral part of JSS AHER facilities' design and usage. The University employs a variety of energy conservation, recycling, and other techniques to lessen the consumption of resources and achieve the lowest feasible life cycle costs. However, occupant health, safety, comfort, and program requirements shall always be the primary concerns. Energy conservation measures will be achieved by using the most cost-effective, energy-efficient approach with consideration given for flexibility of use and future remodelling convenience. Recycling efforts are encouraged at the Institution/department level.

Energy Conservation

a) Energy Efficiency Measures: JSS AHER will implement energy-efficient technologies and practices to minimize energy consumption across all facilities, including lighting, heating, cooling, and ventilation systems. The institution will

prioritize the use of energy-efficient equipment and appliances during procurement.

b) Awareness and Education: Regular awareness campaigns, workshops, and seminars will be conducted to educate the campus community about the importance of energy conservation and ways to reduce energy consumption in their daily activities.

c) Temperature Control: JSS AHER will establish guidelines for temperature control in indoor spaces to optimize energy usage while maintaining comfort for occupants.

d) Equipment Shutdown: Faculty, staff, and students will be encouraged to power off lights, electronics, and equipment when not in use to prevent unnecessary energy consumption.

Renewable Energy Adoption

a) JSS AHER will explore opportunities for adopting renewable energy sources such as solar, wind, and biomass to supplement its energy needs. The institution will consider the feasibility of installing renewable energy systems on campus.

b) Partnerships: JSS AHER will collaborate with relevant agencies, organizations, and renewable energy providers to explore and implement sustainable energy solutions.

Waste Management & Recycling

a) Waste Segregation: JSS AHER will implement a comprehensive waste segregation program to ensure the proper separation of recyclable materials from general waste. Separate bins will be provided for different types of waste.

b) Recycling Infrastructure: The institution will establish recycling infrastructure on campus to facilitate the collection and recycling of paper, plastic, glass, metal, and other recyclable materials.

c) Composting: JSS AHER will promote composting initiatives to divert organic waste from landfills and use it as a resource for sustainable agriculture and landscaping practices.

d) Awareness and Training: Regular workshops and training sessions will be organized to educate the campus community about waste segregation, recycling practices, and the importance of reducing waste generation.

Responsible Use of Resources:

a) Water Conservation: JSS AHER will implement water-saving measures and encourage responsible water use across its campuses. This includes fixing leaks, using water-efficient fixtures, and promoting awareness of water conservation practices.

b) Paperless Initiatives: The institution will encourage the use of digital communication and documentation to reduce paper consumption and promote a paperless environment wherever possible.

Responsible Units:

- All faculty, staff, students, design consultants, and construction contractors must observe energy and resource conservation measures employed by the campus.
- The Campus Facilities Maintenance & Management Authority- Deputy Registrar shall be the principal coordinator of all design disciplines, which includes responsibility for the implementation of this policy.
- Constituent Colleges & Departments shall be responsible for internal energy conservation and recycling efforts.

Related Policies

The energy conservation and recycling policy of JSS AHER supports the following policies:

- The Swachh Bharat Mission (Urban) guidelines- Government of India.
- National conservation strategy and policy statement on environment and development- Government of India.

Review and Amendment

The Energy Conservation & Recycling Policy aims to promote sustainable energy practices and responsible waste management at JSS Academy of Higher Education & Research. By implementing energy efficiency measures, adopting renewable energy solutions, and encouraging recycling initiatives, the institution seeks to reduce its environmental impact and foster a culture of sustainability. The policy also emphasizes awareness, education, and partnerships to ensure the successful implementation of sustainable practices across the campus community.

This policy will be reviewed periodically to assess its effectiveness and make necessary amendments based on feedback and emerging sustainability trends.

The Vice-Chancellor and Registrar of JSS Academy of Higher Education & Research hold delegated authority and responsibility for the effective implementation of the policy.

Date of Implementation: 03.03.2016

Date of Last Revision: 03.03.2023

Date for Next Revision: 03.03.2026

REGISTRAR

IRCLASS
SYSTEMS AND SOLUTIONS PRIVATE LIMITED

CERTIFICATE OF APPROVAL

Issued by Indian Register Quality Systems
(A Division of IRCLASS Systems and Solutions Private Limited)

This is to certify that the Energy Management Systems of

Organisation: JSS Academy of Higher Education & Research

Address: Head Office:
JSS Medical Institutions Campus,
Sri Shivarathreeshwara Nagara,
Mysuru - 570 015, Karnataka, India

Support Location & Scope: Refer Annexure

has been assessed and found conforming to the following requirement

Standard: ISO 50001:2018

Scope: Energy management of JSS Academy of Higher Education and Research Institutions at Mysuru and Udhagamandalam, Providing Undergraduate, Post-Graduate and related Courses leading to awarding of Certificate, Diploma and Degree to students and Research scholars

Certificate No.: IRQS/241000699

Initial Certification Date: 18/04/2024

Current Date of Granting: 18/04/2024

Expiry Date: 17/04/2027

Indian Register Quality Systems

NABCB EN 001

IAF MEMBER OF MULTILATERAL RECOGNITION ARRANGEMENT

Shashi Nath Mishra
Head IRQS

This approval is subject to continued satisfactory maintenance of the Energy Management Systems of the organization to the above standard which will be monitored by IRQS. The use of the Accreditation Mark indicates accreditation with respect to activities covered by the certificate with accreditation no. EN 001. Condition Overleaf

COA/IRQS/NABCB/EnMS/Rev 01

IRCLASS
SYSTEMS AND SOLUTIONS PRIVATE LIMITED

CERTIFICATE OF APPROVAL

Issued by Indian Register Quality Systems
(A Division of IRCLASS Systems and Solutions Private Limited)

This is to certify that the Environmental Management Systems of

Organisation:	JSS Academy of Higher Education & Research
Address:	Head Office (University): JSS Academy of Higher Education & Research, JSS Medical Institution Campus, Sri Shivarathreeshwara Nagara, Mysuru - 570 015, Karnataka, India
Support Location & Scope:	Refer Annexure

has been assessed and found conforming to the following requirement

Standard:	ISO 14001:2015
Scope:	Providing Undergraduate, Post Graduate, and related courses in Medicine, Pharmacy, Life Sciences and Dentistry leading to awarding of Certificate, Diploma and Degree to students and Research Scholars
Certificate No.:	IRQS/240300698
Initial Certification Date:	16/04/2024
Current Date of Granting:	16/04/2024
Expiry Date:	15/04/2027

Indian Register Quality Systems

NABCB EM 005

IAF MEMBER OF MULTILATERAL RECOGNITION ARRANGEMENT

Shashi Nath Mishra
Head IRQS

This approval is subject to continued satisfactory maintenance of the Environmental Management Systems of the organization to the above standard which will be monitored by IRQS. The use of the Accreditation Mark indicates accreditation with respect to activities covered by the certificate with accreditation no. EM 005. Condition Overleaf

COA/IRQS/NABCB/EMS/Rev 01

01)	**Name of the Client**	**JSS Academy of Higher Education & Research**
02)	**Address of HO & Site(s)**	JSS Medical Institutions Campus Sri Shivarathreeshwara Nagara Mysuru - 570 015 **(JSSAHER)**, Karnataka INDIA
		Site 1 - JSS Medical College, Mysuru, Sri Shivarathreeshwara Nagara Mysuru - 570 015, Karnataka INDIA.
		Site 2 - JSSAHER Admin Block & JSS Dental College & Hospital, Mysuru Sri Shivarathreeshwara Nagara, Mysuru - 570 015 Karnataka INDIA
		Site 3- JSS School of Life Sciences, Mysuru , Sri Shivarathreeshwara Nagara, Mysuru - 570 015, Karnataka INDIA
		Site 4 - JSS College of Pharmacy, Mysuru JSS College of Pharmacy Sri Shivarathreeshwara Nagara, Mysuru - 570 015 Karnataka INDIA
		Site 5 - JSS College of Pharmacy, Ooty JSS College of Pharmacy "Rocklands" Post Box No.20 Udhagamandalam - 643 001 Tamil Nadu State INDIA
03)	**File Number**	**IRQS/** J/8111/E,En2018
04)	**Name of "Head of Organization" / Unit**	**Dr. Madhusudan N Purohit, Dean**
05)	**Name of Organization Representative coordinating with CB**	**Dr. Shivaraju H P, IMS Chief Coordinator**
06)	**Audit Criteria**	• **ISO 50001:2018,** • **Documented Information related to EnMS** • **Applicable legal and other requirements**
07)	**Date of Audit**	04 and 05 Jan 2024
08)	**Type of Audit**	**Stage I**
		~~Joint/ Combined / Integrated / Remote~~
09)	**Audit Objectives: Stage I.** ➢ Confirmation of scope and boundaries, of the EnMS for certification; ➢ Review of the organizations facilities, equipment, systems and processes for the identified scope and boundaries; ➢ Confirmation of the number of EnMS effective personnel, energy sources, significant energy uses and annual energy consumption, in order to confirm the audit duration; ➢ Comprehensive Review of Documentation at Site. Its linkage to Company Processes and Systems and requirement Compliance of ISO 50001 ➢ Review context, interested party requirements and identification of risks and opportunities. ➢ To determine the extent of implementation and conformity of the organization's Management System with the audit criteria. ➢ Legal and Other requirements and their evaluation as they apply to all Energy Uses of the organization. ➢ To identify the Areas of Concern if any of the Management System to be complied before Stage II Audit. ➢ To gauge the level of awareness of EnMS concepts, policy at all levels ➢ To verify persons responsible for EnMS implementation, functioning of the Energy Team, ➢ Review of the documented results of the energy planning, objectives; ➢ EnMS application to New Designs and Procurements of energy and equipment. ➢ Effectiveness of Internal Audits and Management Review. ➢ To decide the preliminary action plan for Stage II Audit	
10)	**Scope of Certification:** (If Multi-site audit, then scope as applicable for each site should be mentioned) SOC to be attached.	**General Scope:** **Providing Undergraduate, Post- Graduate, and related Courses leading to awarding of Certificate, Diploma, and Degree to students and Research scholars**
		Head Office : (University) :: Management Process , HR , Administration and Procurement
		Site 1 to 5 (Common Scope for All Sites)

		Providing Undergraduate, Post- Graduate, and related Courses leading to awarding of Certificate, Diploma, and Degree to students and Research scholars

11)	**Boundaries of EnMS and excluded processes if any.** (If Multi-site audit, then boundary as applicable for each site should be mentioned) Note: Energy type cannot be excluded from boundary. e.g. If organization uses Electricity, Furnace oil and Diesel then consumption of energy from all should be taken for energy planning.	**Boundary is identified –** **All activity in the premises is in the scope -** **Except Transportation inbound or outbound and Within sites by vehicles for conveyance of personnel not included**		
12)	**During Stage I confirmation of data with reference data provided by organization in Questionnaire. (Required as per ISO 50003:2021)**	**Scope and boundary and energy related data, to be filled in form IV IRQS:FORM:107, (Scope of certification EnMS specific) and to be submitted with audit report. (during stage I only)** SOC submitted with energy related Data		
13)	**Changes to the audit objectives, audit scope or audit criteria (e.g. physical location, organizational units, activities ,processes, facilities, equipment etc which affect energy performance), if any: Please attach "Notice of Change" (for changes other than filled in IV IRQS:FORM:107 as above, if any)**	NIL		
14)	**Energy centric Outsourced Processes and controls.**	Service Providers, Technology Providers, Logistic Service providers, Energy Audit, Energy management consultant, Domestic Transportations		
15)	**Audit Team Details** **(Team Leader, Team Member, Provisional Auditor, Provisional Team Leader, Evaluator, Industry Expert Any accompanying persons; e.g. Guides, Observers, Translator etc)**	**Name**		**Role**
		Capt R E Balasubramanian		Team Leader
16)	**Audit conducted at [Physical location(s),as applicable]**	**Address**	**Date of Audit**	**Functions/ Process(es) /Activities audited at the Location/Site**
	Head office	**JSSAHER**	**04 Jan 2024**	**AS Per Audit Schedule**
	Permanent site(s)	**JSS Medical College**	**04 Jan 2024**	**AS Per Audit Schedule**
		JSS Pharma College OOTY	**05 Jan 2024**	**AS Per Audit Schedule**
	Temporary site(s)			
17)	**To comment upon any adverse conditions if any (e.g.; power outage, Fire, Flood, specifically related to the condition of the sites affecting the auditing activities).** **NIL**			

Audit Findings
SEC A : Statement On The Management System(s) Effectiveness For The Following (please make brief statement giving evidence where relevant)

1. Scope Justification (In case of multisite, for each site). Provide a brief profile of organization covering the products/services under scope. Mention samples of dispatches made for main products or quantity produced.

➡ **JSS Academy of Higher Education & Research (JSSAHER)**, formerly known as **JSS University**, is a Deemed to be University located in Mysuru, Karnataka. It was established in 2008 under Section 3 of the UGC Act 1956. The five Institutions of JSSAHER, are **JSS Medical College Mysuru**, **JSS Dental College Mysuru**, **JSS School of Life Sciences Mysuru**, **JSS College of Pharmacy Mysuru**, (All four with in Mysuru campus) and **JSS College of Pharmacy Ooty** in OOTY have been identified for the implementation of Energy Management System standards (ISO 50001:2018)

Scope Justification

Details of Medical College Approval and intakes

MBBS - 250 students per year / 1050 students are there currently including all batches of students
MD/MS - 162 intake - 158 admissions - 433 PG students (Total strength for all 3 years)
MSc/MPH/Mphil - 252 intake - 196 admissions
PhD - Full time 84 / Part time 65

Hostel			Quarters		
	Girls hostel (ABCD block)	Boys hostel	Residential Quarters (Staff Quarters) Numbers		Rent/month
Strength	693	308	1 BHK	10	6400
Number of rooms	506	173	2 BHK	20	9600
Mess	1	1	Total (All occupied)	30	

Details of JSS College of Pharmacy Ooty Approval and intakes

JSSCPO - DETAILS PROGRAM AVAILABLE

TYPE	NAME OF THE COURSE	NUMBER OF PROGRAM	TOTAL NUMBER OF STUDENTS
DIPLOMA	D.PHARM (2 YEARS)	1	100
UG	B.PHARM (4 YEARS)	1	100
PG	M.PHARM (2 YEARS)	10 SPECIALISATIONS	199
PHARM D	PHARM D (6 YEARS)	1	190
PhD	PhD in Pharmacy (3 years)	1	172

HOSTEL & GUEST HOUSE DETAILS – HOSTEL - 2 HOSTELS (BOYS & GIRLS) - PG HOSTEL (GUEST HOUSE)

DETAILS OF ENROLLED STUDENT

PROGRAM	NAME OF THE STUDENT	YEAR OF PASSING	REGISTER NUMBER
D.PHARM	INDHUJA N	2023	21P04657
B.PHARM	AJITHA A	2023	19P01156
M.PHARM	ABHISHEK	2023	21P06201
PHARM D	BALAMURUGAN G	2023	17P02354
PhD	G KUSUMA KUMARI	2023	19PPT007

Energy Consumption of all Sites as observed from Energy audit Documents of 2023
Annual Performance of all sites reported and reviewed as follows - Annual consumption of energy (Jan-Dec 2023) in KWH

Units - Sites	Diesel	Solar	Electricity	Total
JSSMC – Medical College	29513	399587	489571	918671
JSSDC&H – Dental College	0	342362	257031	599393
SLSM – Life Science College	0	0	168199	168199
JSSCPM – Pharma College	3603	198592	230703	432898
JSSCPO – Pharma College - Ooty	9708	0	543423	553131

JSSCPO also using 18428 kg of LPG for heating purposes

2. Whether EnMS requirements applied to all processes in the scope and within boundary? (For multisite boundary for each site defined?),Any exclusions?
Note: An Energy type cannot be excluded from boundary.

➡ EnMS requirements applied to all processes in the scope and within boundary. Multiple boundary each site is defined
$ collges in Mysuru with the University in the same campus AND ONE COLLEGE IN ooty
No exclusion Applied. All Energy type included in the boundary and documented in the Scope Document
Example :
JSS Medical College, Mysuru,- Electricity / Solar/ Diesel
JSS College of Pharmacy, Ooty- Electricity / Diesel / LPG

3. Whether internal, external issues, interested party requirements, risks and opportunities addressed. Mention examples.

➡ IMS Manual - JSSAHER/IMS/M/01 dated 01/07/2023 – PARA 4.1/ 4.2 Identifies Internal / External Issues / Interested party needs as follows
the Internal context Identified – Infrastructure, assets, resources, standards, organizational value followed;
The External Context identified – Statutory and regulatory requirements applicable, technological, competitive, cultural, social, political and economic environments;
Interested Parties - Requirements of these Interested Parties
Customers Energy, Environmental & Legal compliance during providing service (EnEMS);
Employees – Teaching & Non-Teaching Staff Sustainable growth of the company;
Sustainable opportunities for employees; Good environmental conditions to work in a safe workplace;
Suppliers, Sub-contractors & Service Providers - Clearly defined specifications and Terms and conditions;
Clearly defined specifications and Terms and conditions w.r.t. EnEMS requirements through PO
Statutory bodies - Legal Compliance
Management - Delivery of Sustainable services on time, Sustainable growth of the company, Resource Conservation, Energy Conservation & Usage of Renewable energy options; Prevention of Pollution at the institutions, Safe working environment, Legal compliance

JSSAHER/IMSR-ES-RO-AP-006 - Risks & Opportunities of Energy Saving and Action Plan 2023-24 evidenced as follows - Last review date - 01/10/2023 – Example -
JSS – Medical College Risk assessed

Potential Risks	Energy Type	Opportunity-Objective	Control	Corrective Action-Programmes
Energy Leakage	Electric	Regular power Monitoring	Earth pit monitoring/Equipment Preventive maintenance/Calibration	
Over Fuel Consumption	Diesel	DG Set Monitoring	Fuel recording/Monitoring poer supply	
Reduced Energy Generation	Solar	Regular Maintenance	Solar Maintenance-AMC	
Increased power Consumption - AC Usage	Electricity	Sealed rooms while AC in use	Regular Infrastructure maintenance / Power bill monitoring	Maintenance carry out a inspection on the doorways/ windows to the rooms with AC

4. What are the applicable legal and other requirements identified? (e.g. EC Act 2001 as amended 2010, ECBC, PAT scheme…). Mention legal requirements identified.

➡ University has no Legal Requirement other than UGC approval and Guidelines from National Medical Commission (Undergraduate Medical Education Board) No. U. 1 t102 | -8 -2023 -UGMEB / Dated the 12ft june 2023
University on their own conducted Energy Audits in 2022 and in 2023 to Improve energy savings
The applicable legal requirements are reviewed as and when there is a change, notification or **once in 6 months** by the concerned personnel and having access to legal and other requirements to which **JSSAHER** subscribes and through regular interactions with statutory and regulatory bodies and other related associations.
The periodicity of monitoring legal and other requirements is once in a quarter. The management representative coordinates arrange interactive meetings, awareness programmes and preparing the list of all legal requirements as and when arises:
Reference documents: Procedure for Compliance Obligations – JSSAHER/IMSP/05 and Records - List of Legal Requirements – JSSAHER/LR-11

5. Is Energy Policy statement available and adequate? How is it communicated?

➡ Energy Policy established and found communicated Ref.Doc. EnEMS - IMS Manual- (Which Include EnMS Requirements) Para 5.2 IMS Manual - JSSAHER/IMS/M/01 dated 01/07/2023 - Example - procurement of energy-efficient products and services. The policy communicated to all though internal web links

6. Is Energy team formed? (state number in team and comment on composition)

➡ EnEMS - IMS Manual- (Which Include EnMS Requirements) Para 6.2 - Functional head is the team leader and constitutes a team for each of the EnEMP. Functional Heads and IMS Coordinators Form Energy Management team - IMS Manual - JSSAHER/IMS/M/01 dated 01/07/2023. Energy Team consists of 12 persons , headed by **Dr. Shivaraju H P**, Associate Professor (IMS Chief Coordinator – JSSAHER)

7. Is methodology for energy review documented? What is the criteria applied to identify SEUs? No. of SEUs identified.

➡ Energy review and assessment for significant energy use 9 SEU) : Procedure evidenced in IMS Manual - JSSAHER/IMS/M/01 dated 01/07/2023 Para 6.3 to 6.5 –

Energy review documented, Criteria adopted for SEU identification based on past and current energy consumption and current energy types and arrives as Total Power consumption per College expressed as kWh/year & Total Power Consumption per Equipment per day in Watts (Annual in KWH)

Details of SEU identified and considered for Energy Review

JSS Medical College Mysuru,
Air Conditioners / Fans - Exhaust & Ceiling / Lighting - tube/CFL/Street / LED/ Animal House / Incubator

JSS Dental College Mysuru,
UPS / Dental Chairs / X-ray IOPAR / Compressors / Air Conditioners / Fans - Exhaust & Ceiling / Computers & Servers
Lifts

JSS School of Life Sciences Mysuru,
Fridge / AC / Incubator / Lighting / Computers & Servers

JSS College of Pharmacy Mysuru
Lights / Refrigerator/ Computers & Servers / Hot Air Oven

JSS College of Pharmacy Ooty
Water Heater / Drinking Water - /Lighting – LED / Lighting – CFL / Fridge / Freezer / Heating

08 Are static factors and relevant variables identified? Mention a few examples.

➡ Static factors/relevant variables identified & documented IMS Manual - JSSAHER/IMS/M/01 dated 01/07/2023 Para 6.3 to 6.5 – Eg. Ambient Temperature, Consumption rate in Hostel Etc

8. What are the objectives for EnMS identified? Are the action plans available to achieve objectives? Mention examples.

➡ Energy Objectives established in - JSSAHER/IMSOT-002 - IMS Objectives & Targets - 2023-24 - Energy Objectives & Targets

Sl.No.	Objectives	Unit	Targets	Supporting Document	Frequencying
a	Fulfillment of Energy Consumption target	kWh	Less by 10%	Monthly Electricity Consumption report	Monthly
b	Preventive Maintenance	no.	100%	Preventive Maintenance Schedule	Continuous
c	Water Consumption	litres	Less by 10%	Monthly Water Consumption Report	Monthly
d	Earth Pit monitoring	resistance	100%	Earth Pit Monitoring report	Quarterly
e	Diesel	Litres	Less by 5%	Monthly Fuel Consumption report	Monthly
f	Transition to BLDC Motor for Ceiling Fans	No.	100%	Service Reports	Continuous (as and when replaced)

9. Are energy baselines established? What is the data period used?

➡ Base line established based on previous year energy consumption 2022. (2022 - Previous year energy Aduit report from JSS Consultant Mysuru, evidenced)

10. Are operational controls of energy intensive processes related to SEUs. available?
(e.g. Process temperature, time, pressure…)

➡ Operational control procedures for energy consuming equipment available
Specific parameters to be maintained for optimum power consumption is being developed being the First year of system operations

11. Is adequate metering available for measurement of energy consumption of SEUs? E.g Electricity, temperature, time etc. (mention details)

➡ Only one Energy meter at the point of incoming supply available at Mysuru and at OOTY Electricity boards. Sites are having individual meters for performance monitoring

12. Is least one Internal Audit & Management Review completed? (mention details)

➡ Internal audits, frequency, plan, actual, coverage of all processes, Auditor qualification Seen. Once in year
JSSAHER-JSS Medical College, Mysuru. - Internal Audit Schedule Internal Audit Ref: 01 - Period: First Internal Audit of 2023-24 - Auditor(s) - Smitha V - **Audit Date** 17-Oct-23 - No NC Issued Only Observation which was liquidated
MRM Conducted once in a year. Last MRM held on 02 Jan 2024 at University evidenced
The minutes of the meeting verified and found to meet the requirements of the Standard

13. Consideration of EnMS in plant design, extension, renovation, refurbishment, new facilities addressed?

➡ No design activity involved in the University and its Sites.

	One500 kVA, one 380 kVA and one 160 kVA Diesel Generator sets are installed, for giving supply to the entire facility in case of power outage. Minor modifications viz. conversion of ordinary lighting into LED, replacing old ACs with Star rated ones evidenced
14.	Consideration of EnMS in procurement of energy (coal, oil..) and equipment (e.g. Motors, boilers, A/Cs…) addressed?
➡	Orders found placed for LED Lights. Transition LED bulbs – Example 23 Oct 2023 – orders placed for 22 LED Panel Light
15	Information for planning stage 2 audit: Specific information about processes, site related, multi sites if any, distance between them, travel related info. etc.
➡	Stage 2 can be planned. As per AAF it is 6.8 Manday audit. Two auditors can be planned, for JSS Medical, Dental college at Mysuru 2 MD days each and 2 MD for OOTY and 0.8 MD for JSS University the Controlling Unit. In Mysuru no travel distance since all sites in the same campus

SEC B : Audit Findings - Areas of Concern

No. of Areas of Concerns: _____ NIL

AOC (List statements of all AOCs with ISO 50001:2018 clause nos. as applicable)

SEC C : Any Unresolved Issues

NIL

SEC D : Audit Program [To be filled for one cycle, upto Renewal]

Type of Audit	Stage 1		Stage 2 / Renewal/ Recertification		Surveillance # 1		Surveillance # 2		Renewal/ Recertification	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
Date Of Audit	*4-1 and 5-1 2024*	*4-1 and 5-1 2024*	*With in 90 days*							
No. of Mandays	*2*	*2*	*6.8*							

*Site(S) / Department/ Functions / Processes	Stage 1		Stage 2 / Renewal/ Recertification		Surveillance # 1		Surveillance # 2		Renewal/ Recertification	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
All Process with in the sites	✓	✓	✓							
Head Office (University) : JSS Academy of Higher Education & Research (JSSAHER).										
Site 1 - JSS Medical College, Mysuru,	✓	✓	✓							
Site 2 - JSSAHER Admin Block & JSS Dental College & Hospital, Mysuru			✓							
Site 3- JSS School of Life Sciences, Mysuru,										
Site 4 - JSS College of Pharmacy, Mysuru										
Site 5 - JSS College of Pharmacy, Ooty	✓	✓	✓							
Shifts audit (at least once in a cycle, if applicable, Processes to be audited in each shift)										

[*Sub-Division in the Department, Processes, Sub-Processes, Activities involved & audited under One Heading to be specified in the "Site(S) / Department/ Functions"]

NOTE:

01) Basic processes of MR & others as required for verification of applicability of the Scope of Certification shall be audited in each visit.

02) Dominant applicable clauses for respective Department/ Functions / Processes to be verified [Refer SEC B: Summary of Conformity.

03) Information required in this Audit Programme is to be updated during First Assessment of the auditee organization in a given cycle i.e. Stage-1 / Transfer / Renewal Audits / Subsequent Audit if there is any modification of Scope (reduction / extension) / Site(S) / Department/ Functions if not audited as planned.

04) Information provided shall remain for guidance purpose only for the Audit Team of subsequent audits in the cycle & hence, shall not be binding w.r.t. additional functions to be audited and / or clauses to be audited in each function to confirm compliance to the respective audit criteria.

SEC E : Effectiveness of audit objectives achievement: : [Please mark 'Tick - ✓' as applicable for Onsite audit and Remote Audit]			
On-site and Remote Audit	**Effectiveness**		
	Achieved	**Not achieved**	**Remarks on what is not achieved or raised it as AOC**
Demonstration of Leadership commitment	✓		
Determination of External & Internal issues	✓		
Needs and expectation of Interested parties	✓		
Access to Legal & other requirements and their compliance	✓		
Process of Setting of objectives and achievements.	✓		
For Operational control	✓		
Process of Performance monitoring and continual improvement.	✓		
Effective conduct of Internal audit and Management review.	✓		
Process of addressing any changes, Management of change.	✓		

REMOTE AUDIT (USING ICT) -NA

The Below Ticked ICT has been used in carrying out audit/assessment and the effectiveness of ICT in achieving the audit/assessment objectives are as noted below:

Based on the Input received in IV IRQS:REC:52 A the following ICT were used: (Tick ✓ which were used), any other means if used please include the same for comments on its effectiveness for achieving the objectives). Micro Soft Team Meeting ZOOM Go-To Meetings Video conferencing WhatsApp Video call Skype. Use of Drone	**Used to gather objective evidences.**	**Effectiveness**	
		Achieved for	**Not achieved or Not fully achieved: for**
	Virtual site visit – Based on respective scheme requirements.		
	Operational activities (EG; Process parameters, Operational control etc.).		
	Sharing of Documents, Documented information, Records on Screen		
	Interview with personnel		
	Uninterrupted connectivity throughout audit duration.		
	Overall Audio / Video clarity.		
	Sharing of photos		
	Documents through mails in time.		
	Maintain Integrity of the audit / assessment process.		
	Usage of Drone		
	Objectives of Current Type of audit as noted above under Section 9 of this report.		
	Any other additional information from FORM 52 A / observations.		

Based on the above:		
Additional Manday required to cover the processes for which objectives not fully achieved	~~YES~~ *~~(Please mention the audit duration that would be required)~~*	NO
Audit Programme amended.	~~YES~~ *~~(Please amend the audit program accordingly with appropriate justification)~~*	NO

SEC F : The audit objectives of Stage – I have been verified through off-site audit/ on-site audit /remote audit. The audit team conclude and recommend for :			
	1)	Can proceed for Stage-2 Audit	**YES**
	2)	Can Proceed for Stage-2 Audit subject to the acceptance of actions taken for the noted "Areas of Concern(s)"	**NA**

Instructions for Corrective Action Plans Submission:
Responsibility: It is IRQS's client's responsibility to provide complete and timely responses to finding reports.
Client is required to submit action taken report on the Areas of Concern with documentary evidences, which will be verified by IRQS. Stage II audit can be planned only after acceptance of the ATR. The stage II needs to be completed within 90 days of completion of stage I audit, failing which the stage I audit will be required to be repeated.

To dispute an audit finding:
The Dispute and Appeals Process is to be used by clients who wish to dispute a certification decision. It also applies in the case of clients who are not satisfied with the results of the dispute process and wish to appeal the decision.

Disclaimer:
Audit methodology was sample based. Random Samples were chosen from the areas covered in the scope. This is to assess suitability and effectiveness of Management System. Any sampling carries certain amount of uncertainty in auditing. Whenever the ICT facility used for gathering audit evidences the risk associated with poor connectivity of audio / video are taken into the account for uncertainty in auditing. Audit recommendations are subject to an independent review prior to a decision concerning the awarding, renewal of certification or follow-up / re-audit.

Confidentiality:
We assure that the information obtained during the audit will be maintained with utmost confidentiality.
Appeal: Our system has a provision of appeal with regards to audit process, difference of opinion and audit report. The client has every opportunity to appeal, dispute or complain against the decision of the auditors.

Should you wish to Contact IRQS in relation to any queries
Indian Register Quality Systems
Head Office: 2nd Floor, New Building, 52 A, Adi Shankaracharya Marg,
Opp. Powai Lake, Powai, Mumbai - 400 072.
Tel. No.:+912230519800 Fax No.: + 91 22 2570 3611

Team Leader Name	**Capt R E Balasubramanian**	**Signature & Date - 11-1-2024** 
Auditee Representative Name	 Dr Shivaraju HP	**Signature & Date**

01)	**Name of the Client**	JSS Academy of Higher Education and Research
02)	**Address of HO & Site(s)**	JSS Medical Institutions Campus Sri Shivarathreeshwara Nagara Mysuru - 570 015 "Rocklands" Post Box No.20 Udhagamandalam - 643 001 Tamil Nadu State
03)	**File Number**	J/8111/E,En2018
04)	**Name of Organization Representative coordinating with CB**	Dr. Madhusudan N Purohit
05)	**Date of Audit**	10th to 12th January 2024
06)	**Type of Audit** (strike out the standard not under audit)	Stage I / ~~Follow-up Stage I / Repeat Stage 1~~
		~~Joint/ Combined / Integrated / Remote~~ On site

07) Audit Objective (Stage –I)

- Review the client's management system documented information's
- Evaluate the client's site-specific conditions and to undertake discussions with the client's personnel to determine the preparedness for Stage 2
- Review the clients status and understanding regarding requirements of the standard wrt identification of key performance or significant aspects, processes, objectives and operation of the management system
- Obtain necessary information regarding the scope of the management system :- The client's site(s), Processes and equipment used, levels of controls established (Particularly in case of multisite clients)
- Applicable statutory and regulatory requirements
- Review the allocation of resources for Stage 2 and agree the details of Stage 2 with client
- Provide a focus for planning Stage 2 by gaining sufficient understanding of the client's management systems, Site operation in the context of management system standard or other normative documents
- Evaluate if the internal audits and management reviews are being planned and performed and that the level of implementation of the management system substantiates the client is ready for Stage 2.

08)	**Audit Criteria:** **(strike out the standard not under audit)**	~~**QMS (ISO 9001)**~~	~~**QMS-MD (ISO 13485)**~~	~~**QMS-EOMS (ISO 21001)**~~	**EMS (ISO 14001)**	~~**OHS (ISO 45001)**~~
		▪ Applicable legal & other requirement. ▪ Organization's procedures & documented information in line with the respective standards.				

09) Scope of Certification: (If Multi-site audit, then scope as applicable at each site should be verified & reported)

General Scope as required on the final "Certificate of Approval"	JSS campus Mysuru: Providing UG and PG education in Medicine, Dentistry, Pharmacy and Life sciences
Scope of Head Office	-do-
Scope of Site	Ooty campus: Providing UG and PG education in Pharmacy
Scope Support Office(s) / Location(s), if any	-

10) Non-Applicability of Clauses & Justification

NA

11) Audit Team Details
(Team Leader, Team Member, Provisional Auditor, Provisional Team Leader, Evaluator, Industry Expert Any accompanying persons; e.g. Guides, Observers, Translator, Facilitator etc.)

Name	Role
T.K. Srivatsan	TL
Mr. Tomcee Thomas	Auditor

12)	Audit conducted at [Physical location(s), as applicable]	Address	Date of Audit	Functions/ Process(es) /Activities audited at the Location/Site
	Head office	JSS Medical Institutions Campus Sri Shivarathreeshwara Nagara Mysuru - 570 015	10th to 12th January 2024	**As per schedule**
	Permanent site(s)	Ooty campus: Providing UG and PG education in Pharmacy		
	Temporary site(s)	-		

13) Auditor to comment :

1. **Any deviation from audit plan and their reasons :-**
2. **Upon any adverse conditions faced during the audit (e.g.; power outage, Fire, Flood, specifically related to the condition of the sites affecting the auditing activities) :-**

➡ **nil**

14) Verification of the Questionnaire Information:

Particulars	Information provided in Questionnaire	Verification of provided information
Number of sites	**1**	**1**
Number of employees	**As per AAF**	**As per AAF**
Language of audit	**English, Kannada**	**English, Kannada**
Current certification & its validity	**New**	**New**
Working in shifts – Shift pattern	**No**	**No**
Products and Services	**Delivering Education service**	**Delivering Education service**
Design & development	**NA**	**NA**
Scope	Providing UG Courses on Life Sciences, Dental, Pharmacy and Life sciences.	JSS Mysuru campus: Providing UG and PG education in Medicine, Dentistry, Pharmacy and Life sciences Ooty campus: Providing UG and PG education in Pharmacy
Externally provided processes, products and services (Outsourced)	**nil**	**Calibration**

Audit Findings

SEC A : Comments on the effectiveness for the action taken for the areas of concern:(In case of repeat Stage I audit).

Findings		Comments on the effectiveness for the closure
No. of Areas of Concerns raised during the stage 1 audit:	NA	--

SEC B : Comment on the management system(s) effectiveness for the following based on objective evidence

a) Review the client's management system documented information's.
(Attach Review of Documented Information/Review–Doc: IV IRQS:FORM:101 for ISO 9001:2015/ISO 14001:2015/ ISO 45001:2018 and IV IRQS:FORM:57 for ISO 45001)

➡ **Refer documented information - attached**

b) Regarding the scope of the management system:- The client's Boundary of management, Site(s), Processes – Sequence & interactions, support functions to sites & scope of support function equipment used, levels of controls established, (Single and particularly in case of multisite clients)

➡ **JSS Academy of Higher Education & Research (JSSAHER), formerly known as JSS University, is a Deemed to be University located in Mysuru, Karnataka. It was established in 2008 under Section 3 of the UGC Act 1956 and is part of JSS Mahavidyapeetha, which runs a variety of educational institutions. This deemed-to-be university is recognized by the Ministry of Education and accredited by NAAC with A+ Grade (3.48 CGPA). JSS AHER has been graded as Category-I Deemed-to-be University by UGC.**

Scope:

SCOPE FOR JSS ACADEMY OF HIGHER EDUCATION AND RESEARCH, MYSORE CAMPUS
PROVIDING UNDERGRADUATE AND POSTGRADUATE EDUCATION IN MEDICINE, DENTISTRY, PHARMACY AND LIFE SCIENCES

SCOPE FOR JSS ACADEMY OF HIGHER EDUCATION AND RESEARCH, OOTY CAMPUS
PROVIDING UNDERGRADUATE AND POSTGRADUATE EDUCATION IN PHARMACY
Doc Ref: JSSAHER/IMS/M/01

Process

Top Management/MR, Course Delivery, Maintenance/Utilities, HR/Admin/Security, Purchase, Stores, Customer services, Laboratory, Library, Waste Handling

Samples

Maintenance /Utilities-Pharmacy campus-Mysuru

Silent D.G Set with 160KVA Auto Powerica CPCB (central Pollution Control Board) Compliant – Environment Friendly
Model Family # CP/160D5B/F42
AMC report evidenced for Nov 23
Monitoring consumption of diesel consumption register
Nov: 42Ltrs
Aspect & Impact: JSSAHER/AI-RO/TCH-01, Issue# 1 & Issue Date: 01.07.23
Consumption of fuel. Generation of Noise, Generation of fumes etc.
OCP: OCP-09,06,01,04,05

Dental and Environmental Science campus-Mysuru
D.G set 2Nos

1. 380KVA

2. 500KVA Cummins make - Silent genset

AMC from: M/s Muniranjan Diesel Sales & sevices
Contract period: 28.11.2023 to 27.11.2024
AMC on monthly basis – Reports for both Generators verified.
Date of service 14.12.2023
Daily DG set monitoring checklist verified & information available up to date: 11.01.24
Storage of diesels in 200Ltr Barrels & pumped through motor – No spillage noticed.
Control room well maintained
Aspect & Impact common for the both campus

Library-Mysuru campus

Total No of books available on environment: 258
Evidences for environmental related books available at library

1. Environmental science a new approach
2. Sewage disposal & air pollution engineering by Santhosh Kumar Garg
3. Ecology principles & Applications by J L Chapman & M J Reiss

PO sample of JSS College of Pharmacy, Mysuru
PO no: JSSCPM/C9/2066/2023-24
Date: 19-12-23
Description- Order for supply of chemical
VASA Scientific Co.,
MSDS available.
Verified for Nicotinamide Adenine Dinucleotide . Adequate.

PO sample of JSS Dental College, Mysuru
PO No: DCH/DVP/745/2023-24
Date: 20-11-23
Hydrogen peroxide 450 ML -10 Nos
Radha Medicals

Supplier list available for Dental College.
102 suppliers available.
Radha Medicals verified.

PO sample for medical college.
PO no: JSS/NC/Stores/Library/6374/2023-24
13.12.23
Maruthi Enterprises
Xerox machine to library

Supplier list available-72 nos

PO sample for life sciences
PO no: JSSAHER/Reg/SLS/Mys/2023-24/867
26th Dec 23
Sri Ram Distributors
List of Chemicals

PO sample of Ooty campus
PO Number-3300/2023-24
Date 07.11.23
Jayam scientific company
Rhodamine 6 G
Qty-5 gms

PO number: 3299/2023-24
30.11.23
Precision Scientific Co.,
Hamilton Syringe
1 no

Waste Handling-Mysuru campus

Bio medical waste handling guide lines display with photographs

Bin colours with same colour bags against waste for disposal

1. Yellow : Incinerable waste
2. Blue : Glass ware & metal
3. White : Disinfectant waste
4. Red : Plastic waste

Waste generated at dental treatments centres will be moved by helpers

Interviewed Mr. Ramesh who is moving the waste to the common waste bins located
Explained in detail about waste handling
Training provided at the site about waste handling

M/s Sree consultants - Central waste disposal contractor

Labwaste - Ooty campus

Nature of waste generated in the lab: Tissues, Syringes, filter paper, Broken glass, Animal & Blood waste etc.
Separate bins provided to handle the waste against color codes

Blue: Syringes, Broken glass waste
Yellow: Animal waste, Blood waste

Green: Filter paper, Tissue Paper & Nonhazardous waste

Disposal through Separate bio degradable covers with identification against Ooty standard – as per the guidance to meet the no plastic zone.

c) The clients status and understanding regarding requirements of the standard wrt identification of key performance or significant aspects, processes, objectives and operation of the management system: (e.g. Context of organization, Interested parties, Risks and opportunities, Setting of objectives, Procedures for Aspect – Impact / Hazard Identification Risk assessment , Life cycle assessment, Management program, KPI's, etc.,)

Interested parties Needs and Expectation

S. No.	Interested Parties	Their Needs	Their Expectations
Internal Interested Parties:			
1	Management	Complete the Environmentally Responsible Work, Proper Communication	Follow the Centre Rules & Instructions, Environmental compliance, Employee Ownership, On time Work Completion, Proper handover
2	Oversees counterparts	Healthy relationship/Clear in communication	Quick response to queries
3	Inter Departments	Complete the Responsible Work, Proper Communication	Ontime Work Completion
4	Employees	Salary, Job Assurance, Good working environmental	On time salary, Career Growth, Safety and Security
External Interested Parties:			
5	Statutory and Regulatory Body	Fulfil the statutory and regulatory compliance	Ontime Fulfil the Compliance
6	Certification Body	Fulfil the standard requirement & Support the Audits	On time Audit completion & Post Audit Activities
7	Neighbors / Local Communities	Feel free Environments	Emergency Support
8	External Providers	Proper Inputs / Spec. given about requirements	Regular Orders & On time payment
9	Customers	Delivered the Actual & Clear Reports, Fulfil their Requirements of services & Proper Communication	On time amendments, Emergency Response, Prior Communication, redressal of complaints Compliance with any specific requirement
10	Bank	On time Interest Pay	Fluent Financial Flow
11	Reference Doctors	Delivered the Actual & Clear Reports, Fulfil their Requirements & Proper Communication	On time Auditing& Reporting, Emergency Response

Context

s.no	Issues	Internal/External	+/-ve	Risk to Business
1	Communication disturbance – Network configuration	External	-ve	Communication misunderstood and Business continuity issue
2	Power consumption	Internal	-ve	Depletion of resources/Cost to

				organization
3	**Employee/Students Health and safety**	**Internal**	**-ve**	**Illness impacting productivity**
4	**Outsource and provider control**	**External**	**-+ve**	**Provider relationship and delivery delay, Environmental requirement/ inconsistent**
5	**Statutory and Regulatory compliance**	**Internal/External**	**-Ve**	**Closure of institution**
6	**Competent manpower**	**Internal**	**-ve**	**Planning and EMS objectives affected**
7	**Generation of Waste**	**Internal**	**-ve**	**Environmental complaints, Cost escalation**
8	**Operational control**	**Internal**	**+ve**	**No environmental complaints.**

Objectives

Sl.No.	Objectives	Unit	Targets	Supporting Document	Frequency of Monitoring	Last monitored date
A	**Energy Objectives & Targets**					
a	Fulfillment of Energy Consumption target	kWh	Less by 10%	Monthly Electricity Consumption report	Monthly	Nov'23
b	Preventive Maintenance	no.	100%	Preventive Maintenance Schedule	Continuous	Dec'23
c	Water Consumption	litres	Less by 10%	Monthly Water Consumption Report	Monthly	Nov'23
d	Earth Pit monitoring	resistance	100%	Earth Pit Monitoring report	Quarterly	last quarter
e	Diesel	Litres	Less by 5%	Monthly Fuel Consumption report	Monthly	Nov'23
f	Transition to BLDC Motor for Ceiling Fans	No.	100%	Service Reports	Continuous (as and when replaced)	as and when
g						
B	**Environmental Objectives & Targets**					
a	Solar System Installation	Nos. of sites	2	Installation Records	3 years	2023
b	Implementation of Rainwater Harvesting	Litres	100%	Water collected statistics through Water Bills	Monthly	Continuous
c	TransitionLED bulbs	No.	100%	Service Reports	Continuous (as and when replaced)	Dec'23
C	**Others**					
a	Environmental Compliance Fulfillment	%	100%	Legal Register	Continuous	Continuous
b	Incidents of reportable accidents	No.	Zero	Monthly NC Report	Monthly	Dec'23

Procedures for Aspect – Impact/Life cycle assessment, Management programs:
Aspect-Impact Documents available for processes. Procedure is adequately explained in the manual
Life cycle assessment is adequately explained in OCPs and Manual
Doc Ref: JSSAHER/IMS/M/01

	Management programs on Green belt development, Rain water collection, Energy saving initiatives -Adequate
d)	**Applicable statutory and regulatory requirements. (QMS – Product related, EMS – Environmental Legal & other requirements, OHS - OH&S Legal and other requirements)**
➡	Karnataka State Pollution Board Consent JSS Dental College No: 325/KSPCB/RO-1/HCE/2017-18/1342 Dated 18.08.2017 One time consent Type of waste- Human anatomical waste, Animal Anatomical Waste, Soiled Waste, Expired or Discarded Medicines, Chemical Waste, Chemical Liquid Waste-1.18 Kg/Day Disposal – Shree consultants for 5 years; 31.12.24 Life science-white category- No pollution certificate required. JSS College of Pharmacy Consent Authorization no: 25, KSPCB/RO-I/HCE/2019-20/602 Dated 02.07.19 One time consent. Type of waste- Human anatomical waste, Animal Anatomical Waste, Soiled Waste, Expired or Discarded Medicines, Chemical Waste, Chemical Liquid Waste-0.26 Kg/Day Disposal- GIPS Biotech validity till 31.12.24 JSS College of Pharmacy TNPCB consent authorization Water Consent Order No: 2108139843883 Proceedings No; F.0709NLG/OM/DEE/TNPCB/NLG/W/2021 dated 26-07-2021 Air Consent Order No: 2108239843883 Proceedings No; F.0709NLG/OM/DEE/TNPCB/NLG/A/2021 dated 26-07-2021 Consent validity-31st Mar 2031 Fire NOC L.Dis. No: 586/B1/2023 License No: 99/2023 Dated 14.02.23 Validity till-13.02.24 Fire training given as per the conditions to operate fire extinguishers. 29th Sep 23 Radiology-Legal Registration for operation of Medical Diagnostic X ray Equipment Case file: KA/20230/RF/XR/009 Issue date: 18.10.23 Expiry date: 18.10.2033 Radiology Doses -Dose report of Radiology workers. Jul-Sep 23 24 Radiology workers tracked. Within the limits Karnataka State Electricity Board ACEI/MYS/TEC 326 EIN/2016-17/9774-76 31.03.17

	250 Kva transformer in pharmacy campus ACEI/MYS/TEC 39 EIN/2017-`8/1590-916 160 KV Generator in Pharmacy campus Solar 100 KW linked to grid on 20.07.2019 EE (E)/AEE (E) (o)/AE (T)/SRTPV/2019-20/3366-70 Adequate
e)	**The internal audits and management reviews are being planned and performed and that the level of implementation of the management system substantiates the client is ready for Stage 2. (At least one round of IA & MR)**
➡	**Internal audit** Internal Audit was done on 20.10.23 Audit plan verified. JSS/DCM/IMS/AAP-01 Audit was done by Ms. Smitha, Third party Smitha competency certificate verified. Lead auditor, ISO 14001-2015 by TUV SUD (TUVSA/AC/2018/EHS26/OH/0005/0007) Audit program verified. *Audit report verified.* NC's recorded- 8 NCs for Dental, 9 NCs For JSS College of Pharmacy, 9 NCs for Medical, 9 NCs for Pharmacy, Ooty, 9 NCs for life science NC closure reports verified. Meet the requirements. Conclusion on the effectiveness of IA-Adequate **MRM** MRM was conducted on 2nd Jan 24 MOM available. Attended by 17 members EMS external and internal issues, Changes in needs and expectations of the interested parties, Significant environmental aspects reported, Changes in Risks and Opportunities, Objectives, Internal Audit programs verified. *conclusion on the effectiveness of conducted Management review, Improvement, Output* -Adequate
f)	**Based on the evaluation of the client's site-specific conditions, maturity / level of integration (in case of integrated management system) and discussion with client personnel to determine the preparedness for Stage 2.**
➡	**Client is prepared for stage 2, Stage 2 shall be progressed.**
g)	**Provide a focus for planning Stage 2 based on sufficient understanding of the client's management systems, Site operation in the context of management system standard or other normative documents. (Prepare a rough audit plan for Stage – 2).**
➡	**Mysuru and Ooty sites. Process of course delivery and interaction with Environment and validation/revalidation shall be considered against EMS, needs to be sampled further. Audit plan informed to client for 3 days covering all processes with 4 auditors.**
h)	**The allocation of resources for Stage 2 and agree the details of Stage 2 with client. (as applicable e.g. Logistic arrangement – Travel time (To and between the location, sites, various departments / functions), Requirement of Industry expert – Needed not needed, Identify the process owner for the department / functions being audited, to avoid repeated visit to the same process /person, Mondays, Competence of the Audit Team required to conduct stage 2, etc.)**
➡	11.5 mds with 4 auditors for 3 days to cover the site and scope, shall be planned
i)	**Comments on the process of Organization's Management of Change**
➡	As of now the change is on infrastructure and alignment to process – being done on direct control of Registrar and Dean.

SEC C : Current Areas of Concern.			
a)	**AOC No.**	**Clause No.**	**Statement(s)**
			--
b)	**No. of AOCs raised**		**nil**

SEC D : Any Unresolved Issues

➡ **nil**

SEC E: Audit Program [To be filled for one cycle, upto Renewal]

Any Significant issues impacting audit program to be recorded

Type of Audit	Stage 1		Stage 2 / Renewal		Surveillance # 1		Surveillance # 2		Renewal	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
Date Of Audit	Jan 24	10-12 Jan 24	Feb 24		Jan 25		Dec 25		Nov 26	
No. of Mandays	6	6	11.5		6		6		11.5	

*Site(s) [covering Temporary /Permanent] / Department/ Functions / Processes (Please mark [✓]Tick Mark)	Stage 1		Stage 2 / Renewal		Surveillance # 1		Surveillance # 2		Renewal	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
TM/MR&MA	✓	✓	✓		✓		✓		✓	
Customer services	✓	✓	✓		✓		✓		✓	
Purchase	✓	✓	✓		✓		✓		✓	
Stores	✓	✓	✓		✓		✓		✓	
Course Delivery	✓	✓	✓		✓		✓		✓	
Maintenance	✓	✓	✓		✓		✓		✓	
HR/Training	✓	✓	✓		✓		✓		✓	
Legal	✓	✓	✓		✓		✓		✓	
Safety and Emergency preparedness	✓	✓	✓		✓		✓		✓	
Processes to be audited in each shift as applicable during Stage 2	***Only General shift***									

[*Sub-Division in the Department, Processes, Sub-Processes, Activities involved & audited under One Heading to be specified in the "Site(s) [covering Temporary /Permanent]/ Department/ Functions"]

Note:

a) Stage 1 Audit Programme to be addressed the Number of Shifts & audit is planned for at least one of the shifts inside and one outside of regular office hours

b) Stage 2 / Renewal / Surveillance Audit : as per the Stage 1 Audit Programme, audit is conducted for at least one of the shifts inside and one outside of regular office hours

c) In case of Migration to ISO 45001:2018 : Audit outside of regular office hours, all shifts audits to be conducted during all audits during the cycle. In case of migration during surveillance, then during all subsequent for cycle to be covered. If migration done during:-

1) Surveillance #1 – Then Surveillance #2, Renewal and Surveillance #1 after renewal.
2) Surveillance # 2 – Then during Renewal , Surveillance #1 and Surveillance #2.

SEC F : Effectiveness of audit objectives achievement: :
[Please mark 'Tick - ✓' as applicable for Onsite audit and Remote Audit]

On-site and Remote Audit	Effectiveness		
	Achieved	Not achieved	Remarks on what is not achieved or raised it as AOC
Demonstration of Leadership commitment	✓		
Determination of External & Internal issues	✓		
Needs and expectation of Interested parties	✓		
Access to Legal & other requirements and their compliance	✓		
Process of Setting of objectives and achievements.	✓		
For Operational control	✓		
Process of Performance monitoring and continual improvement.	✓		
Effective conduct of Internal audit and Management review.	✓		
Process of addressing any changes, Management of change.	✓		

~~REMOTE AUDIT (USING ICT~~) Not Applicable

~~The Below Ticked ICT has been used in carrying out audit/assessment and the effectiveness of ICT in achieving the audit/assessment objectives are as noted below:~~

Based on the Input received in IV IRQS:REC:52 A the following ICT were used: (Tick ✓ which were used), any other means if used please include the same for comments on its effectiveness for achieving the objectives).	~~Used to gather objective evidences.~~	~~Effectiveness~~	
		~~Achieved for~~	~~Not achieved or Not fully achieved: for~~
Micro Soft Team Meeting ZOOM Go-To Meetings Video conferencing WhatsApp Video call Skype. Use of Drone	~~Virtual site visit – Based on respective scheme requirements.~~		
	~~Operational activities (EG; Process parameters, Operational control etc.).~~		
	~~Sharing of Documents, Documented information, Records on Screen~~		
	~~Interview with personnel~~		
	~~Uninterrupted connectivity throughout audit duration.~~		
	~~Overall Audio / Video clarity.~~		
	~~Sharing of photos~~		
	~~Documents through mails in time.~~		
	~~Maintain Integrity of the audit / assessment process.~~		
	~~Usage of Drone~~		
	~~Objectives of Current Type of audit as noted above under Section 9 of this report.~~		
	~~Any other additional information from FORM 52 A / observations.~~		

~~Based on the above:~~

~~Additional Manday required to cover the processes for which objectives not fully achieved~~	~~YES~~ ~~(Please mention the audit duration that would be required)~~	~~NO~~
~~Audit Programme amended.~~	~~YES~~ ~~(Please amend the audit program accordingly with appropriate justification)~~	~~NO~~

SEC G : Maturity Of The Management System			
(i)	Level of Integration in case of Integrated Management System:		
	a)	Integrated Documentation (Manual, policy and objectives, procedures, work instruction etc.)	☒ Yes ☐ No
	b)	An Integrated approach to Roles & Responsibilities	☒ Yes ☐ No
	c)	Conduct of Integrated / approach to Internal Audit	☒ Yes ☐ No
	d)	Conduct of Integrated Management Reviews considering the overall business strategy and plan	☒ Yes ☐ No
	e)	An Integrated approach to systems processes	☒ Yes ☐ No
	f)	An Integrated approach to continual Improvement mechanisms	☒ Yes ☐ No
	g)	Organization's personnel to respond to questions more than one management system standards.	☒ Yes ☐ No
ii)	Comment on the maturity of the management system i.e. about the management system is fully established in the organization and the level of support that it has from senior and top management.		**Environment related focus is good and commitment of Leadership also proves the maturity of EMS**

SEC H :		
Based on the above, it is confirmed that the effectiveness of the management system has the capability to meet applicable requirements and expected outcomes for the scope of certification scope. The audit objectives of Stage – I have been verified through off-site audit/ on-site audit /remote audit. The audit team conclude and recommend for :		
01)	Can proceed for Stage-2 Audit	**Yes**
02)	Can Proceed for Stage-2 Audit subject to the acceptance of actions taken for the noted "Areas of Concern(s)"	--
Based on the above, it is confirmed that the effectiveness of the management system does not have the capability to meet applicable requirements and expected outcomes for the scope of certification scope. The audit objectives of Stage – I have been verified through off-site audit/ on-site audit /remote audit. The audit team conclude and recommend for :		
Stage – 1 Audit to be repeated		-

To dispute an audit finding:
The Dispute and Appeals Process is to be used by clients who wish to dispute a certification decision. It also applies in the case of clients who are not satisfied with the results of the dispute process and wish to appeal the decision.

Disclaimer:
Audit methodology was sample based. Random Samples were chosen from the areas covered in the scope. This is to assess suitability and effectiveness of Management System. Any sampling carries certain amount of uncertainty in auditing. Whenever the ICT facility used for gathering audit evidences the risk associated with poor connectivity of audio / video are taken into the account for uncertainty in auditing. Audit recommendations are subject to an independent review prior to a decision concerning the awarding, renewal of certification or follow-up / re-audit.

Confidentiality:
We assure that the information obtained during the audit will be maintained with utmost confidentiality.
Appeal: Our system has a provision of appeal with regards to audit process, difference of opinion and audit report. The client has every opportunity to appeal, dispute or complain against the decision of the auditors.

Should you wish to Contact IRQS in relation to any queries
Indian Register Quality Systems
Head Office: 2nd Floor, New Building, 52 A, Adi Shankaracharya Marg,
Opp. Powai Lake, Powai, Mumbai - 400 072.
Tel. No.:+91 22 30519800/ 71199800 Fax No.: + 91 22 2570 3611

Team Leader Name	**T.K.Srivatsan**	 **Signature & Date : sd/-, dt. 12.01.24**
Auditee Representative Name	**Mr. Shiva Raju H P.**	**Signature & Date : sd/-, dt. 12.01.24**

ENERGY AUDIT REPORT

JSS ACADEMY OF HIGHER EDUCATION AND RESEARCH

MYSURU, KARNATAKA

SAVE ENERGY SAVE OUR PLANET

ENERGY AUDIT CONDUCTED BY

JSS CONSULTANTS, MYSURU

ACKNOWLEDGEMENT

Our sincere thanks to the following dignitaries, for having given us an opportunity to conduct the Energy Audit in JSS AHER, Mysuru.

1. Dr. B. Suresh, Pro Chancellor
2. Dr. Surinder Singh, Vice Chancellor
3. Dr. B. Manjunatha, Registrar
4. Dr. M N Purohit, Dean IQAC
5. Mrs. Kokila M.S, Deputy Registrar
6. Principals and Heads of all Constituent colleges and Departments

We tried our best to present this energy report as per the requirements of the JSS AHER.

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DISCLAIMER

The primary objective of this Energy Audit is to identify and evaluate opportunities for energy conservation through visits to your facility. Data was gathered during Five-days site visit and energy conservation opportunities were identified. When an energy conservation opportunity involving engineering design and capital investment is attractive to the institution and engineering services are not available in-house, it is recommended that a consulting engineering firm be engaged to do the detailed engineering design and cost estimations for implementing the energy conservation opportunity.

In addition, since the site visits by our team are brief, they are necessarily limited in scope and a consulting firm could be more thorough. The contents of this report are offered only as guidance. JSS Consultants, Mysuru and all technical sources referenced in this report do not-

(a) Make any warranty or representation, expresses or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe on privately owned rights.

(b) Assume any liabilities with respect to the use of, or for damages resulting from the use of, any information, apparatus, method, or process disclosed in this report. This report does not reflect official views or policies of the previously mentioned institutions. The assumptions and equations used to arrive at the energy consumption and cost savings for the energy conservation opportunities are given in the report. These assumptions are intended to be conservative. If the client does not agree with the assumptions made, the assumptions may be adjusted and, using the same equation, new values for the energy and cost savings for each energy conservation opportunity may be determined.

Dr Dayakar G. Devaru, Ph.D., CEM
Principal Assessor
Professor,
Dept. of Industrial & Production Engineering
SJCE, JSSSTU, Mysuru -570006

Dr Mohan N, Ph.D.
Co – Assessor
Assistant Professor,
Dept. of Electrical & Electronics Engineering
SJCE, JSSSTU, Mysuru -570006

WORK COMPLETION REPORT

This is to certify that ***JSS Consultants*, Mysuru** has successfully conducted **Energy Audit** at **JSS AHER, Mysuru, Karnataka** from 31 **July 2023 to 16 September 2023**.The work of energy audit was completed on **16 September 2023**.

Thanking you and assuring you our best service always.

Audit Report BY:

Dr Mohan N, **Co – Assessor** **Electrical Engineer** **JSS Consultants,** **Mysuru -570006**	**Dr Dayakar G. Devaru,** **Certified Energy Manager** **Principal Assessor** **JSS Consultants,** **Mysuru -570006**

Date: 16/9/23
Place: Mysuru

Chief Executive Officer

Chief Executive
JSS CONSULTANTS
JSS Technical Institutions Campus
MYSURU-570 006

Principal Assessor

CERTIFIED ENERGY MANAGER
CEM®
20475
EXP. 12/31/2025
Dr. Dayakar G. Devaru

ENERGY AUDIT TEAM

Name	Designation
Mr. Rajendra Prasad H N	Chief Executive, JSS Consultants, Mysuru - 570006
Dr Dayakar G. Devaru	Certified Energy Manager & Principal Assessor, JSS Consultants, Mysuru - 570006
Dr Mohan N	Electrical Engineer & Co – Assessor JSS Consultants, Mysuru - 570006
Mrs. Vidya	Electrical Engineer, JSS Consultants, Mysuru -570006
Mr. Mallikarjun Swamy	Solar Electrical Engineer, JSS Consultants
Mr. Madhusudhana N	Electrical Technician JSS Consultants, Mysuru - 570006
Mr. Pradeepa K P	Electrical Technician JSS Consultants, Mysuru - 570006

EXECUTIVE SUMMARY

The objective of the audit was to study the energy consumption pattern of the facility, identify the areas where potential for energy/cost saving exists and prepare proposals for energy/cost saving along with investment and payback periods. The salient observations and recommendations are given below.

1. **JSS Medical College, Dental College and School of Life Sciences uses energy in the following forms**
   - **A. From Chamundeshwari Electricity supply corporation Limited, Mysuru.**
   - **B. From 484 kW Solar Photo voltaic Power Plant**
   - **C. From 500 kVA and 380 kVA Diesel Generators**
2. **JSS College for Pharmacy, Mysuru uses energy in the following forms**
   - **A. From Chamundeshwari Electricity supply corporation Limited, Mysuru.**
   - **B. From 132 kW Solar Photo voltaic Power Plant**
   - **C. From 160 kVA Diesel Generator**
3. **JSS DHSMS, Ramanuja Road uses energy in the following forms**
   - **A. From Chamundeshwari Electricity supply corporation Limited, Mysuru.**
4. **JSS College for Pharmacy, Ooty uses energy in the following forms**
   - **A. From Tamil Nadu Generation and Distribution Corporation Ltd., Nilgiris**
   - **B. From 250 kVA Diesel Generator**

   Electrical energy is used for various applications, like: Medical Equipment, AC Units, Cold Rooms, Laboratory Equipment, Computers, Lighting, Fans, Printers, Xerox machines, UPS, LCD Projector, Router system, Compressors, Pumps, motors, etc.
5. After the measurement and analysis, we propose herewith following Energy Conservation Opportunities as shown in Table 2.

The total energy used is **29,07,246 kWh/yr** (Table 1). Total energy costs for this period was **₹ 2,52,38,658/-**. The Energy Conservation Opportunities (ECOs) contained in this Report could save **5,76,777 kWh/yr.** which is equivalent to reduction in CO_2 emissions of **5,47,938 Kgs** or equal to planting **26,092 Trees**. The total energy cost savings would amount to approximately **₹ 49,20,505/-** or approximately **19.5%** of the annual energy costs for this facility. The total estimated implementation cost is **₹ 1,91,37,910/-** which gives an average simple payback of around **47 months.**

Table 1: Annual Energy Consumption of different Campuses of JSS AHER

Name of the Campus	kWh	Rupees
JSS Medical, Demtal and LifeSciences Colleges CESC	1,050,825	10,259,784
JSS Medical, Demtal and LifeSciences Colleges Solar	695,419	4,311,599
JSS College of Pharmacy, Mysuru CESC	308,430	3,144,940
JSS College of Pharmacy, Mysuru Solar	191,088	1,184,746
JSS College of Pharmacy, Ooty TG&DC	557,084	5,479,949
JSS DHSMS, Ramanuja Road	1,04,400	857,640
Total	**29,07,246**	**2,52,38,658**

Table 2: Energy Conservation Opportunities

Sl. No.	Energy Conservation Opportunity	Annual Energy Savings (kWh)	CO_2 Savings (Kgs)	Annual Energy Cost Savings	Implementation Cost	Payback in Months
1	Replace Fluorescent Tube Lights with LED Tube Lights	93,421	88,750	7,94,080	5,51,760	9
2	Replace the existing induction motor fans with new BLDC motor fans in JSS AHER Campus	165,615	1,57,335	14,18,714	75,94,400	64
3	Retrofit existing inefficient and old Fan Regulators with Electronic Regulators in Dental college campus to Save Energy	6,750	6,413	57,375	56,250	12
4	Replace the existing old Air Conditioners with 5 Star Air Conditioners with inverter technology.	1,83,090	1,73,936	15,56,265	77,75,000	60
5	Install Occupancy/Motion Sensors in Designated Areas	17,006	16,156	144,551	100,500	8
6	Use solar water heater in conjunction with heat pumps to reduce water heating energy consumption for the hostel	1,03,512	98,336	8,79,852	28,50,000	39
7	Install Variable Speed Drives on the Refrigerant Compressors of Air conditioner used for Animal House	2,775	2,636	23,588	30,000	16
8	Paint the roof with white Reflective Roof-Top Coating to reduce heat load in JSS Ramanuja Road Campus Building	4,608	4,378	46,080	1,80,000	47
Total		**5,76,777**	**5,47,938**	**₹ 49,20,505**	**₹ 1,91,37,910**	**47 Months**

It should be noted that a "law of diminishing returns" applies to the total cost savings. That is, the figure of **₹49,20,505** is based on the sum of the cost savings for each ECO as if they were independent, but they are not.

Proposal: It is recommended to install Solar Rooftop Photovoltaic power plant in JSS College of Pharmacy, Ooty Campus to generate electivity and save money on electric bills and also reduce carbon footprint. Table 3 shows the details of this proposal.

Table 3: Proposal for Solar Rooftop Photovoltaic Power Plant

Sl. No.	Energy Generation Opportunity	Energy Generation (kWh)	CO_2 Savings (Kgs)	Annual Cost Savings	Implementation Cost	Payback in Months
1	Install Solar PV Rooftop in JSS College of Pharmacy, Ooty Campus	1,92,000 kWh	3,936 Tones Co_2	16,32,000	45,93,408	34 months

Prioritizing Energy Conservation Opportunities: Energy Conservation opportunities can be prioritized based on the payback period and the ECOs with less than 12 months payback can be considered for implementation with high priority. So, the ECOs shown in Table 4 can be considered for immediate implementation.

Table 4: Energy Conservation opportunities with payback of less than 12 months

Sl. No.	Energy Conservation Opportunity	Annual Energy Savings (kWh)	CO_2 Savings (Kgs)	Annual Energy Cost Savings	Implementation Cost	Payback in Months
1	Replace Fluorescent Tube Lights with LED Tube Lights	93,421	88,750	7,94,080	5,51,760	9
2	Retrofit existing inefficient and old Fan Regulators with Electronic Regulators in Dental college campus to Save Energy	6,750	6,413	57,375	56,250	12
3	Install Occupancy/Motion Sensors in Designated Areas	17,006	16,156	144,551	100,500	8

6. Best Practices found in the institution.

a. LED Tube lights in campus
   JSS AHER is replacing the fluorescent lighting with LED lighting and more than 70% of the lights have been already replaced.
b. BLDC Fans in Pharmacy College Hostel
   JSS College for Pharmacy, Mysuru has started replacing its induction motor fans in the hostel with Brushless DC Motor fans and the other campuses are planning to follow them.
c. Capacitor banks for Power factor correction
   All the campuses have capacitor banks installed for power factor correction and are maintaining good power factor.
d. Air Conditioners with inverter technology
   JSS AHER has started replacing its non-inverter air-conditioners with inverter air-conditioners in all the campuses. For any new extension, it is procuring only inverter air conditioners.
e. Motion sensors and timers on lights
   JSS College for Pharmacy, Mysuru has installed motion sensors on lights in the hostel corridors and the other campuses are planning to follow them. Timers are installed on Street lights in the same Campus.
f. LED Street Lights
   Street lights on all the JSSAHER campuses are replaced to LED street lights.
g. Solar Power Plant connected to the grid - wheeling to the grid

In the Medical and Pharmacy college campuses in Mysuru, Solar Power Plant of 85% capacity of the contract demand are installed and are generating electricity and exporting the excess energy generated to the grid.

h. Conventional fans with Electronic Regulators that save energy

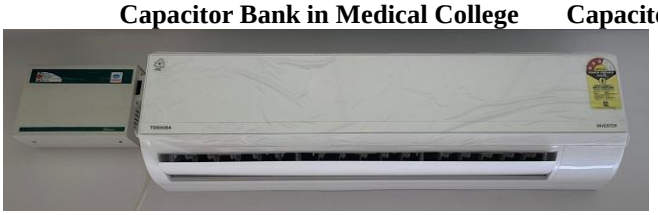
BLDC Fan

Motion Sensor

Electronic Fan Regulator

Capacitor Bank in Medical College

Capacitor Bank Panel in Pharmacy College, Mysuru



Air Conditioner with Inverter Technology

LED Lighting

Solar Panels installed at the campus Left: Dental College, Right: Pharmacy College, Mysuru

Fig 1: Photos of the Best Practices found in the JSSAHER Campus

Positive Observations

a. Electrical Cables laid in the Underground
b. Continuous replacement of conventional lights with LED lights
c. All open conduits are being concealed
d. In Medical and Pharmacy campus, 40% of campus electrical energy consumption is generated from Solar Power Plant.
e. Charging points for Electric Vehicles

CHAPTER 1
INTRODUCTION
JSS MEDICAL COLLEGE

Introduction:

JSS Medical College, a constituent college of JSS Academy of Higher Education and Research, holds an esteemed position in the realm of medical education, research, and healthcare excellence. Accredited with an exemplary A+ Grade by the National Assessment and Accreditation Council (NAAC), this institution stands as a beacon of academic distinction.

Located in the tranquil and verdant environs of Sri Shivarathreeshwara Nagara, Mysuru, Karnataka, India, JSS Medical College has been a cornerstone of medical education since its establishment in the year 1984. Nestled within an expansive 43-acre campus, the college provides an ideal setting for fostering the growth and development of future healthcare professionals.

During its formative years, JSS Medical College was affiliated with the University of Mysore from 1984 to 1995 and subsequently with the Rajiv Gandhi University of Health Sciences, Bangalore, until 2008. Since May 28, 2008, it has proudly served as a constituent college of JSS Academy of Higher Education and Research, established under Section-3 of the UGC Act. This affiliation to a prestigious academic institution further enhances the college's commitment to excellence in medical education, research, and healthcare services.

JSS Medical College's standing in the medical community is underscored by its recognition by the National Medical Council (NMC). The college is dedicated to imparting high-quality medical education that not only uplifts the health sector but also caters to the healthcare needs of all segments of society. This commitment to inclusivity and excellence is at the heart of JSS Medical College's mission and vision.

As part of our energy audit report, we will delve into the energy consumption patterns and sustainability initiatives at JSS Medical College. We will analyze the institution's dedication to optimizing energy utilization while upholding its exceptional standards of medical education, pioneering research, and healthcare delivery. Our report aims to provide a comprehensive assessment of the college's energy management strategies, current energy consumption, and recommendations for energy efficiency improvements. By aligning with JSS Medical College's overarching goals of excellence and inclusivity, our findings will contribute to the institution's ongoing mission to enhance healthcare and medical education in India.

JSS DENTAL COLLEGE

Introduction:

J.S.S. Dental College & Hospital, Mysore, has firmly dedicated itself to becoming a beacon of excellence in Dental Education and a global leader in the field of Dental Sciences, including hospital practice, with the noble objective of strengthening healthcare across the nation. Nestled in the enchanting city of Mysore, Karnataka State, this institution epitomizes both academic distinction and a commitment to superior healthcare. Mysore, renowned for its palaces and gardens, is conveniently located approximately 150 kilometers from Bangalore, ensuring easy accessibility via well-connected roads and railways.

Founded in 1986-87, the Dental College offers a comprehensive range of educational programs, including BDS and MDS courses in nine specialized divisions, along with Post Graduate Diploma courses in five distinct specialties. It has earned recognition from both the Dental Council of India and the Government of India, solidifying its position as a respected institution in the field. Affiliated to the JSS Academy of Higher Education & Research (JSSAHER), Mysuru since 2008-09, it was previously affiliated to the Rajiv Gandhi University of Health Sciences, Karnataka, from 1996-97, and the University of Mysore from 1986-87.

Nestled within the lush expanse of the JSS Medical Institutions Campus, spanning over 38 acres, JSS Dental College & Hospital occupies five acres exclusively for its operations. The institution is steadfast in providing separate hostel facilities for both male and female students, ensuring a comfortable and conducive learning environment.

Notably, JSS Dental College & Hospital extends its mission beyond education, actively contributing to the healthcare needs of the community. The institution is dedicated to delivering top-notch treatment to all patients in need, while also reaching out to rural populations by providing essential dental education and healthcare services.

As part of our energy audit report, we will delve into the energy consumption patterns and sustainability initiatives at JSS Dental College & Hospital. Our aim is to analyze the institution's dedication to optimizing energy utilization while maintaining its exceptional standards of dental education, healthcare, and community outreach. This report will provide a comprehensive assessment of the college's energy management strategies, current energy consumption, and recommendations for energy efficiency improvements. Our findings will align with JSS Dental College & Hospital's commitment to excellence in dental education,

research, and healthcare delivery, furthering its mission of strengthening healthcare across the nation.

JSS COLLEGE OF PHARMACY, MYSORE

Introduction:

JSS College of Pharmacy, a pivotal component of the prestigious JSS University, Mysore, stands as an emblem of excellence in pharmaceutical education, research, and healthcare practice. The institution's roots can be traced back to the visionary leadership of Jagadguru Sri Dr. Shivarathri Rajendra Mahaswamjigalavaru, the 23rd pontiff of Sri Suttur Veerasimhasana Math, who played a pivotal role as the architect and founder president of JSS Mahavidyapeetha in 1954. Under the divine inspiration of Sri Swamiji, the JSS College of Pharmacy commenced its journey in 1973 in the vibrant city of Mysuru.

Located within a sprawling campus of [square meter measurement], JSS College of Pharmacy stands as a dynamic hub of pharmaceutical education and innovation. Its infrastructure is thoughtfully designed to cater to the evolving needs of students, faculty, and researchers. It features modern classrooms, well-equipped laboratories, an extensive pharmacy library, and state-of-the-art research facilities.

The institution offers a comprehensive range of pharmacy education and training opportunities, including Diploma in Pharmacy (D.Pharm), B.Pharm (Practice), Bachelor of Pharmacy (B.Pharm), Doctor of Pharmacy (Pharm.D.), Master of Pharmacy (M.Pharm), and Doctoral (PhD) programs, along with Residency Programs in Oncology & Nephrology. Supplementary postgraduate diploma and certificate courses enhance the educational experience.

JSS College of Pharmacy's commitment to excellence is underscored by its recognition by the Ministry of Human Resource Development, Government of India, in 2008. Jagadguru Sri Shivarathreeshwara University (JSSU), Mysore, Karnataka, was declared a deemed university, solidifying its reputation as a center of academic distinction.

The institution proudly hosts a Drug Testing Laboratory, approved by the Government of Karnataka and accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL). This laboratory reflects the institution's dedication to pharmaceutical research and quality assurance.

JSS College of Pharmacy has earned national acclaim through accreditation by the National Board of Accreditation (NBA), India, and international recognition with the certification of its Pharm.D. Program by the Accreditation Council for Pharmacy Education (ACPE), USA. It is

also consistently ranked among the top 10 pharmacy colleges in India, according to the National Institutional Ranking Framework (NIRF) by the Ministry of Human Resource Development, Government of India.

The institution boasts an active Training and Placement Cell, facilitating annual campus drives with the participation of a diverse pool of pharmaceutical companies and research organizations. This initiative ensures that students are well-prepared for opportunities in the pharmaceutical industry.

In our forthcoming energy audit report, we will delve into the energy consumption patterns and sustainability initiatives at JSS College of Pharmacy. Our aim is to analyze the institution's commitment to optimizing energy utilization while maintaining its exceptional standards of pharmaceutical education, cutting-edge research, and healthcare practices. This report will provide a comprehensive assessment of the college's energy management strategies, current energy consumption, and recommendations for energy efficiency improvements. Our findings will align with JSS College of Pharmacy's dedication to excellence in pharmaceutical education, research, and healthcare delivery, furthering its mission of advancing healthcare and pharmaceutical sciences nationally and internationally.

SCHOOL OF LIFE SCIENCES (SLS), JSS ACADEMY OF HIGHER EDUCATION & RESEARCH

Introduction:

The School of Life Sciences (SLS) at JSS Academy of Higher Education & Research, Mysuru, was founded in the year 2013, under the auspicious blessings of His Holiness Sri Shivarathri Deshikendra Mahaswamiji, the esteemed Chancellor of the institution. Today, the School stands as a distinguished and unparalleled institution in India, renowned for its multidisciplinary and interdisciplinary approach to teaching and research in the field of life sciences.

SLS finds its place within the comprehensive Strategic Planning Framework of JSS Academy of Higher Education & Research, guided by a clear vision and mission of achieving both national and international recognition while upholding local relevance. The School offers a diverse array of courses spanning biological, biomedical, and environmental sciences, with a particular emphasis on interdisciplinary research. Graduates of SLS are poised for a multitude of career opportunities, ranging from biotechnology and agriculture to pharmaceutical

industries, research and development organizations, and teaching institutions across India and overseas.

At the heart of SLS's ethos lies a profound appreciation for the equivalence of teaching and research as essential components of continual professional and scientific development. Pioneering efforts have been made to fuse principles from physical, chemical, and computer sciences with life sciences, aligning with the norms set forth in the National Education Policy (NEP) of 2020. The ongoing objective is to attain excellence in both research and education, constantly striving to interweave research and life science skill sets into the curriculum at every conceivable juncture. The academic programs maintain a rigorous curriculum that prioritizes the development of students' problem-solving abilities, critical and lateral thinking, and communication skills—preparing them not only for employment but also for personal growth and development.

SLS extends a warm welcome to students from every corner of the world, who are eager to embark on a journey of knowledge acquisition and practical application in the realm of life sciences. The famous words of Victor Hugo, "An invasion of armies can be resisted, but not an idea whose time has come," resonate deeply with the spirit of SLS—a place where groundbreaking ideas and innovations in life sciences find their fertile ground.

The strategic plan of the institute is encapsulated in the acronym "JEEVAM," which stands for Jubilate Life Science Education and Research by Empowering Value-based Accomplishments through Mentorship. This plan reflects the commitment of SLS to celebrate and advance the fields of life sciences through education, research, and mentorship.

In our forthcoming energy audit report, we will explore the energy consumption patterns and sustainability initiatives within the School of Life Sciences. Our goal is to assess the institution's dedication to optimizing energy utilization while maintaining its exceptional standards in multidisciplinary life sciences education and groundbreaking research. This report will provide a comprehensive assessment of the School's energy management strategies, current energy consumption, and recommendations for energy efficiency improvements. Our findings will align with SLS's commitment to excellence in life sciences and its broader mission of advancing knowledge and fostering sustainability in the field.

JSS COLLEGE OF PHARMACY, OOTY

Introduction:

Established in 1980 with its pioneering D.Pharm. program, JSS College of Pharmacy, Ooty, has emerged as a cornerstone of pharmaceutical education and research. This institution is a constituent college of the prestigious Jagadguru Sri Shivarathreeswara University (JSS University), Mysuru, since 2008, and it has firmly established itself as a premier postgraduate and research institution. JSS College of Pharmacy, Ooty, offers a comprehensive range of programs, including D.Pharm., B.Pharm., M.Pharm. (with 10 specializations), Pharm.D., and PhD. The institution also provides "Add-On" PG Diploma and Certificate courses, enriching students' knowledge in interdisciplinary subjects.

Renowned for its commitment to academic excellence, JSS College of Pharmacy, Ooty, has earned accolades from prestigious accrediting bodies. The institution and the JSS Academy of Higher Education & Research (JSS AHER) hold the distinguished `A+` Grade accreditation from the National Assessment and Accreditation Council (NAAC). The B.Pharm. Program at the college is accredited by the National Board of Accreditation (NBA), New Delhi, and its Pharm.D. Program is internationally certified by the Accreditation Council for Pharmacy Education (ACPE), USA—the first in the Asia Pacific Region to achieve this honour. The Drug Testing Laboratory at the institution is accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL). Additionally, both the college and CADRAT (Centre for Advanced Drug Research, Analysis, and Training) hold ISO 9001:2015 certifications for their quality management systems.

JSS College of Pharmacy, Ooty, has also made its mark in national rankings, securing the 8th position in India according to the National Institutional Ranking Framework (NIRF) for the year 2019.

With a core belief in 'Team Play,' the institution emphasizes collaboration over competition, resulting in a multitude of national and international Memorandums of Understanding (MoUs). These agreements foster teaching, learning, research, and knowledge exchange through faculty and student interactions, consultancy services, training programs, and more.

JSS College of Pharmacy, Ooty, boasts a distinguished legacy of advancing pharmaceutical education, practice, and research. It stands as a beacon for pharmacy professionals, shaping their capabilities to align with international standards and meet the ever-evolving requirements of the pharmaceutical industry.

In our forthcoming energy audit report, we will delve into the energy consumption patterns and sustainability initiatives at JSS College of Pharmacy, Ooty, analyzing the institution's commitment to optimizing energy utilization while maintaining its exceptional standards of pharmaceutical education, research, and healthcare practices. This report will provide a comprehensive assessment of the college's energy management strategies, current energy consumption, and recommendations for energy efficiency improvements. Our findings will align with JSS College of Pharmacy, Ooty's mission of advancing pharmaceutical education and research while contributing to its sustainability goals.

DEPARTMENT OF HEALTH SYSTEM MANAGEMENT STUDIES, JSS ACADEMY OF HIGHER EDUCATION & RESEARCH

Introduction:

The Department of Health System Management Studies at JSS Academy of Higher Education & Research (JSS AHER) has been at the forefront of healthcare management education and research since its establishment in 2012. Under the benevolent guidance of His Holiness Shri Shivarathri Deshikendra Mahaswamiji, the revered Chancellor of JSS AHER, this department has evolved into a hub of excellence dedicated to nurturing future healthcare administrators.

Within its modern infrastructure, the department offers a diverse array of academic programs, including MBA in Hospital Administration, MBA in Pharmacy Administration, and BBA in Hospital & Health System Management. These programs are designed to equip students with the skills and knowledge required to excel in the dynamic healthcare industry.

Our well-equipped classrooms, enriched with modern audiovisual aids, facilitate an interactive and immersive learning experience. Our unique teaching approach, with a blend of classroom interaction and integrated practical work, enables students to grasp the nuances of Hospital Management effectively. Practical work involves data collection, analysis, and interpretation, contributing to continuous improvement in healthcare systems.

Our libraries, both central and departmental, are equipped with Wi-Fi connectivity and house a vast collection of Management and Hospital Administration books, complemented by subscriptions to national and international journals. The computer lab, also featuring Wi-Fi, provides access to over 50 computer systems, fostering research and practical learning.

The practical aspect of our programs is further enhanced through hospital training, where students gain real-world exposure to healthcare management at JSS Hospital and other healthcare institutions.

As part of our commitment to academic enrichment, we actively organize conferences, workshops, and seminars, encouraging students to participate in events hosted by other institutions. Collaborations with national and international organizations and institutes further enhance our academic and research endeavors, as well as faculty and student exchange programs.

In addition to academic pursuits, we offer a range of value-added programs, including hospital and industrial visits, soft skill courses, international tours, outbound programs, yoga and meditation sessions, stress management programs, and values and ethics education.

Our students also benefit from exclusive hostels with modern amenities, sports facilities, leisure spaces, and a multi-cuisine food court, creating a conducive learning environment.

The Department of Health System Management Studies at JSS AHER is committed to excellence in healthcare management education and research. In alignment with our commitment to sustainability, this Energy Audit Report will delve into our energy consumption patterns and initiatives. We aim to optimize energy utilization while maintaining our exceptional standards in healthcare management education, research, and practice. This report will provide a comprehensive assessment of our energy management strategies, current energy consumption, and recommendations for energy efficiency improvements. Our findings will align with our dedication to excellence and sustainability, contributing to our broader mission of advancing healthcare management on a global scale.

CHAPTER 2

INTRODUCTION TO ENERGY AUDIT

2.1 General

The JSS AHER, Mysuru entrusted the work of conducting a Detailed Audit to the JSS Consultants at Mysuru with the main objectives as below:

- To study the present pattern of energy consumption.
- To identify potential areas for energy optimization.
- To recommend energy conservation proposals with cost-benefit analysis.

2.2 Scope of work, Methodology and Approach

The scope of work and methodology were as per the proposal. While undertaking data collection, field trials, and their analysis, due care was always taken to avoid abnormal situations to generate a normal/representative pattern of energy consumption at the facility.

2.2.1 Approach to Energy Audit

We focused our attention on energy management and optimization of energy efficiency of the systems, subsystems, and equipment. The key to such performance evaluation lies in the sound knowledge of the performance of equipment and system as a whole.

2.2.2 Energy Audit

The objective of Energy Audit is to balance the total energy inputs with their use and to identify the energy conservation opportunities in the stream. Energy Audit also gives focused attention to energy cost and cost involved in achieving higher performance with technical and financial analysis. The best alternative is selected on a financial analysis basis.

2.2.3 Energy Audit Methodology

Energy Audit Study is divided into the following four steps.

2.2.4 Historical Data Analysis

The historical data analysis involves the establishment of energy consumption patterns.
to establish baseline data on energy consumption and its variation with change in production volumes.

2.2.5 Actual measurement and data analysis

This step involves actual site measurement and field trials using various portable measurement instruments. It also involves input to output analysis to establish actual operating equipment efficiency and find out losses in the system.

2.2.6 Identification and evaluation of Energy Conservation Opportunities

This step involves the evaluation of energy conservation opportunities identified during the energy audit. It gives the potential of energy-saving and investment required to implement the proposed modifications with a payback period. All recommendations for reducing losses in the system are backed with its cost-benefit analysis.

2.3 List of Instruments used for Energy Auditing

2.3.1 FLUKE 434-II POWER ANALYZER

Fig 2: FLUKE 434-II POWER ANALYZER

2.3.2 Clamp Meter

Fig 3: Clamp Meter

CHAPTER 3

STUDY OF ENERGY CONSUMPTION PROFILE

Sources of Energy:

JSS Medical College, Dental College and School of Life Sciences, Mysuru uses Energy in the following forms:

3.1. Electricity from CESC

Electricity from Chamundeshwari Electricity Supply Corporation Limited, Mysuru. Medical College campus has two 500 kVA Transformers and Pharmacy college has one 250 kVA transformer.

Fig 4: Transformers installed for incoming supply in Medical College and Pharmacy College

Fig 5: Transformers installed for incoming supply at JSS College of Pharmacy, Ooty

3.2. Electricity from Grid connected Solar Power Plant (484 kW & 132 kW)

Fig 6: Shows Solar Panels installed at Left: Dental College, Right: Pharmacy College, Mysuru

3.3. Diesel Generator

Diesel is used as a fuel for Diesel Generator which is run whenever power supply from Chamundeshwari Electricity Supply Corporation Limited, Mysuru is not available.

Fig 7: Diesel Generators (500 kVA & 380kVA) installed at the Medical College Campus

Fig 8: 160kVA Diesel Generator installed at the College of Pharmacy, Mysuru Campus

Fig 9: 250 kVA Diesel Generator installed at the Pharmacy, Ooty Campus

CHAPTER 4
STUDY OF ELECTRICAL SYSTEMS

4.1 Electrical Supply Details

The electrical supply to JSS AHER come from CESC, Mysuru at 11 kV.

Fig 10: Incoming Supply Bus-Bar installed in the campus, JSSCPM, JSSMC, JSSCPO

4.1.1 Tariff and electricity charges at Medical College Campus

The electric supply at JSS AHER is charged under HT-2C2of the Chamundeshwari Electricity Supply Corp Ltd (CESCOM) the tariff structure of HT-2C2 general is given in Table 5.

HT-2C2 Shall be given for Educational Institutions.

Table 5: Tariff structure- HT-2C2* (CESC Electricity Tariff 2021 Annexure V)

Fixed Charges	Rs.240 per kVA of billing demand/month.	
Energy Charges	For the first one lakh units	815 paisa per unit
	For the Balance units	855 paisa per unit
	Current Flat Rate* (Sept 2023)	850 paisa per unit

* Average kWh Charge used for calculation

4.2 Electrical Energy Cost Analysis of JSS Medical, Dental and Life Sciences Campus

4.2.1 CESC Consumption

The monthly energy consumption in kWh from CESC*, Mysuru for the past 12 months is shown in Table 6.

Table 6: Energy consumption in kWh from CESC in JSSAHER main campus

SL.	Month	Contract Demand in kVA	Metered Demand in kVA	Consumption from CESC (kWh)	Total Bill Paid to CESC* in Rs.
1	Jan 2022	450	226	77,675	6,75,788
2	Feb 2022	450	250	69,675	6,17,601
3	Mar 2022	450	277	97,850	9,06,315
4	Apr 2022	450	324	1,00,125	8,78,794
5	May 2022	450	317	99,325	9,38,762
6	June 2022	450	293	95,000	9,33,284
7	July 2022	450	296	91,550	9,30,024
8	Aug 2022	450	235	86,425	8,18,499
9	Sep 2022	450	288	84,750	9,03,907
10	Oct 2022	450	263	76,400	8,24,850
11	Nov 2022	450	277	84,400	9,00,594
12	Dec 2022	450	274	87,650	9,31,366
TOTAL				**10,50,825**	**1,02,59,784**

*Indicates the data extracted from the CESC Monthly Consumption bill.

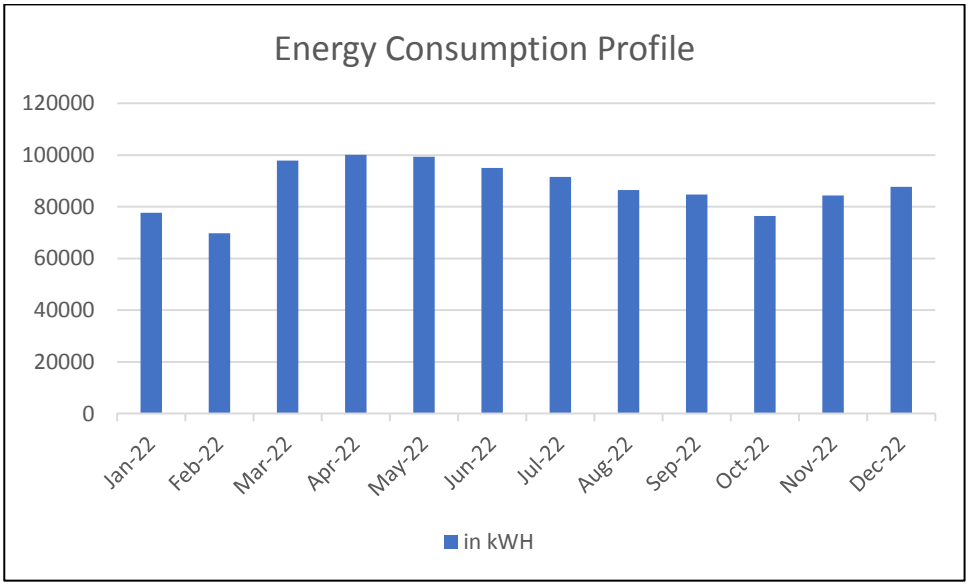


Fig 11: Energy Consumption profile from CESC in JSSAHER main campus

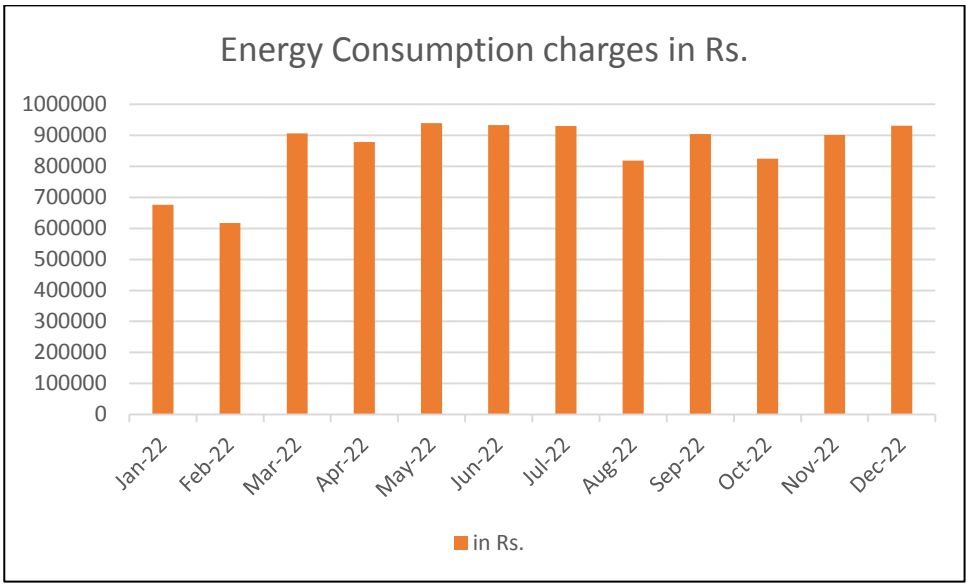


Fig 12: Energy Consumption charges from CESC in JSSAHER main campus

4.2.2 Roof Top 484kWp Solar Power Plant.

The monthly Bill paid to CLEANMAX IPP 1 PRIVATE LTD for installed **484kWp Roof Top solar Power Plant** at JSS AHER is shown in Table 7.

Table 7: Energy generation in kWh from Roof Top 484 kWp Solar Power Plant

SL.NO	MONTH	Generated unit	Rate per unit	Total amount (Rs) paid to seller
1.	Jan 2022	63,498	6.2	393,688
2.	Feb 2022	64,668	6.2	4,00,942
3.	Mar 2022	70,094	6.2	4,34,583
4.	Apr 2022	58,009	6.2	3,59,656
5.	May 2022	53,900	6.2	3,34,180
6.	June 2022	59,705	6.2	3,70,171
7.	July 2022	48,273	6.2	2,99,293
8.	Aug 2022	60,759	6.2	3,76,706
9.	Sep 2022	49,892	6.2	3,09,330
10.	Oct 2022	59,435	6.2	3,68,497
11.	Nov 2022	51,697	6.2	3,20,521
12.	Dec 2022	55,489	6.2	3,44,032
TOTAL		**6,95,419**		**43,11,599**

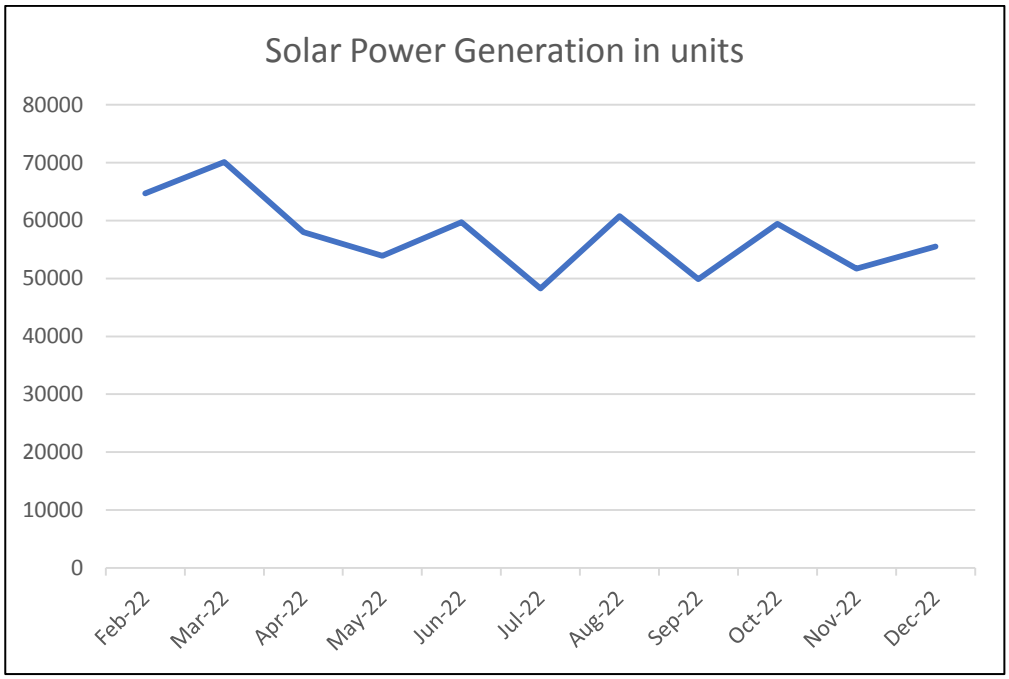


Fig 13: Energy generation profile from Solar in JSSAHER main campus

4.3 Electrical Energy Cost Analysis at Pharmacy College, Mysuru Campus

4.3.1 CESC Consumption

The monthly energy consumption in kWh from CESC*, Mysuru for the past 12 months is shown in Table 8.

Table 8: Energy consumption in kWh from CESC in Pharmacy College, Mysuru

SL.	Month	Contract Demand in kVA	Metered Demand in kVA	Consumption from CESC (kWh)	Total Bill Paid to CESC* in Rs.
1	July 2022	150	89	24,968	2,46,716
2	Aug 2022	150	93	24,750	2,39,505
3	Sep 2022	150	136	28,942	2,91,544
4	Oct 2022	150	125	24,555	2,31,469
5	Nov 2022	150	133	29,775	3,03,616
6	Dec 2022	150	95	24,795	2,48,867
7	Jan 2023	150	95	20,648	1,87,586
8	Feb 2023	150	121	23,258	2,28,843
9	Mar 2023	150	132	28,875	2,88,206
10	Apr 2023	150	155	29,205	2,74,879
11	May 2023	150	116	25,598	3,50,768
12	June 2023	150	133	23,063	2,52,941
TOTAL				**3,08,430**	**31,44,940**

*Indicates the data extracted from the CESC Monthly Consumption bill.

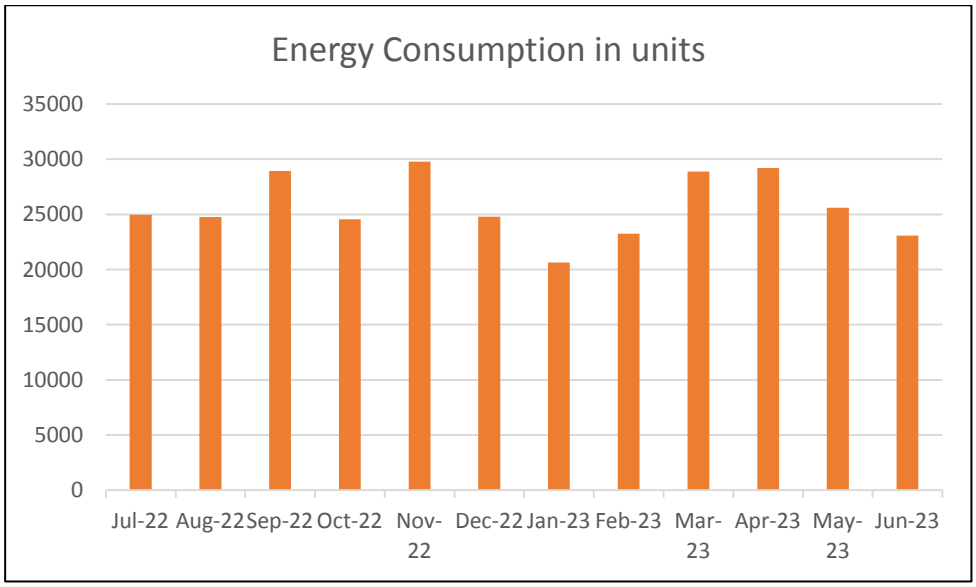


Fig 14: Energy Consumption profile from CESC in Pharmacy College, Mysuru

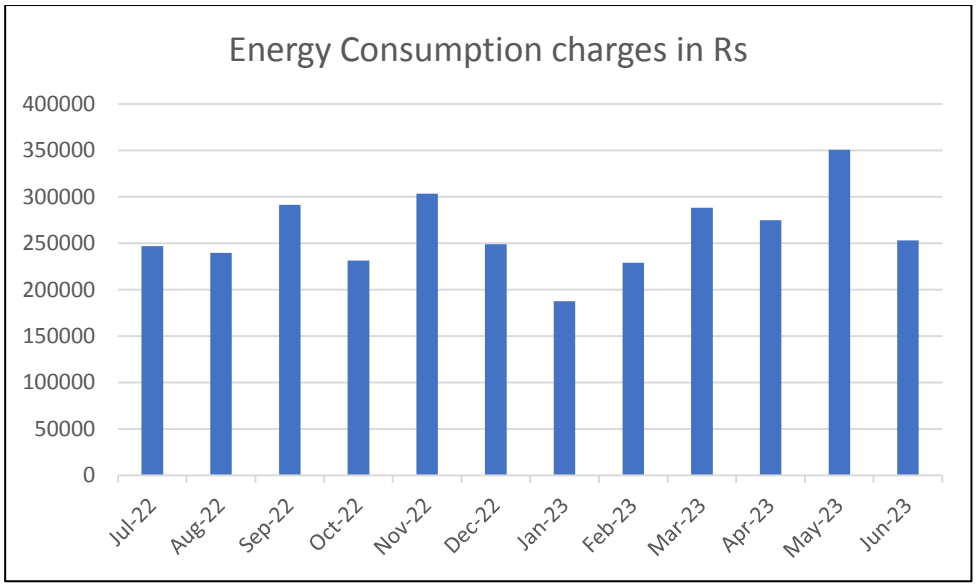


Fig 15: Energy Consumption charges from CESC in Pharmacy College, Mysuru

4.3.2 Roof Top 132 kWp Solar Power Plant.

The monthly Bill paid to CLEANMAX IPP 1 PRIVATE LTD for installed **132kWp Roof Top solar Power Plant** at JSS PCM is shown in Table 9.

Table 9: Energy generation in kWh from Roof Top 132 kWp Solar Power Plant

SL.NO	MONTH	Generated unit	Rate per unit (Rs)	Total amount (Rs) paid to seller
1.	Apr 2022	17,351	6.2	1,07,576
2.	May 2022	14,713	6.2	91,221
3.	June 2022	15,710	6.2	97,402
4.	July 2022	12,502	6.2	77,512
5.	Aug 2022	15,936	6.2	98,803
6.	Sep 2022	13,300	6.2	82,460
7.	Oct 2022	16,065	6.2	99,603
8.	Nov 2022	13,593	6.2	84,277
9.	Dec 2022	14,553	6.2	90,229
10.	Jan 2023	19,381	6.2	1,20,162
11.	Feb 2023	18,356	6.2	1,13,807
12.	Mar 2023	19,628	6.2	1,21,694
TOTAL		**1,91,088**		**11,84,746**

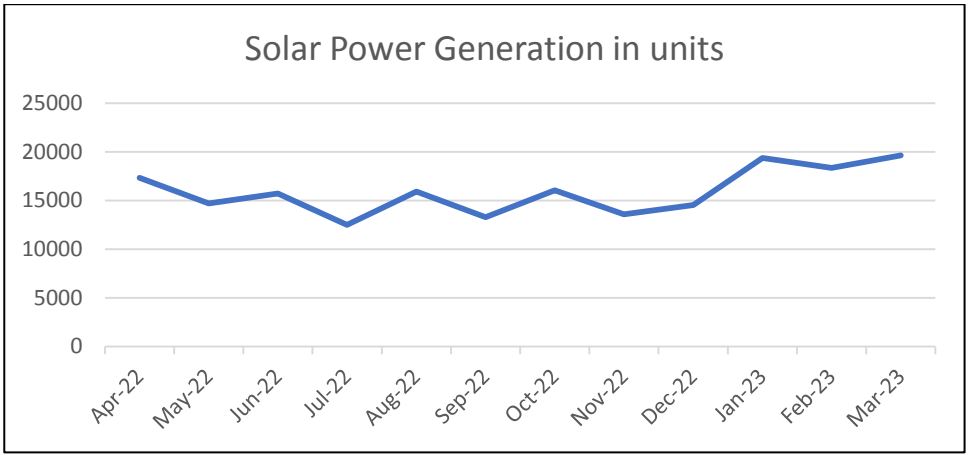


Fig 16: Energy generation profile from Solar in Pharmacy College, Mysuru

4.4 Electrical Supply Details of JSS College of Pharmacy (JSS CPO), Ooty

The electrical supply to JSS College of Pharmacy (JSS CPO), Ooty, Nilgiris supply at 11kV.

4.4.1 Tariff and electricity charges

The electric supply at JSS College of Pharmacy, Ooty has the tariff structure as given in Table 10.

Table 10: Tariff structure- TG&DC, Ooty

Industrial Consumption*	Rs.7.5 /unit
Peak Hour consumption	Rs. 1.27/unit
Night Hour consumption (rebate)	Rs. 0.3175/unit
Demand Charges	Rs. 350 per kVA
Average kWh Charge used for calculation	Rs. 8.5 /unit

*indicates Present Tariff structure

4.5 Energy Cost Analysis of JSS College of Pharmacy (JSS CPO), Ooty

4.5.1 TG&DC Consumption

The monthly energy consumption in kWh from **TG&DC**, Ooty for the past 12 months is shown in Table 11.

Table 11: Energy consumption in kWh from TG&DC in Pharmacy College, Ooty

SL.	Month	Contract Demand in kVA	Metered Demand in kVA	Consumption from TG&DC (kWh)	Total Bill Paid to TG&DC * in Rs.
1	July 2022	150	135	46,740	3,63,597
2	Aug 2022	150	135	46,220	3,60,883
3	Sep 2022	150	135	48,204	4,56,360
4	Oct 2022	150	135	44,297	4,61,369
5	Nov 2022	150	135	50,666	5,16,227
6	Dec 2022	150	135	49,458	5,05,091
7	Jan 2023	150	135	49,570	5,05,423
8	Feb 2023	150	135	46,646	4,82,023
9	Mar 2023	150	135	50,578	5,15,840
10	Apr 2023	150	135	45,472	4,70,851
11	May 2023	150	135	42,809	4,49,536
12	June 2023	150	135	36,424	3,92,749
TOTAL				**5,57,084**	**54,79,949**

* data extracted from electricity bills

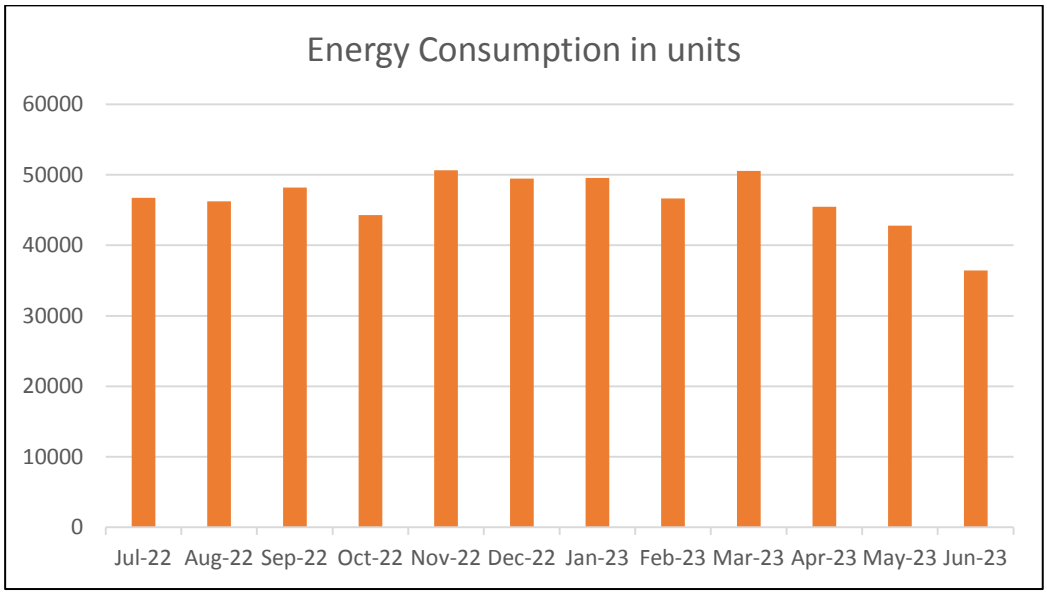


Fig 17: Energy Consumption profile from TG&DC in Pharmacy College, Ooty

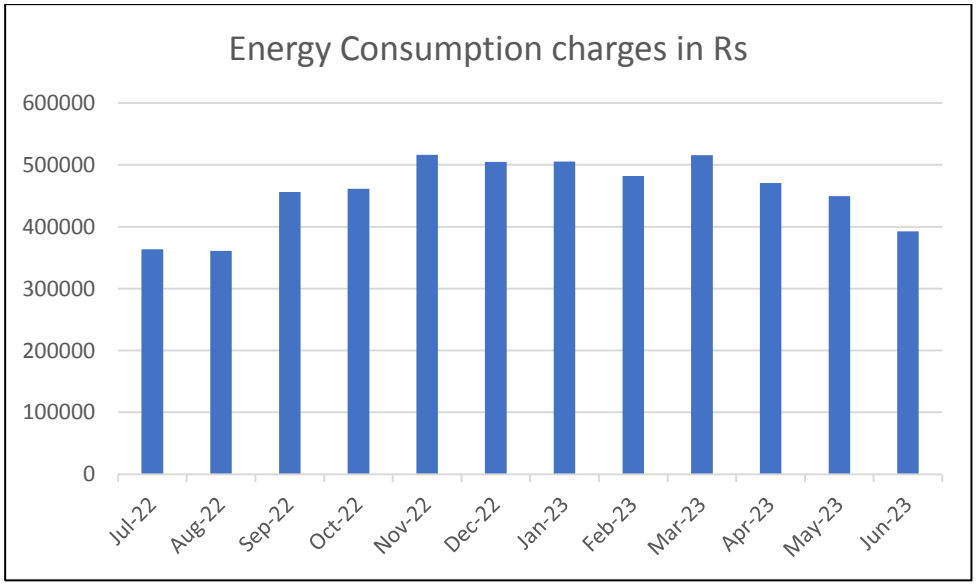


Fig 18: Energy Consumption charges from TG&DC in Pharmacy College, Ooty

4.5.2 Electrical Energy Cost Analysis at DHSMS, Ramanuja Road, Mysuru Campus

4.5.3 CESC Consumption

The monthly energy consumption in kWh from CESC*, Mysuru for the past 12 months is shown in Table 12.

Table 12: Energy consumption in kWh from CESC in DHSMS, Mysuru

SL.	Month	Consumption from CESC (k195Wh)	Total Bill Paid in Rs.
1	July 2022	7,330	58,640
2	Aug 2022	7,260	58,080
3	Sep 2022	7,330	58,640
4	Oct 2022	7,620	60,960
5	Nov 2022	7,300	58,400
6	Dec 2022	6,870	54,960
7	Jan 2023	7,400	59,200
8	Feb 2023	7,810	62,480
9	Mar 2023	12,060	96,480
10	Apr 2023	13,560	1,08,480
11	May 2023	8,640	69,120
12	June 2023	11,220	1,12,200*
Total		**1,04,400**	**8,57,640**

* Rs. 10/kWh used for calculation for this facility as per June month bill

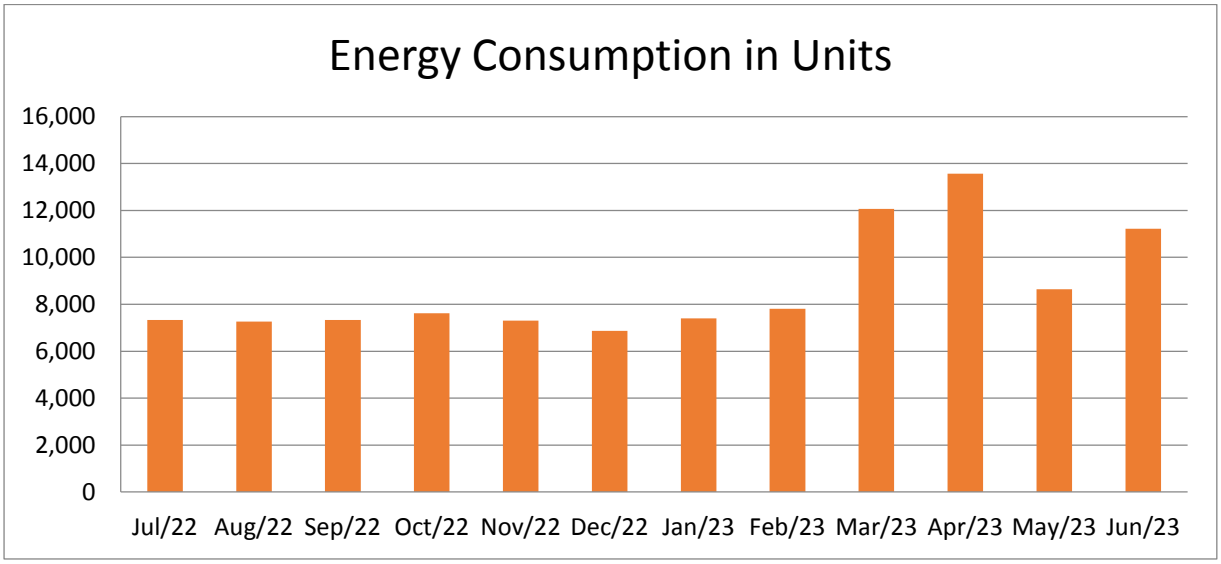


Fig 19: Energy Consumption profile from CESC in DHSMS, Mysuru

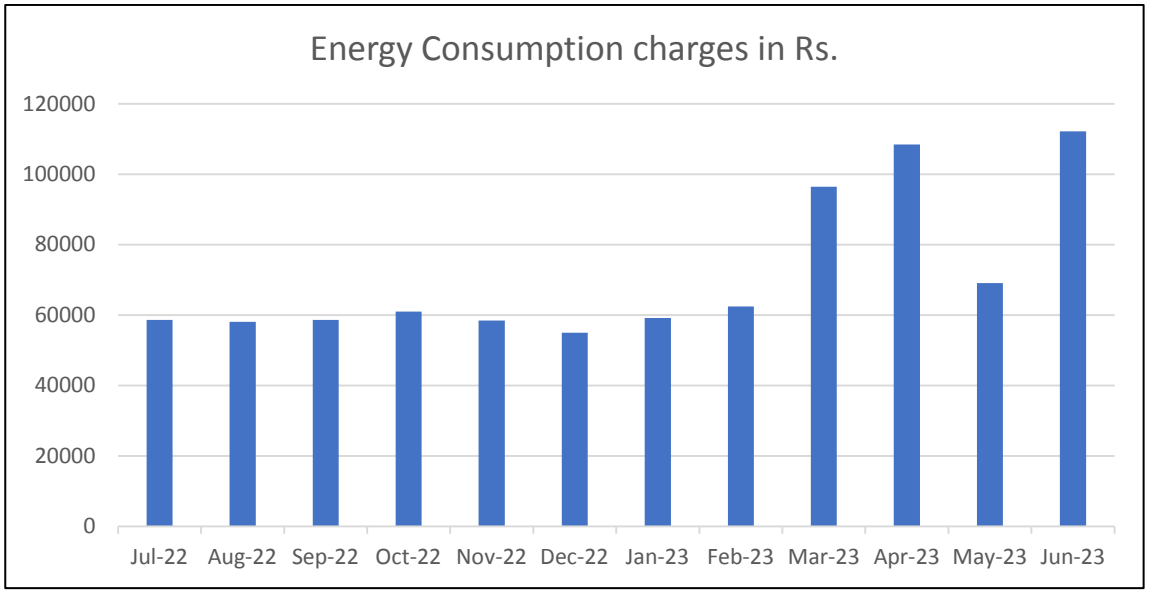


Fig 20: Energy Consumption charges from CESC in DHSMS, Mysuru

CHAPTER 5

CONNECTED LOAD AND ITS ANALYSIS

5.1 Load Pattern of AHER Campuses

*This is total load consumption considered approximately. Actual load consumption might be different according to actual use of power for particular time period. 1hp = 735.5W

Table 13: CONNECTED LOAD DETAILS at Medical College Campus

Sl No.	Name of the appliance	Power Rating (Watts)	Quantity	Power Consumption (Watts)	Usage per day (Hr)	Power Consumption/ day (Watts)
A	B	C	D	E=C*D	F	G=E*F
Computer and Equipment Microbiology						
1	Incubator	600	7	4200	24	100800
2	Co2 Incubator	1000	2	2000	24	48000
3	Bact/Alert 3d Blood Culture System	2000	2	4000	24	96000
4	Vitek -2 Compact	1000	2	2000	24	48000
5	Biosafety Cabinet Class 2	1000	4	4000	4	16000
6	Autoclave	6000	3	18000	4	72000
7	Centrifuge	350	2	700	12	8400
8	Bod Incubator	1000	1	1000	24	24000
9	Waterbath	270	1	270	4	1080
10	Laminar Airflow	1000	1	1000	4	4000
11	-80 Deep Freezer	260	1	260	24	6240
12	Microplate Washer	300	1	300	4	1200
13	Micro Plate Reader	300	1	300	4	1200
14	Abbott I 1000sr	1700	1	1700	24	40800
15	Vitros Immunodiagnostics System	1000	1	1000	24	24000
16	Hot Air Oven	1800	2	3600	4	14400
17	Digital Weighing Balance	80	1	80	4	320
18	VDRL shaker	500	1	500	8	4000

19	-20 deep freezer	80	1	80	24	1920
20	Walk in cold room	1000	1	1000	24	24000
21	MiniVidas	100	1	100	24	2400
22	CFX96DX REAL TIME PCR machine	850	1	850	6	5100
23	Cepheid GeneXpert Systems	500	1	500	6	3000
24	Immunofluorescence Microscope	500	1	500	6	3000
25	Micro centrifuge	1000	2	2000	4	8000
Computer and Equipment Pathology						
1	Hot Plate	3000	1	3000	8	24000
2	Cytospin 4	150	1	150	0.5	75
3	Centrifuge	500	1	500	8	4000
4	Lab Centrifuge	500	1	500	8	4000
5	Centrifuge	300	2	600	8	4800
6	Roche Binocular U 601 Urine Analyser	500	1	500	12	6000
7	6 Part Sysmex Xn-1000	270	2	540	8	4320
8	6 Part Cell Counter Mindray	500	2	1000	12	12000
9	T Coag Destiny Plus (Automated)	300	1	300	12	3600
10	Centrifuge	368	1	368	0.5	184
11	Remi Laboratory Refrigerator	2000	1	2000	24	48000
12	Refrigerator Reagent	1500	1	1500	2	3000
13	Hot Air Oven	1000	1	1000	24	24000
14	Ortho workstation	150	1	150	0.5	75
15	Centrifuge	322	1	322	12	3864
16	Refrigerator Samsung	1000	1	1000	24	24000

17	Leica Fullt Automatic Microtome	350	1	350	3	1050
18	Leica Paraffin Cold plate	1000	1	1000	3	3000
19	Leica Immuno Stainer	1000	1	1000	4	4000
20	Histokinette Thermoscienctific	2000	1	2000	16	32000
21	Auto stainer	300	1	300	5	1500
22	Grossing station	1500	1	1500	3	4500
23	Olympus CX43 Microscope Penra head	100	1	100	1	100
24	Olymus BX53F2 Microscope Deca Head	100	1	100	1	100
25	Research Microscope Polarizer	100	1	100	0.5	50
26	WIIS Digital Scanner Morphle (Slide scanner)	300	1	300	0.5	150
27	Digital PH Meter	250	1	250	1	250
28	Incubator	250	1	250	2	500
29	VOC/ Formaldehyde monitor table top	100	1	100	24	2400
30	Electronic Weighing Machine	500	1	500	0.5	250
31	Tissue Flotation bath	500	2	1000	3	3000
32	Hot plate	3000	1	3000	5	15000
33	Ultr Low Freezer- REMI (-80 Degrees)	2000	1	2000	24	48000
34	Leica Fully- SEMI Automatic Microtome	350	1	350	2	700
35	Cryostat Leica	1500	1	1500	24	36000
36	Leica Cryostat	1500	1	1500	24	36000
37	Tissue Processor Leica	1650	1	1650	18	29700

38	Paraffin embedding station-Leica (Hot plate embedder)	2500	1	2500	3	7500
39	Paraffin embedding station-Leica (Coldplate embedder)	1000	1	1000	3	3000
Computer and Equipment Biochemistry						
1	Microplate reader	50	1	50	3	150
2	-80ºC Deep freezer	300	2	600	24	14400
3	Liquid nitrogen tank	300	3	900	-	
4	Gentle Tissue Dissociator	300	1	300	1	300
5	Magnetic assorted cell sorter	250	1	250	1	250
6	Refrigerated centrifuge	300	1	300	5	1500
7	-40ºC deep freezer	300	1	300	24	7200
8	Biosafety cabinet	200	1	200	4	800
9	CO2 incubator	300	1	300	24	7200
10	Water Bath	1000	2	2000	5	10000
11	Weighing balance	500	1	500	2	1000
12	Thermocycler	1000	1	1000	6	6000
13	Electrophoretic unit	80	1	80	4	320
14	Ice flake Machine	550	1	550	6	3300
15	Microcentrifuge	20	1	20	3	60
16	Vortex Mixer	24	2	48	3	144
17	Gel documentation system	50	1	50	2	100
18	Inverted Microscope	50	1	50	1	50
19	Nanodrop	45	1	45	2	90
20	Delfia Multilable counter	30	1	30	4	120
21	Magnetic stirrer	550	1	550	2	1100
22	pH meter	5	2	10	1	10
23	Fluorescent microscope	200	1	200	1	200
24	Refrigerated centrifuge	110	1	110	4	440

25	Shaker incubator	50	1	50	6	300
26	Western blot unit	200	2	400	5	2000
27	Hot air oven	1500	2	3000	3	9000
28	Incubator	100	1	100	3	300
29	Autoclave	1500	1	1500	2	3000
30	Gel Electrophoresis Unit(100well)	80	1	80	6	480
31	Microwave Oven	800	1	800	2	1600
32	Heat Block LED Digital Dry bath	800	1	800	5	4000
33	4º Refrigerator	500	1	500	24	12000
34	Binocular research Phase contrast Microscope	20	2	40	2	80
35	Binocular research Stereo zoom Microscope	20	3	60	2	120
36	Slide Hybridisation System	50	1	50	1	50
37	Photoelectric Colorimeter	50	1	50	1	50
38	Vortex Mixer	24	1	24	2	48
39	Cooling Centifuge	200	1	200	3	600
40	Electrophoresis	200	1	200	5	1000
41	-20 freezer	520	1	520	24	12480
42	Slide Warming table	200	1	200	2	400
43	Chem doc Imaging System	120	1	120	1	120
44	-25ºC deep freezer	520	1	520	24	12480
45	Cold Centrifuge Neuation	200	1	200	3	600
JSS MEDICAL COLLEGE						
1	CFL	18	57	1026	4	4104
2	LED 4 feet tube light	20	1604	32080	6	192480
3	LED 2 feet tube light	10	724	7240	4	28960
4	LED surface/down light	15	906	13590	5	67950
5	LED Bulb	9	249	2241	6	13446

6	FAN	50	1684	84200	6	505200
7	ordinary Tube light fitting	36	1250	45000	6	270000
8	Led fancy light	20	40	800	1	800
9	Geyser	2000	1	2000	0.5	1000
10	Street light	50	105	5250	12	63000
JSS MEDICAL COLLEGE(AC DETAILS)						
Sl no	Department	Capacity in TR	Power used in (watts)	Power used in (KW)	Usager per day (hours)	Average KWH per day
1	Medical College(AC)	225.5	789250	789.25	3	2367.75
2	Animal House(AC)	23.2	81200	81.2	3	243.6
JSS MEDICAL COLLEGE(LIFT DETAILS)						
Sl no	Location	Capacity	Stop's	Power (KW)	Usager per day (hours)	Average KWH per day
1	JSSMC - 1	13 Passenger	G+3	15	6	90
2	JSSMC - 2	13 Passenger	G+3	6.3	6	37.8
3	Girls hostel 'D' Block - 1	13 Passenger	G+7	6.3	7	44.1
4	Girls hostel 'D' Block - 2	8 Passenger	G+7	3.9	7	27.3

Table 14: CONNECTED LOAD DETAILS at Dental College:

Sl No.	**Name of the appliance**	**Power Rating (Watt)**	**Quantity**	**Power Consumption (Watt)**	**Usage per day (Hr)**	**Power Consumption/day (Watt)**
A	**B**	**C**	**D**	**E=C*D**	**F**	**G=E*F**
HVAC						
1	AUTOCLAVE	2000	40	80000	2	160000
2	COOKER TYPE	2000	5	10000	2	20000

	AUTOCLAVE					
3	REFRIGERATOR	2000	9	18000	24	432000
4	DENTAL CHAIR	2000	336	672000	6	4032000
5	OPG DIGITAL	630	1	630	6	3780
6	CBCT IMAGING	2500	1	2500	6	15000
7	SCALER	20	25	500	2	1000
8	X RAY IOPAR	7500	13	97500	5	487500
9	SPOT WELDER	8500	4	34000	1	34000
10	MODEL TRIMMER	500	10	5000	3	15000
11	PHYSIO DISPENSER	500	2	1000	2	2000
12	FURNACE	400	2	800	4	3200
13	LIGHT CURE	80	10	800	2	1600
14	UPS6 KV	6000	1	6000	6	36000
15	UPS 5 KV	5000	3	15000	6	90000
16	UPS 700 VA	7000	35	245000	6	1470000
17	UPS KV 3	3000	2	6000	6	36000
18	GEYSER 2KV	2000	2	4000	2	8000
19	AUDIO SYSTEM	1000	4	4000	1	4000
20	TV LED	150	13	1950	3	5850
21	LIFT	6500	1	6500	7	45500
LIGHTINING						
1	TUBE LIGHT REGULAR	40	254	10160	5	50800
2	LED 20W TUBE LIGHT	20	294	5880	5	29400
3	FANS CEILING	80	552	44160	5	220800
4	FANS WALL MOUNT	80	10	800	5	4000
5	AIR	2300	21	48300	5	241500

	CONDITIONER					
6	EXACUST FAN	60	20	1200	1	1200
7	FOCUS LIGHT	100	4	400	1	400
8	CCTV	10	12	120	7	840
9	FAX MACHINE	30	2	60	2	120
COMPUTER AND ITS EQUIPMENT						
1	DESK TOP COMPUTERS	200	65	13000	6	78000
2	LAP TOPS	200	12	2400	5	12000
3	LCD PROJECTORS	280	15	4200	2	8400
4	PRINTER	40	20	800	2	1600
5	LAN MAIN POINTS	40	15	600	6	3600
KITCHEN and APPLIANCES						
1	ELECTRIC STOVE	3000	5	15000	1	15000
2	OVEN	3000	2	6000	1	6000
3	WATER PURIFIER	60	4	240	6	1440
OTHER EQUIPMENT						
1	COMPRESSOR 25 HP	18000	2	36000	7	252000
2	COMPRESSOR 7.5HP	5000	1	5000	7	35000
3	COMPRESSOR 5HP	3700	2	7400	7	51800
4	OXYGEN ROOM WITH COMPRESSOR	3700	1	3700	4	14800

Table 15: CONNECTED LOAD DETAILS at Pharmacy College, Mysuru:

Sl No	Name of the appliance	Power Rating (Watts)	Quantity	Power Consumption (Watts)	Usage per day (Hr)	Power Consumption/day (Watts)
A	B	C	D	E=C*D	F	G=E*F
Department of Pharmaceutics						
Computer and equipment						
1	Hot air oven	2000	06	12000	1	12000
2	Orbital shaking incubator	500	01	500	2	1000
3	Dissolution apparatus	100	02	200	1	200
4	Refrigerator	500	06	3000	24	72000
5	UV-1800	400	01	400	1	400
Kitchen and appliances						
6	Hardness tester	250	01	250	1	250
7	DST -SERBZETA	250	01	250	1	250
8	Shimadju, UFLC	100	01	100	3	300
9	Direct-Q	250	01	250	24	6000
Other equipments						
10	Rimek(minipress)	200	01	200	1	200
11	Tablet counter	100	01	100	1	100
12	Ezee blist	100	01	100	1	100
13	Pharmaceutical Surgical equipments	100	01	100	1	100
Pharmaceutical Chemistry						
Lighting						
7	Led Tube	20	388	7760	06	46560
8	Florescent tube	26	240	6240	05	31200
9	Street light	50	44	2200	10	22000
10	LED	35	256	8960	03	26880

11	LED	30	58	1740	10	17400
Computer and equipments						
12	Spectrophotometer	100	03	300	01	300
13	pH meter	50	02	100	01	100
14	Electrophoresis	50	01	50	00	0
15	Melting point APP	200	01	200	00	0
16	Conductivity meter	50	02	100	00	0
17	UFLC	200	01	200	06	1200
18	HPLC	200	03	600	06	3600
19	Moisture balance	250	01	250	00	0
20	Photofluorometer	100	02	200	01	200
Kitchen and appliances						
21	Fridge	500	04	2000	24	48000
Other equipments						
22	Nephlophotometer	500	01	500	01	500
23	UV visible photometer	500	01	500	02	1000
24	Hot air oven	1500	01	1500	04	6000
25	Deep freezer	500	01	500	24	12000
26	Fuming cupboard	250	04	1000	02	2000
27	Computer	250	203	50750	06	304500
28	Xerox machine	1500	01	1500	06	9000
Department of Pharmacology						
1	UV spectrophotometer	500	01	500	0.5	250
2	Cooling centrifuge	1500	01	1500	1	1500
3	ICE flaker	500	01	500	4	2000
4	Tissue homogenizer	250	01	250	0.5	125
5	Hot air oven	1500	01	1500	24	36000
Kitchen and appliances						
6	Deep freezer	500	01	500	24	12000

7	Cell frost	250	01	250	24	6000
8	Vest frost	250	01	250	24	6000
9	Refrigerator	500	01	500	24	12000
Department of Pharmacognosy						
1	LG Refrigerator	500	01	500	24	12000
2	Hot air oven	1500	01	1500	0.5	750
3	UV-visible spectrophotometer	500	01	500	0.25	125
4	FLASH chromatography	200	01	200	1	200
5	Serological water both	500	01	500	3	1500
Kitchen and appliances						
6	Muffle Furnace	1000	01	1000	3	3000
7	Hot air oven	1500	01	1500	1	1500
8	Rotary evaporator	1500	01	1500	1	1500
Other equipments						
9	Hematology analyzer	500	01	500	01	500
10	Centrifuge	1500	01	1500	01	1500
11	Vacuum oven	1500	01	1500	01	1500
12	Vacuum pump	1000	01	1000	01	1000

Table 16: CONNECTED LOAD DETAILS at School of Life Sciences, Mysuru

Sl No.	**Name of the appliance**	**Power Rating (Watt)**	**Quantity**	**Power Consumption (Watt)**	**Usage per day (Hr)**	**Power Consumption/day (Watt)**
A	**B**	**C**	**D**	**E=C*D**	**F**	**G=E*F**
HVAC						
1	AC	2500	19	47500	24	1140000

2	Exhaust fans	55	3	165	8	1320
3	Ceiling Fan	20	209	4180	6	25080
LIGHTINING						
1	Ceiling Light	40	455	18200	7	127400
COMPUTER AND EQUIPMENT						
1	DESK TOP COMPUTERS	200	84	16800	6	100800
KITCHEN AND APPLIANCES						
1	Induction Stove	1700	2	3400	As an when required	
2	Microwave Oven OTG (small)	2000	1	2000	0.3	600
3	Blender	500	1	500	0.3	150
4	Toaster	1000	1	1000	0.3	300
5	Mini Grinder	350	1	350	0.3	105
6	Mixer	750	1	750	0.3	225
7	Electrical Beater	350	1	350	0.5	175
8	Electical weighing balance	30	1	30	0.5	15
9	Dryer	200	1	200	0.3	60
10	Juicer	200	1	200	0.5	100
11	Inbuilt cooking stove and oven toaster griller	4000	8	32000	1	32000
12	Eleactrical Steamer	300	1	300	24	7200
OTHER EQUIPMENT						
1	Atc Probe	2.5	1	2.5	1	2.5
2	Autoclave	5000	4	20000	2	40000

3	Bacteriological incubator	1000	4	4000	24	96000
4	Biorad Themal cycler	700	1	700	4	2800
5	BOD Incubator	1000	2	2000	24	48000
6	Body Compostion Analyser	200	1	200	0.5	100
7	Centrifuge	150	7	1050	1	1050
8	CO2 Incubator	1000	1	1000	24	24000
9	COD Digester	750	1	750	3	2250
10	Colony counter	50	3	150	2	300
11	Colorimeter	50	16	800	1	800
12	Compund Microscope	55	10	550	0.5	275
13	Conductivity Meter	200	1	200	1	200
14	Cooling Centrifuge	710	2	1420	4	5680
15	Cryostat Microtome	1000	1	1000	3	3000
16	Cyclo Mixer {CM - 101}	58	1	58	0.5	29
17	Deep Freezer	1300	2	2600	24	62400
18	Digital Flocculator (Jar Test Apparatus)	50	1	50	1	50
19	Digital Photo Electric Colorimeter	20	3	60	0.6	36
20	Digital rotary evaporator	1400	1	1400	3	4200
21	Distillation Unit	1000	2	2000	8	16000

22	Double Distillation Unit	1500	2	3000	24	72000
23	Dry bath	85	1	85	0.5	42.5
24	Equiptronics Dual Channel potentiometer	10	1	10	1	10
25	Electronic Balance	10	1	10	1	10
26	Electrophoresis unit (Horizontal)	80	2	160	6	960
27	Electrophoresis unit (Vertical)	80	2	160	6	960
28	Electrospinning	20	1	20	6	120
29	ELISA reader	75	1	75	6	450
30	ESPIN-Nano High voltage	20	1	20	1	20
31	Flame Photometer	20	1	20	3	60
32	Fridge	750	4	3000	24	72000
33	Gel shaker	15	1	15	6	90
34	GM Counting System	100	1	100	1	100
35	Horizontal Laminar air flow	450	1	450	1	450
36	Hot Air Oven	1750	8	14000	3	42000
37	Hot Plate	1200	1	1200	1	1200
38	IC Checker	150	2	300	2	600
39	Ice flaker	200	1	200	2	400
40	Incubator	250	6	1500	24	36000
41	Inverted microscope	50	2	100	0.5	50
42	KEL PLUS Automatic	400	1	400	2	800

	Distillation System					
43	KEL PLUS Automatic Nitrogen/Protein Estimation System	220	1	220	1	220
44	KjeldLal Operating System	250	1	250	2	500
45	Biosafety cabinet	100	1	100	8	800
46	LABQUEST Borosil HME500-Mantel heater	100	1	100	3	300
47	Laminar Air Flow	200	5	1000	1.5	1500
48	Magnetic Stirrer	200	13	2600	0.5	1300
49	Melting and Boiling point apparatus	120	2	240	4	960
50	MICROPLATE SPECTROMETER-Elisa Reader	75	1	75	0.5	37.5
51	Microscope	200	23	4600	0.5	2300
52	Microwave	1200	2	2400	4	9600
53	Minispin Centrifuge	70	1	70	0.5	35
54	Muffle Furnace	3000	2	6000	24	144000
55	Orbital Shaking Incubator	1000	1	1000	24	24000
56	Oscilloscope	150	2	300	2	600
57	Oven	1000	1	1000	0.5	500
58	pH meter	2.5	15	37.5	0.5	18.75
59	Photoelectric Colorimeter	20	1	20	2	40

60	Plant Growth Chamber	2750	1	2750	24	66000
61	Precice Weighing Balance	10	4	40	0.5	20
62	Probe sonicator	150	1	150	2	300
63	projector (Hitachi)	250	1	250	2	500
64	Radiation Counting System	1000	1	1000	1	1000
65	Refrigerator	350	7	2450	24	58800
66	Resisistance Box	100	2	200	2	400
67	Ring Water Bath	1500	1	1500	1	1500
68	Rotor Heads (Model : R-244M)	3000	1	3000	2	6000
69	Rotor Heads (Model : R-247M)	4000	1	4000	1	4000
70	Semi Auto Analyser	80	1	80	1	80
71	Shaking incubator	1500	2	3000	24	72000
72	Siplab Flat Electrode	2.5	4	10	1	10
73	Sonicator	50	2	100	6	600
74	Sonicator Bath	50	1	50	1	50
75	Soxhlet Extraction Unit	750	3	2250	4	9000
76	Spectrofluorimeter	40	1	40	2	80
77	SPINX vortex	66	2	132	1	132
78	Stereo microscope	50	1	50	6	300
79	Table top centrifuge	110	1	110	2	220
80	ULTRASONIC Cleaner	100	1	100	1	100
81	UPS Battery	1000	1	1000	24	24000

82	UV Cabinet cL-705	200	1	200	3	600
83	UV Spectrophotometer	200	5	1000	1	1000
84	UV transilluminator	200	3	600	0.5	300
85	Vacuum Pump	1400	1	1400	1	1400
86	Vortex	30	4	120	4	480
87	Water bath	270	6	1620	4	6480
88	Water Bath Shaker	500	1	500	0.5	250
89	Water bath- stirred	1500	1	1500	4	6000
90	Weighing balance	80	10	800	8	6400
91	Wrist Action Shaker	50	2	100	1	100

Sl. No.	Name	Rating	Qty.	Usage per day
92	Analytical weighing balance	220V	4	<1 H
93	Atc Probe	2.5W	1	1hr
94	Autoclave	230V	4	2 H
95	Bacteriological incubator	220V	4	24 H
96	Biorad Themal cycler	700 Watts	1	4
97	BOD Incubator	230 V	2	24hr
98	Body Compostion Analyser	60.500W	1	10 Minutes to1hr
99	Centrifuge	220-230V	7	1hr
100	CO2 Incubator	220 V	1	24 H
101	COD Digester	240V	1	3hr
102	Colony counter		3	2
103	Colorimeter	50-100V	16	1hr
104	Compund Microscope	55W	10	<1 H
105	Conductivity Meter	230V	1	1hr
106	Cooling Centrifuge	710 W	2	4
107	Cryostat Microtome	220V	1	~ 3 H
108	Cyclo Mixer {CM - 101}	58W	1	30 Minutes
109	Deep Freezer	1300 W	2	24 H
110	Digital Flocculator (Jar Test Apparatus)	110-220V	1	1hr
111	Digital Photo Electric Colorimeter	20W	3	40 Minutes

112	Digital rotary evaporator	1400 Watts	1	3
113	Distillation Unit	1000W	2	8 hour
114	Double Distillation Unit	1.5 KW	2	24hr
115	Dry bath	85W	1	<1 H
116	Eaviptronics Dual Channel potentiometer	1.08V	1	1hr
117	Electronic Balance	220V	1	<1 H
118	Electrophoresis unit (Horizontal)	80W	2	6
119	Electrophoresis unit (Vertical)	80W	2	6
120	Electrospinning	20 watt	1	5-6 hours
121	ELISA reader	75 W	1	6
122	ESPIN-Nano High voltage	Electrode Spinning	1	1hr
123	Flame Photometer	150-200V	1	3hr
124	Fridge	220V	4	24 H
125	Gel shaker	15 W	1	6
126	GM Counting System	1500 V	1	1hr
127	Horizontal Laminar air flow	450W	1	1hr
128	Hot Air Oven	1760W	8	~ 3 H
129	Hot Plate	220V	1	hr
130	IC Checker	150w	2	2
131	Ice flaker	200W	1	2 H
132	Incubator	0.25 KWatts	6	24
133	Inverted microscope	220V	2	<1 H
134	KEL PLUS Automatic Distillation System	400W	1	2hr
135	KEL PLUS Automatic Nitrogen/Protein Estimation System	220W	1	1hr
136	KjeldLal Operating System	220-230V	1	2hr
137	Biosafety cabinet		1	8
138	LABQUEST Borosil HME500-Mantel heater		1	3
139	Laminar Air Flow	220 V	5	~2 H
140	Magnetic Stirrer	220V	13	<1 H
141	Melting and Boiling point apparatus	120 W	2	4
142	MICROPLATE SPECTROMETER-Elisa Reader	75W	1	30 Minutes
143	Microscope	220V	23	<1 H
144	Microwave	1200 Watts	2	4
145	Minispin Centrifuge	70W	1	<1 H
146	Muffle Furnace	230V	2	24hr
147	Orbital Shaking Incubator	230V	1	24 H

148	Oscilloscope	150w	2	2
149	Oven	230V	1	<1 H
150	Ovtex	10-20 V	1	1hr
151	pH meter	12V DC	15	<1 H
152	Photoelectric Colorimeter	20W	1	2hr
153	Plant Growth Chamber	2760W	1	24 H
154	Precice Weighing Balance	220V	4	<1 H
155	Probe sonicator	150W	1	2
156	projector (Hitachi)		1	2
157	Radiation Counting System	1500 V	1	1hr
158	Refrigerator	350W	7	24
159	Resisistance Box	100W	2	2
160	Ring Water Bath	230V	1	<1 H
161	Rotor Heads (Model : R-244M)	3000W	1	2hr
162	Rotor Heads (Model : R-247M)	4000W	1	1hr
163	Semi Auto Analyser	80W	1	1hr
164	Shaking incubator	220 V	2	24 H
165	Siplab Flat Electrode	2.5W	4	1hr
166	Sonicator	50 W	2	6
167	Sonicator Bath	220 V	1	<1 H
168	Soxhlet Extraction Unit	230 V	3	4hr
169	Spectrofluorimeter	40 W	1	2
170	SPINX vortex	66W	2	<1 H
171	Stereo microscope		1	6
172	Table top centrifuge	110 W	1	2
173	ULTRASONIC Cleaner	100W	1	1hr
174	UPS Battery	200V	1	24hr
175	UV Cabinet cL-705	150-220V	1	3hr
176	UV Spectrophotometer	Kw 40A	5	1hr
177	UV transilluminator	240V	3	<1 H
178	Vacuum Pump	1400W	1	1hr
179	Vortex	30W	4	4
180	Water bath	500 W	6	4
181	Water Bath Shaker	1500W	1	30 Minutes
182	Water bath- stirred	1500 Watts	1	4
183	Weighing balance	15 W	2	8
184	Weighing balance		1	30 minutes
185	weighing balance	8 Watts	1	4
186	Weighing Balance (2)	12-15 V	1	3hr
187	Weighing machine sartorius		1	3
188	Wrist Action Shaker	230 V	2	1hr

Table 17: CONNECTED LOAD DETAILS at DHSMS, Mysuru Campus

SI. No.	Name of Appliance	Power Rating (Watt)	Quantity	Power consumption (watt)	Usage per day/hr	Power consumption /day (watt)
1	LED tube light	24	173	4152	8	33216
2	Fan	60	113	6780	8	54240
3	Projector	30	20	600	8	4800
4	Desktop	200	30	6000	8	48000
5	Printer	50	8	400		0
6	Scanner	50	3	150		0
7	UPS I	20,000	1	20000		0
8	UPS II	40,000	1	40000		0
9	CCTV	35	33	1155	8	9240
10	LCD Projector	80	18	1440	8	11520
11	LED Projector	74	4	296	4	1184
12	TV	100	7	700	8	5600
13	Water cooler	200	1	200	8	1600
14	Refrigerator I	800	1	800	24	19200
15	Refrigerator II	800	1	800	24	19200
16	Water purifier	500	1	500	24	12000
17	Electrical bell	100	2	200		0
18	Lift	4000	2	8000		0
19	Surface fitting	12	180	2160	8	17280
20	PA system	100	3	300		0
21	Photocopying machine	2000	2	4000		0
22	Network switch	500	1	500	8	4000
23	AC 2TR		7	0		0
24	AC 1.5 TR		1	0		0
25	Laptop	65	20	1300	8	10400
26	Tab	5	2	10	8	80
27	Patient monitor	65	6	390	7	2730
28	Amplifier					
High Fidelity Manikins						0
1	Sim Man 3G	115.2	1	115.2	1	115.2
2	Sim MOM	115.2	1	115.2	1	115.2
3	Sim Junior	115.2	1	115.2	1	115.2
4	Sim Baby	115.2	1	115.2	1	115.2
5	Sim Newborn	115.2	1	115.2	1	115.2
						0
Surgical Simulators						0
1	GI- Broncho mentor	12500	1	12500	1	12500
2	Ortho mentor	12500	1	12500	1	12500

3	Laparoscopic mentor	12500	1	12500	1	12500
4	Pelvic examination mentor	12500	1	12500	1	12500
5	Ultrasound mentor	12500	1	12500	1	12500
6	Hystero turp mentor	12500	1	12500	1	12500
7	Uro perc mentor	12500	1	12500	1	12500
				0		0
Task trainers				0		0
1	Megacode kid	115.2	1	115.2	1	115.2
2	Resusci Anne Advanced skill trainer	115.2	1	115.2	1	115.2
3	SAM II Auscultation trainer	115.2	1	115.2	1	115.2
4	laerdal sonosim procedure trainer (Ultrasound)	65	1	65	1	65
5	Nebulizer machine	50	1	50	1	50
6	Anesthesia machine	127	1	127	1	127
7	Defibrillator	100	1	100	1	100
8	OT light -I	55	1	55	1	55
9	OT light -II	55	1	55	1	55
10	Ventilator machine	38	1	38	1	38
11	Medical gas pipeline with din outlet and air compressor, vacuum pump including manifolds with cylinder	330	1	330	1	330

Table 18: CONNECTED LOAD DETAILS at Pharmacy College, Ooty:

Sl no	Name of the Appliance	Power rating in Watts	Quantity	Usage per day in hr
Lighting				
1	LED Stret Light	45	34	11 hr
2	LED Panel Light	30	12	9 hr
3	LED Tube Light	20	620	9 hr
4	LED bulb	8	90	9 hr
5	LED Light	12	50	9 hr
6	LED bulb	15	235	9 hr
7	LED Panel Light	20	140	9 hr
8	LED Panel Light	30	20	9 hr
9	LED Panel Light	50	10	9 hr
10	PL Lamp	11	42	9 hr
11	CFL	18	40	9 hr
12	T 5 Light	20	340	9 hr
13	Fluorescent Tube Light	40	345	9 hr

Computer and Equipments				
14	LCD Projcter	500	20	6 hr
15	Monitor	36	150	8 hr
16	CPU	45	140	8 hr
17	Printer	500	56	8 hr
18	Camera & Accessories	3000		24 hr
19	Network & Accessories	3000		24 hr
20	TV	100	30	4 hr
21	LED Panel	2000	1	8 hr
Kitchen and Appliances				
22	Wet Grainder	736	6	4 hr
23	Chapathi Making	4000	1	4 hr
24	Exist Fan	100	50	6 hr
25	Exist Duck	736	5	4 hr
26	Vegetable Cutting Machine	736	2	1 hr
27	Aata Mixing	736	2	1 hr
28	Coconut Scraper	736	3	1 hr
29	Potato Scraper	736	2	1 hr
30	Compriser	1472	1	2 hr
31	Mixer	750	3	1/2 hr
32	Fridge	750	10	24 hr
33	Freezer	750	5	24 hr
Other Equipments				
34	Washing Machine	1000	1	2 hr
35	Water Pumps	736	7	3 hr
36	R.O Water systems	736	3	2 hr
37	Drinking Water system	2000	15	24 hr
38	Lift	736	1	8 hr
39	UPS	80 KVA	14	24 hr
40	Water Heater	2000	58	12 hr
41	Air Water Heater	5000	3	6 hr

CHAPTER 6
DIESEL GENERATORS

6.1 Diesel Generator System

One 500 kVA, one 380 kVA, one 160 kVA and one 250 kVA Diesel Generator sets are installed for giving supply to different campuses in case of power outage.

Fig 21: 160kVA Diesel Generator installed at the College of Pharmacy, Mysuru Campus

Energy Saving Measures for DG Sets

- Ensure steady load conditions on the DG set, and provide cold, dust free air at intake (use of air washers for large sets, in case of dry, hot weather, can be considered.
- Improve air filtration.
- Ensure fuel oil storage, handling, and preparation as per manufacturers' guidelines/oil company data.
- Consider fuel oil additives in case they benefit fuel oil properties for DG set usage.
- Calibrate fuel injection pumps frequently.
- Ensure compliance with maintenance checklist.

- Ensure steady load conditions, avoiding fluctuations, imbalance in phases, harmonic loads.
- In case of a base load operation, consider waste heat recovery system adoption for steam generation or refrigeration chillers unit incorporation. Even the Jacket Cooling Water is amenable for heat recovery, vapour absorption system adoption.
- In terms of fuel cost economy, consider partial use of biomass gas for generation. Ensure tar removal from the gas for improving availability of the engine eventually. (Biogas may be generated from the degradable waste generated at the college campus Kitchen/Canteen. Carryout regular field trials to monitor DG set performance, and maintenance planning as per requirements.

CHAPTER 7

MEASUREMENT OF HARMONICS AND LOAD CURRENT

7.1 Readings recorded by Fluke 434-ll power analyser in Medical College Campus

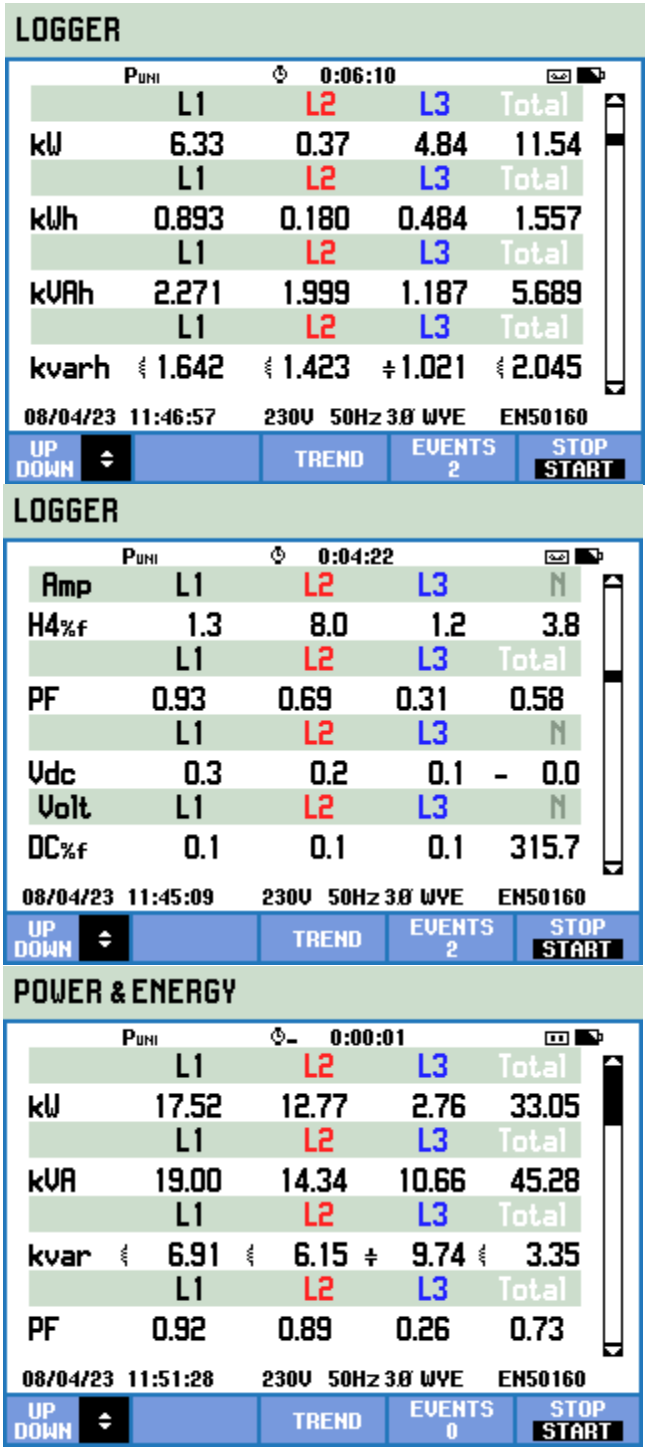


Fig 22: Electrical Readings recorded by Fluke 434-ll power analyser

7.2 Waveforms from Fluke 434-ll Power Analyser in Medical College Campus

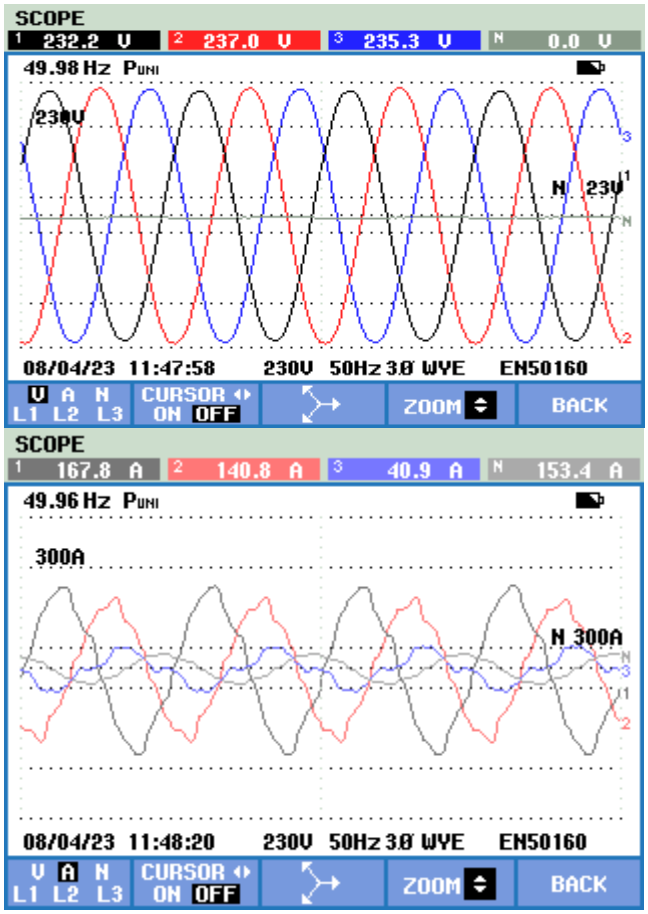


Fig 23: Voltage and Current (Distorted) Sinusoidal Waveform of the Campus

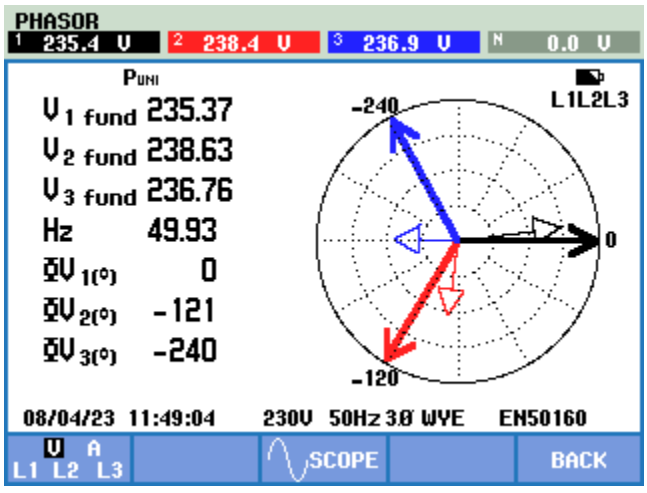


Fig 24: Phasor Diagram of Voltage

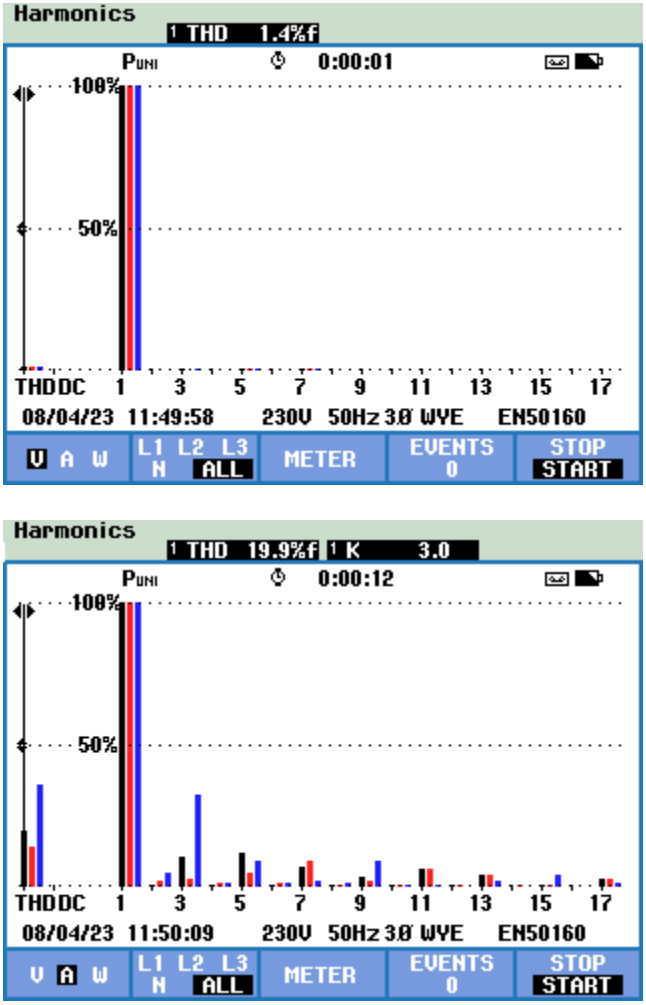


Fig 25: Voltage and Current Harmonics of Campus

Observations: Analysis using Power Analyzer shown that the current load on each phaseis not balanced properly and unbalanced current is flowing through the neutral conductor.This is causing harmonic distortions which will adversely affect the life of the electrical equipment used in your campus. Hence it is recommended to balance the loads on eachphase of the bus bar properly by redistributing the load on each phase.

7.3 Readings recorded by Fluke 434-ll power analyser in Pharmacy Campus, Mysuru

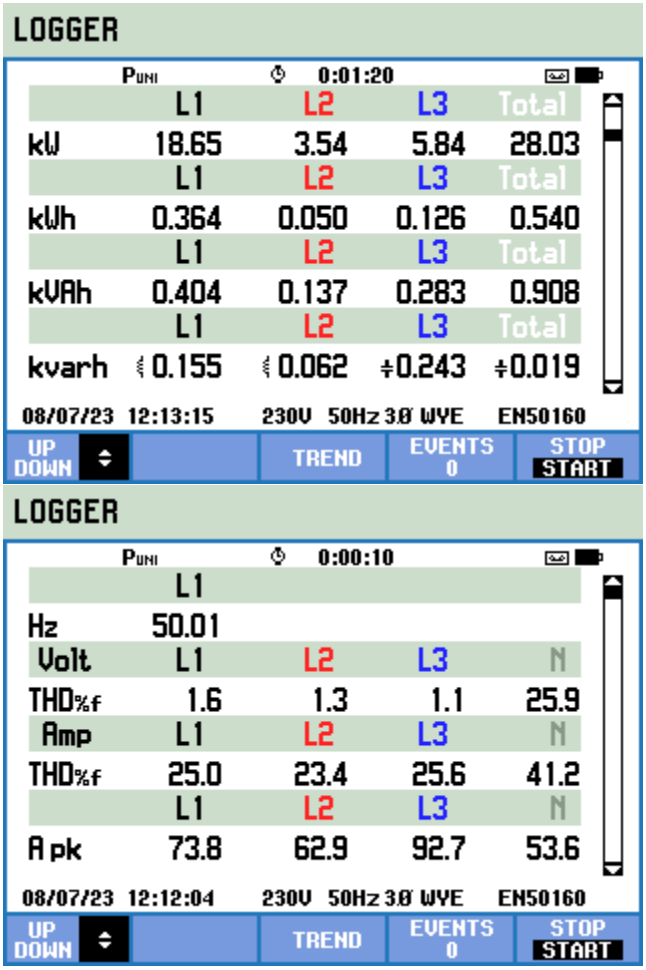
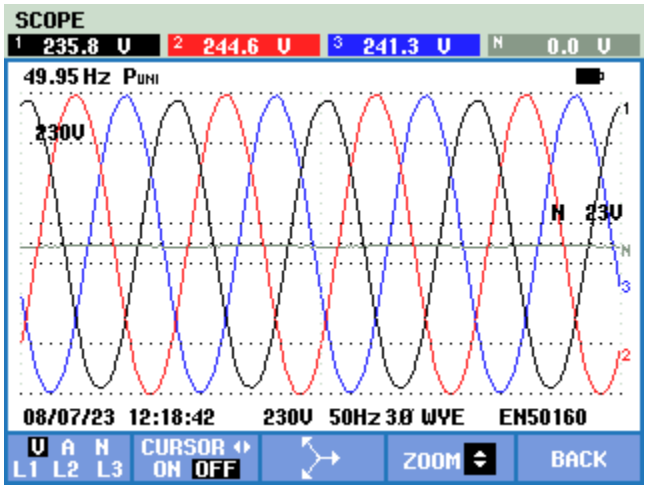


Fig 26: Electrical Readings recorded by Fluke 434-ll power analyser

7.4 Waveforms from Fluke 434-ll Power Analyser in Pharmacy Campus, Mysuru



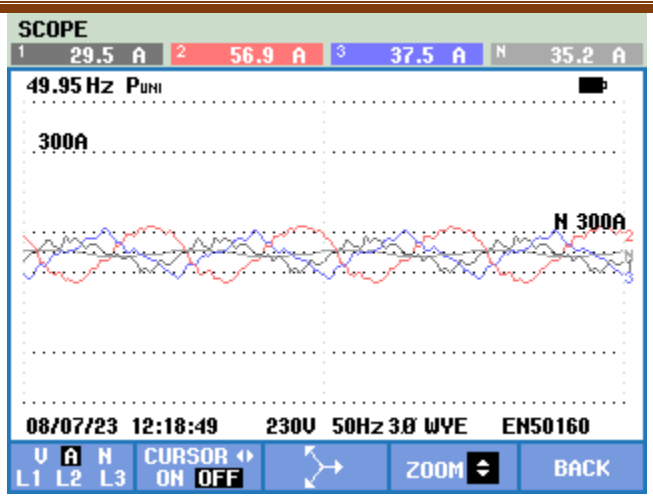


Fig 27: Voltage and Current (Distorted) Sinusoidal Waveform of the Campus

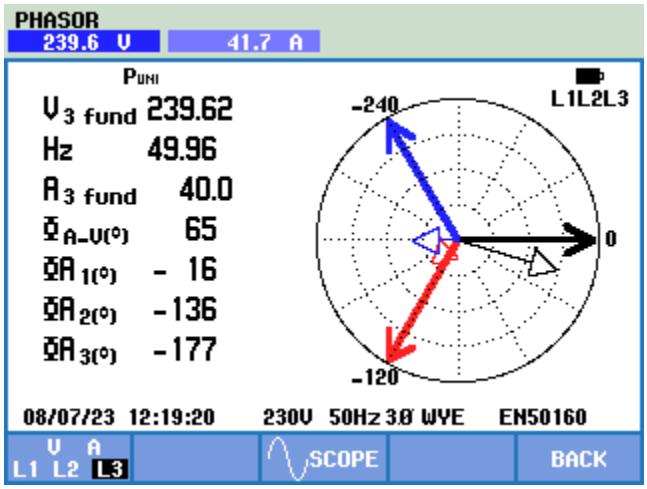


Fig 28. Phasor Diagram of Voltage

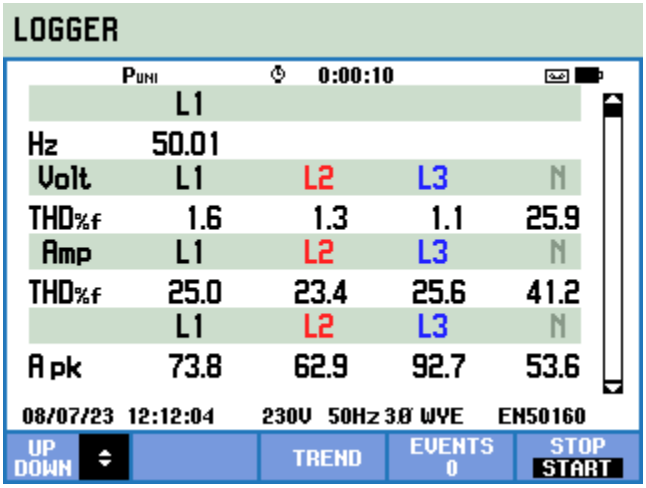


Fig 29: Voltage Harmonics of Campus

Observations: Analysis using Power Analyzer shown that the current load on each phase is not balanced properly and unbalanced current is flowing through the neutral conductor. This is causing harmonic distortions which will adversely affect the life of the electrical equipment used in your campus. Hence it is recommended to balance the loads on each phase of the bus bar properly by redistributing the load on each phase.

7.5 Readings recorded by Fluke 434-ll power analyser in Pharmacy Campus, Ooty

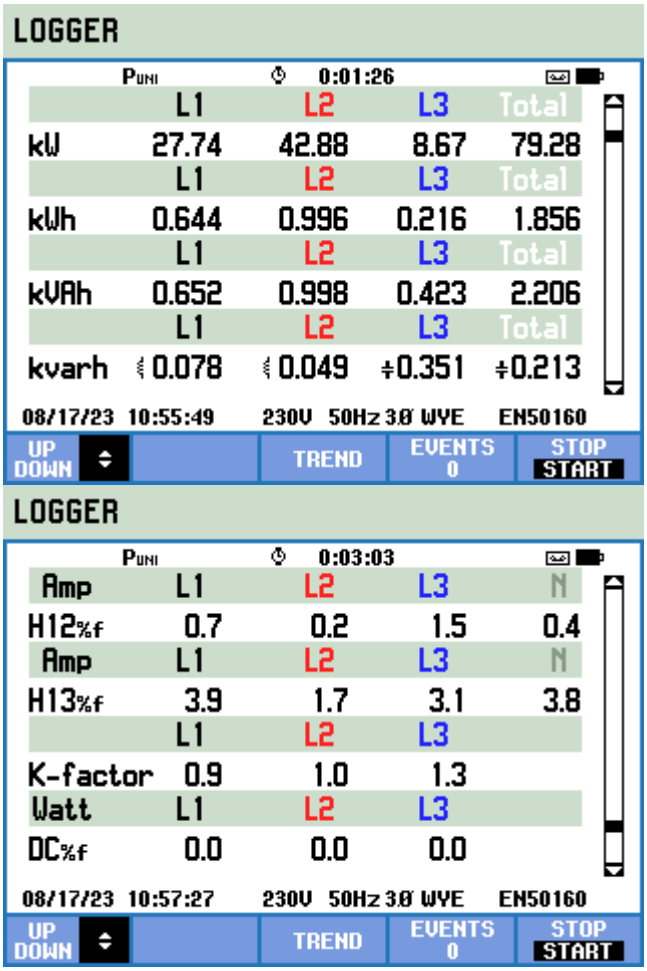
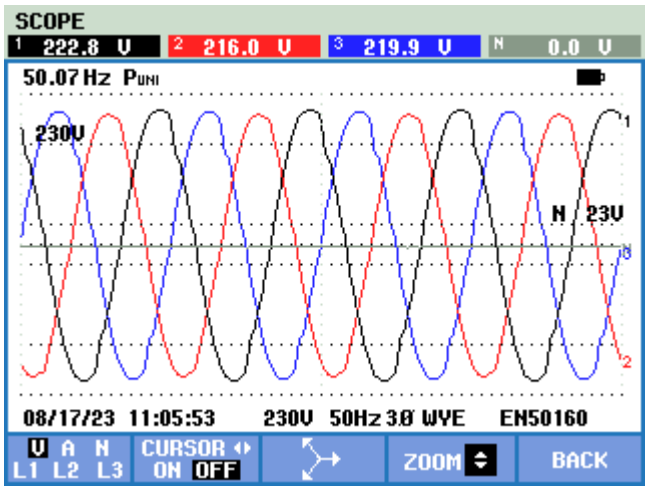


Fig 30: Electrical Readings recorded by Fluke 434-ll power analyser

7.6 Waveforms from Fluke 434-ll Power Analyser in Pharmacy Campus, Ooty



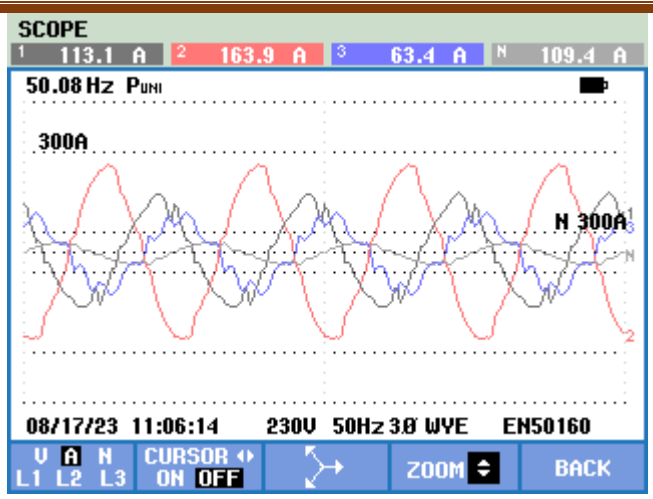


Fig 31: Voltage and Current (Distorted) Sinusoidal Waveform of the Campus

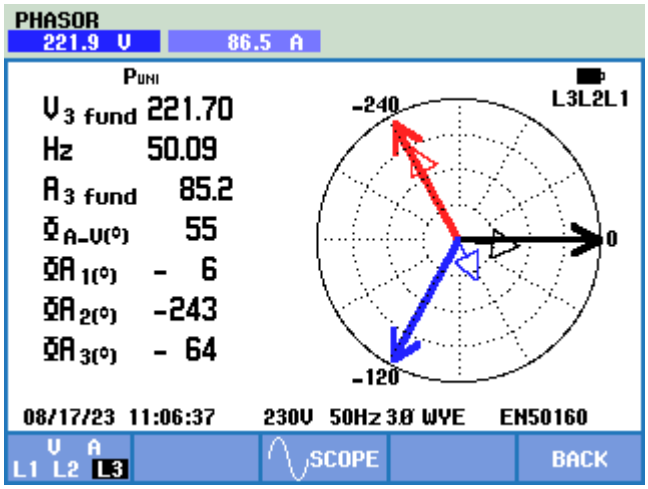


Fig 32: Phasor Diagram of Voltage

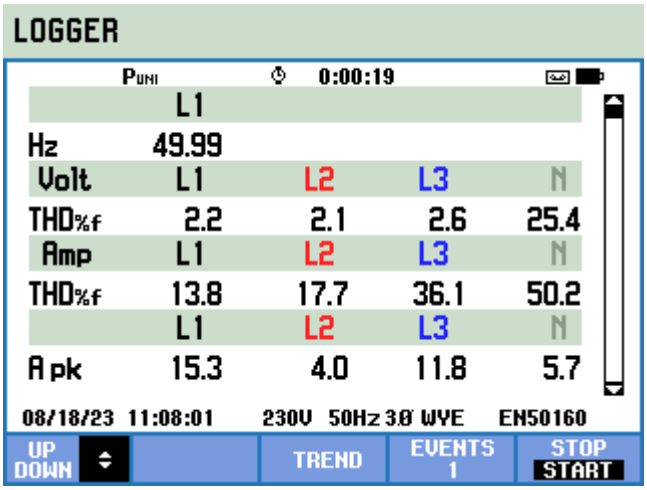


Fig 33: Voltage Harmonics of Campus

Observations: Analysis using Power Analyzer shown that the current load on each phase is not balanced properly and unbalanced current is flowing through the neutral conductor. This is causing harmonic distortions which will adversely affect the life of the electrical equipment used in your campus. Hence it is recommended to balance the loads on each phase of the bus bar properly by redistributing the load on each phase.

CHAPTER 8

ENERGY CONSERVATION MEASURES

The following energy conservation measures can be adopted at JSS AHER, Mysuru.

8.1 Replace Fluorescent Tube Lights (FTL) with LED Tube Lights

The 36 W FTLs can be replaced with the LED tube lights 20 W. These changes can be made at the places where the usage is higher. Usually minimum of 1 years warranty is given and approximate burning hours is 40,000. (15 years considering 8 hours per day running).

Following calculations (Table 19) are done for 5 hours working for JSS College of Pharmacy Mysuru Campus:

Table 19: Calculations to Replace Fluorescent Tube Lights (FTL) with LED Tube Lights

Power consumption by 36 W FTL with conventional choke	= 40 W/ Tube Light.
Equivalent LED tube light	= 20 W/ Tube Light.
Savings in power	= 20 W/ Tube Light.
Operating hours = 5 h/day x 300	= 1500 h/year.
Tube Light Yearly savings	= 1500 x 20 W = 30 kWh/year/Tube Light.
Average Cost of electricity	= Rs. 8.5/ kWh.
Saving	= 30 kWh x 8.5 = Rs. 255 / year / Tube light.
Approximate investment on single LED Tube lights	= Rs. 219. (Panasonic LED20W Batten, 1 pc).
Number of Tube Lights to be replaced	**= 350**
Electrical Energy Saved	**= 30 x 350** = 10500 kWh / yr
Total Yearly Saving =350 x 255	=**Rs. 89250 /-year**
Total Investment =350 x Rs.219	**=** Rs.76,650/-
Payback	**(**76,650/89250**)*** 12 months **= 11 months**

Summary of replacing fluorescent light with led lights in all the campuses is listed in the Table 20.

Table 20: Summary of Energy Savings, Cost Savings and Implementation Cost

Sl, No,	Location	Wattage		Nos.	Working Hours per day	No. of days in a year	Energy Savings kWh/yr	Cost Savings	Imp Cost	Payback Period
		Current	Proposed							
1	JSSCPM	40	20	350	5	300	10,500	89,250	76,650	11
2	JSSMC	40	20	840	6	300	30,240	2,57,040	1,83,960	9
3	JSSMC Girls Hostel	40	20	410	6	300	14,760	1,25,460	89,790	9
4	JSSAHER Canteen	40	20	27	6	300	972	8,262	5,913	9
5	JSSAHER	18	9	134	4	300	1,447	12,301	13,400	14
6	JSSDC	40	20	313	5	300	9,390	79,815	68,547	11

7	SLSM	40	20	155	7	300	6,510	55,335	33,945	8
8	JSSCPO	40	20	345	9	300	18,630	1,58,355	75,555	6
9	JSSCPO	18	9	40	9	300	972	8,262	4,000	6
Total	**-**			**2,614**			**93,421**	**794,080**	**5,51,760**	**9**

This recommendation has a annual savings Rs. 7**,94,080** and an implementation cost of Rs. **5,51,760** with a simple payback of **9** months.

8.2 Replace the existing induction motor fans with new BLDC motor fans in JSS AHER Campus

Brush-Less Direct Current (or BLDC) fans are advanced fans that use special motors known as brushless motors. These motors have special electronics that helps them to spin, so that they use less electricity and also these fans have higher life than normal fans due to this new technology. Since they have lesser moving parts, they need less maintenance. BLDC fans produce less heat since they do not have brushes and hence last longer than conventional fans.

A BLDC motor fan consumes approximately 28 watts, while the induction motor fan in the campus consumes 55 Watts[1] on average. The list of fans in the campus is shown in the Table 21.

Table 21: List of fans used in the JSSAHER Campus

Location	Quantity	Wattage	Average Consumption	Usage per day	No of days
Medical College	820	70	55	6	300
Boys Hostel	272	70	55	6	300
Girls Hostel	592	70	55	6	300
Dental College	414	70	55	5	300
Dental College	225*	70	75	5	300
School of Life Sciences	169	70	55	7	300
JSSAHER Guest House	71	70	55	4	300
JSSAHER Admin Bldg	45	70	55	6	300
JSSAHER Canteen	18	70	55	6	300
JSSCPM	713	70	55	5	300
JSS Ramanuja Road Campus	113	60	55	8	300

*Old Rheostat type Fan Regulator

It is recommended to replace the existing fans as listed above with BLDC fans since the usage is higher in these areas. Sample calculation to replace the existing induction motor fans with new BLDC motor fans are shown in the Table 22.

[1] https://www.crompton.co.in/product-category/consumer-fans/ceiling-fans/energy-efficient-and-low-voltage/

Table 22. Sample Calculation to replace induction motor fans with BLDC motor fans

Energy Consumption per Year	Electricity Cost /Year	Total Energy Savings (w.r.t BLDC fans every year)	Total Cost Savings (w.r.t BLDC fans every year)	BLDC fans cost*	Pay Back Period
820 fans x 55 W/Fan x 6 hours/day x 300 days/yr = 81,180 kWh	81,180 kWh x ₹8.5 /kWh = 690,030	820 fans x (55–28) W/fan x 6 hours/day x 300 days/yr = **39,852 kWh**	= 39,852 x ₹8.5 /kWh = ₹338,742	= (₹2,200 x 820 fans = **₹1,804,000**	=₹1,804,000/₹338,742 x 12 months/yr = 64 **months**

*The existing old fans can be traded in for new fans for ₹ 300 which is not considered here

Table 23 shows the summary of Energy savings, Cost Savings, implementation cost and payback period.

Table 23: Summary of Energy Savings, Cost Savings, Implementation Cost & payback

Qty	Wattage	Hours / day	No. of days	Current Electricity Cost	Proposed Wattage	Energy Savings	Cost Savings	BLDC Fan Cost	Payback period
820	55	6	300	6,90,030	28	39,852	3,38,742	18,04,000	64
272	55	6	300	2,28,888	28	13,219	1,12,363	5,98,400	64
592	55	6	300	4,98,168	28	28,771	2,44,555	13,02,400	64
414	55	5	300	2,90,318	28	16,767	1,42,520	9,10,800	77
225	75	5	300	2,15,156	28	15,863	1,34,831	4,95,000	44
169	55	7	300	1,65,916	28	9,582	81,450	3,71,800	55
71	55	4	300	39,831	28	2,300	19,553	1,56,200	96
45	55	6	300	37,868	28	2,187	18,590	99,000	64
18	55	6	300	15,147	28	875	7,436	39,600	64
713	55	5	300	4,99,991	28	28,877	2,45,450	15,68,600	77
113	55	8	300	1,49,160	28	7,322	73,224	2,48,600	41
3,452				**28,30,472**		**1,65,615**	**14,18,714**	**75,94,400**	**64**

This recommendation has a annual savings Rs. 14,18,714 and an implementation cost of Rs.75,94,400 with a simple payback of 64 months.

Fig 34: BLDC Fan in JSS College of Pharmacy Hostel, Mysuru Campus

8.3 Retrofit existing inefficient and old Fan Regulators with Electronic Regulators in Dental college campus to Save Energy

The difference between the electronic and ordinary electrical regulator is that in electronic regulator power losses are less because as we decrease the speed the electronic regulator gives the power needed for that speed but in case of ordinary rheostat type regulator, the power wastage is same for every speed and no power is saved. In electronic regulator, triac is employed for speed control by varying the firing angle speed and it is controlled but in rheostatic control resistance is decreased by steps to achieve speed control[2]. Also, capacitive type fan regulators are available that will save energy compared to rheostat type of regulators. Following calculations (Table 24) are done for 5 hours working:

Table 24: Calculations to Replace old Fan Regulators with Electronic Regulators

Power consumption by 70 W with conventional regulator from full speed to minimum speed	**= 75 W/ fan**
Equivalent Energy Efficient Regulator	**= 55 W/ Fan**
Savings in power	**= 20 W/ Fan**
Operating hours = 5 h/day x 300	**= 1,500 h/year**
Fan Energy Yearly savings = 1,500 x 20	**= 30 kWh/year/Fan**
Average Cost of electricity	**= Rs. 8.5/ kWh**
Saving = 30 kWh x 8.5	**= Rs. 255 / year / Fan**
•Approximate investment on single Electronics Regulators	**= Rs.250 (Approximate)**
Number of Fan Regulators to be replaced	**= 225**
Electrical Energy Saved = 30 x 225	**= 6,750 kWh / yr.**
Total Yearly Saving =225 x 255	= Rs. 57,375 /year
Total Investment = 225 x Rs. 250	= Rs. 56,250/-
Payback	**= (56,250/57,375) = 0.98** Year = around 12 months.

This recommendation has a annual savings Rs. 57,375 and an implementation cost of Rs. 56,250 with a simple payback of 12 months.

[2] https://engineeringslab.com/all_interview_questions/what-is-the-difference-between-electronic-regulator-and-ordinaryelectrical-rheostat-regulator-for-fans-3655.htm#:~:text=regulator%20for%20fans%3F-, The%20difference%20between%20the%20electronic%20and%20ordinary%20electrical%20regulator%20is, wastage%20is %20same%20for%20every

Fig 35: Old Rheostat type Fan Regulator in the campus & Proposed Electronic Regulator

8.4 Replace the existing old Air Conditioners with 5 Star Air Conditioners with inverter technology

The main difference between an inverter and non-inverter AC lies in their compressor speed. An inverter AC has a variable speed compressor, while a non-inverter AC has a fixed speed compressor. Variable speed compressors are more energy efficient than their fixed counterparts and make less noise as well.

An inverter air conditioner is a type of air conditioning unit that can adjust the compressor's motor speed to regulate the temperature. The use of an inverter switch allows for greater flexibility in terms of power usage. Inverter ACs are more energy efficient than non-inverters because they can change their power consumption depending on how hot it is outside, or if you have multiple people in your home at any given time.

Another difference worth mentioning is that the refrigerant used in non-inverter AC emits harmful emission which adversely impacts the environment. Modern inverter ACs use efficient refrigerants such as R32 which provides better cooling capacity and emits less harmful emissions to the environment.

Inverter ACs save up to 30% of electricity compared to non-inverters[3].

Non-inverter air conditioners use the on/off method, where the compressor is switched on and off at regular intervals to maintain the desired temperature. This uses more energy than inverters and can result in more wear and tear on your system. Compressors that are non-inverters do not run at full speed all the time, making them less efficient than their inverter counterparts.

As said before, an inverter AC uses variable speed compressors, which have a wider range of speeds compared to on/off compressors used by non-inverters. This allows it to operate in more modes that take advantage of different conditions and load requirements, thereby improving its efficiency throughout a wide range of operating conditions. Table 25 shows the sample calculations for replacing old Ac with 5 Star inverter AC in Dental College.

Oytput wattage for 1.5 ton AC	Star Rating (Split AC)	Min EER needed	Input Wattage
(Watts)	Stars	W/W	(Watts)
5275	*	2.7	1954
5275	**	2.9	1819
5275	***	3.1	1702
5275	****	3.3	1598
5275	*****	3.5	1507

Fig 36: Output and Input Wattage of Air Conditioners based on Star Rating

[3] https://www.tcl.com/global/en/blog/what-is-the-difference-between-inverter-and-non-inverterac#:~:text=Inverter%20ACs%20save%20up%20to,electricity%20compared%20to%20non%2Dinverters.

Table 25: Sample calculations for replacing old AC with 5 Star inverter AC

Existing Energy Consumption per Year	Proposed Energy Consumption per Year	Total Energy Savings	Total Cost Savings	Air Conditioner cost	Pay Back Period
2.3 kW x 21 units x 5 hours/day x 300 days/yr. = 72,450 kWh	1.5 kW x 21 units x 5 hours/day x 300 days/yr. = 47,250 kWh	= 72,450 - 47,250 =25,200 **kWh**	= 25,200 x ₹ 8.5 /kWh = ₹ 214,200	= 21 x ₹ 37,500 = ₹ 7,87,500	= ₹ 7,87,500 /₹ 214,200 x 12 months/yr. = 44 **months**

Following tables 26 & 27 shows the AC Details, AC rating, Energy Savings, Energy Cost Savings, and payback period for this recommendation.

Table 26: AC Details and rating

Sl. No.	Equipment	LOCATION	Usage per day	No. of Units	Capacity in TR	Old AC Input Kilo Watts	New AC Input Kilo Watts	Implementation Cost per unit
1	SPLIT AC	Dental College	5	21	1.5	2.3	1.5	37,500
2	SPLIT AC	Pharmacy College	5	29	2	2.9	2.0	50,000
3	SPLIT AC	Medical College	3	23	1.5	2.3	1.5	37,500
4	SPLIT AC	Medical College	3	28	2	2.9	2.0	50,000
5	SPLIT AC	Medical College	3	38	3	4.3	3.0	75,000
6	SPLIT AC	School of Life Sciences	4	8	1	1.4	1.0	25,000
7	SPLIT AC	School of Life Sciences	24	4	1.5	2.5	1.5	37,500
8	SPLIT AC	School of Life Sciences	4	2	1.5	2.5	1.5	37,500

Table 27: Energy Savings, Energy Cost Savings, and payback period

Sl. No.	Current Energy Consumption	Proposed Energy Consumption	Energy Savings	Total Cost Savings	Implementation Cost	Payback Period
1	72,450	47,250	25,200	2,14,200	7,87,500	44
2	1,26,150	87,000	39,150	3,32,775	14,50,000	52
3	47,610	31,050	16,560	1,40,760	8,62,500	74
4	73,080	50,400	22,680	1,92,780	14,00,000	87
5	1,47,060	1,02,600	44,460	3,77,910	28,50,000	90
6	13,440	9,600	3,840	32,640	2,00,000	74
7	72,000	43,200	28,800	2,44,800	1,50,000	7
8	6,000	3,600	2,400	20,400	75,000	44
Total	**5,57,790**	**3,74,700**	**1,83,090**	**15,56,265**	**77,75,000**	**60**

This recommendation of replacing old AC with 5-star Inverter AC will result in energy savings of 183,090 kWh, cost savings of ₹15,56,265 per year with implementation cost of ₹ 77,75,000 and a payback of 60 months.

Fig 37: Old Non-inverter AC in the campus

Fig 38: New Inverter AC in the campus

8.5 Install Occupancy (Motion) Sensors in Designated Areas

Install occupancy sensors with ultrasonic motion sensing in the Gallery 05 of Medical College, Class rooms of Pharmacy College, Mysuru and Hostel areas of Pharmacy College, Ooty to reduce the electrical usage for lighting and fans during unoccupied periods. The list of areas identified for installing occupancy sensors is shown in Table 28. Gallery 05 is a big classroom and many times there will be very few students and it was the situation at the time of assessment.

By wiring occupancy sensors into this area, the lighting and fan usage could be reduced during unoccupied periods. It is estimated that by installing occupancy sensors, usage of lighting and fans can be reduced by at least 2 hours per day. It is recommended to install one occupancy sensor for every 2 lights and 2 fans and the calculations are shown in Table 29.

Table 28: List of lights and fans identified to install occupancy sensors

Location	Type of Unit	Total No. of Units	Wattage per unit (W)	Total Wattage (W)	Hours of Energy Saving (hr/yr)
JSS Medical College					
Gallery 05, JSSMC	Fluorescent Lights	21	40	840	600
Gallery 05, JSSMC	Ceiling Fans	14	55	770	600
Gallery 05, JSSMC	Wall mount fans	10	55	550	600
Total		**45**		**2,160**	
JSS College of Pharmacy, Mysuru					
10 Class rooms, JSSCPM	Fluorescent Lights	100	40	4000	600
10 Class rooms, JSSCPM	Ceiling Fans	80	55	4400	600
Total		**180**		**8,400**	
JSS College of Pharmacy, Ooty					
Boys Hostel Bath Rooms	LED Lights	24	20	480	4,380
Boys Hostel Bath Rooms	LED Lights	64	9	576	4,380
Boys Hostel Corridor	LED Lights	36	9	324	4,380
Girls Hostel Bath Rooms	LED Lights	32	20	640	4,380
Girls Hostel Bath Rooms	LED Lights	16	20	320	4,380
Girls Hostel Corridor	LED Lights	8	12	96	4,380
Total	**-**	**180**	**-**	**2,436**	**-**

Table 29: Calculations for Installing Occupancy (Motion) Sensors

Energy Savings for JSSMC, ES1	= 2,160 x 600 / 1,000 = 1,296 kWh/yr
Energy Savings for JSSCPM, ES2	= 8,400 x 600 / 1,000 = 5,040 kWh/yr
Energy Savings for JSSCPO, ES3	= 2,436 x 4,380 / 1,000 = 10,670 kWh/yr
Total Energy Savings = ES1 + ES2 + ES3	=1,296 + 5,040 +10,670 = 17,006
Energy Cost Savings, ECS	= ES x (unit cost of electricity) = 17,006 kWh/yr x 8.5 Rs./kWh

	= Rs. 144,551/-
No of occupancy Sensor required for JSSMC	45/4 = 11.25 ~ = 12
No of occupancy Sensor required for JSSCPM	18/4 = 4.5 ~ = 5 x 10 Classrooms = 50
No of occupancy Sensor required for JSSCPO	16 Bath Rooms x 3 + 8 Corridors x 3 = 72
Total no. occupancy Sensors required	12 + 50 + 72 = 134
Cost of one occupancy sensor in Rs.	450/-
Capital cost (CC) for the occupancy sensors in Rs.	134*450 =60,300/-
Installation and wiring cost per sensor in Rs.	300/-
Total Installation cost in Rs.	134*300 = 40,200/-
total implementation cost	60,300 + 40,200 = 100,500
Payback period	(100,500/144,551)*12 months = 8 months

The occupancy sensors recommended would work in conjunction with the existing switches. Several types of controls are available, including motion sensors. An ultrasonic motion-sensing controller, which produces a low intensity, inaudible sound and detects changes in the sound waves caused by any type of motion, can be used for the designated areas. Also, Passive infrared sensors can be used. PIR (passive infrared) sensors utilize the detection of infrared that is radiated from all objects that emit heat. This type of emission is not visible to the human eye, but sensors that operate using infrared wavelengths can detect such activity.

Fig 39: Occupancy Sensor

The total cost savings of Rs. **1,44,551/yr** will pay for the implementation cost of **Rs. 100,500** in **8** months.

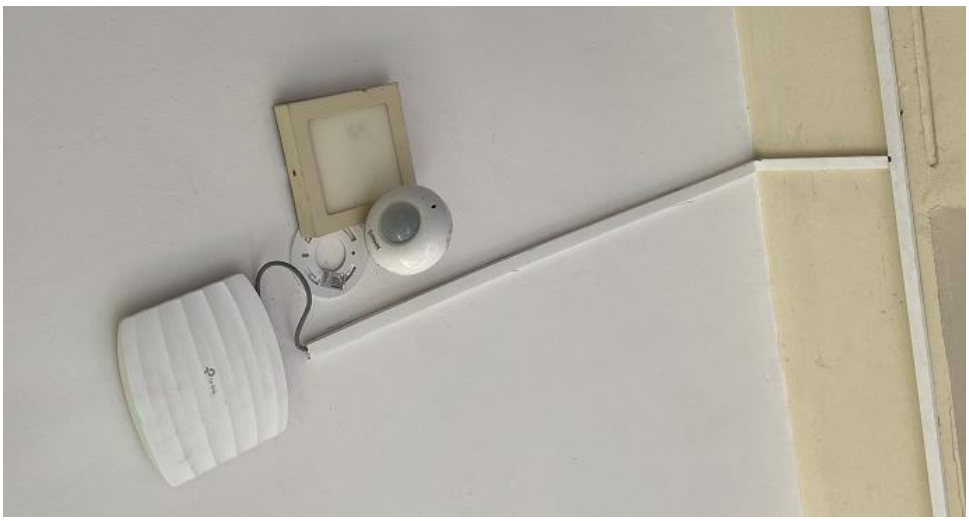


Fig 40: Occupancy / Motion Sensor in Pharmacy College Hostel, Mysuru Campus

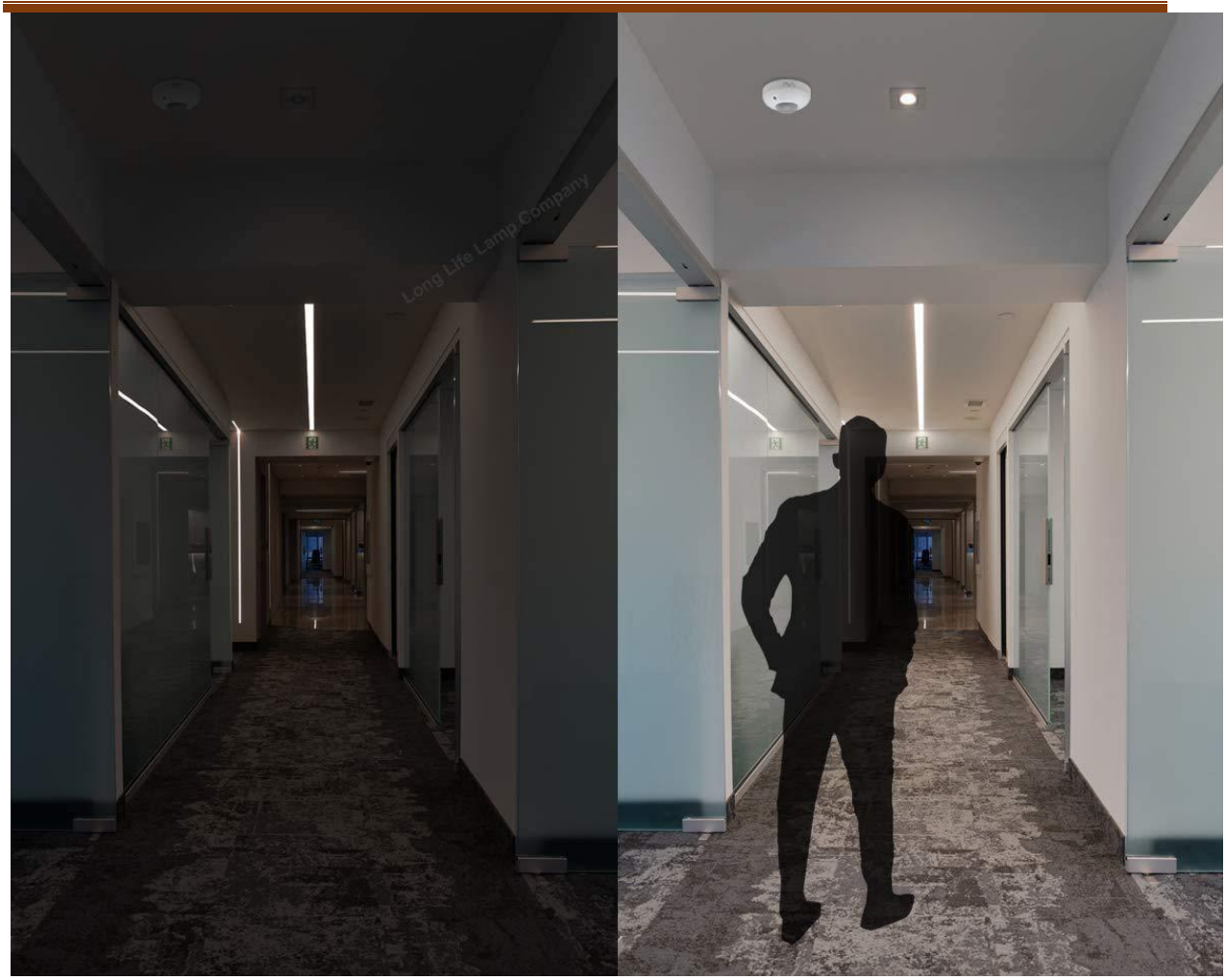


Fig 41: Working of Lights with and without Occupancy / Motion Sensor

8.6 Use solar water heater in conjunction with heat pumps to reduce water heating energy consumption for the hostel

Currently the campus has heat pumps of different ratings as shown in the Table 30 to heat the water for hostel students. Earlier, Solar water heaters were used in conjunction with heat pumps and have been disconnected now. It is recommended to use solar water heaters to heat the water along with heat pumps to save energy. Also, regular maintenance of solar water heater will help to increase its life. It is estimated that solar water heater can provide hot water for 80% of the time in a year due to climatic condition of Mysuru and heat pump has to be used during remaining 20% of the time.

Table 30: Heat pumps in the Campus

Sl. No,	Location	Rating in kW	No. of Units
1	JSSCPM	5	2
2	JSSMC	4.28	7
3	JSSMC	4.8	5
4	JSSMC	4.5	2
5	JSSMC	2.4	2
6	JSSMC	4.9	1
7	JSSMC	3.6	1
	Total	**29.48**	**20**

Sample calculations are shown Table 31 for 5 kW rated heat pump in JSSCPM.

Table 31: Calculations for using solar water heater in conjunction with heat pump

Rated Heating capacity	5kW
No. of heat pumps	2
Water capacity	7 LPM or 420 liters per hour
Usage per day	5 hours or 2100 ltrs
Energy consumed per heat pump	5 kW x 5 hours = 25 kWh
Total Energy consumed by two heat pumps per day	25 kWh x 2 = 50 kWh
Current Annual energy consumption	50 kWh*300 days/yr = 15,000 kWh
Current Electricity Cost per year	15,000 kWh*8.5 = 1,27,500/-
Total Cost savings in Rs.	= 0.8 x 1,27,500 = 1,02,000
Cost of Solar water heater 1000 L	75,000/-
No. of Solar water heaters required	2 x 2 = 4
Total Cost of Solar water Heater	3,00,000/-
Payback period	(3,00,000/1,02,000)*12 months = 36 months

It is recommended to install 2 Solar water heaters of 1000 liters capacity in place of one 5 kW heat pump. So, totally 4 Solar water heaters of 1000 liter capacity are

required for the above example. Similarly calculations are done for other heat pumps for 5 hours usage in a day and 300 days in a year and are summarized as shown in the Table 32.

Table 32: Energy Savings, Energy Cost Savings, and payback period

Sl. No.	Rating in kW	No of Units	Water supplied in Liters	Current Energy used in kWh	Current Energy Cost	Energy Savings	No of Solar Water heaters reqd.	Imp Cost	Payback in months
1	5	2	4,200	15,000	1,27,500	1,02,000	4	3,00,000	36
2	4.28	7	14,000	44,940	3,81,990	3,05,592	14	10,50,000	42
3	4.8	5	10,000	36,000	3,06,000	2,44,800	10	7,50,000	37
4	4.5	2	4,000	13,500	1,14,750	91,800	4	3,00,000	40
5	2.4	2	2,000	7,200	61,200	48,960	2	1,50,000	37
6	4.9	1	2,000	7,350	62,475	49,980	2	1,50,000	37
7	3.6	1	2,000	5,400	45,900	36,720	2	1,50,000	50
Total	**29**	**20**	**38,200**	**1,29,390**	**10,99,815**	**8,79,852**	**38**	**28,50,000**	**39**

The total energy savings is **103,512** kWh/yr, the total cost savings is Rs. **8,79,852**/yr and will pay for the implementation cost of Rs. **28,50,000** in **39** months.

Fig 42: Existing Heat pump in Pharmacy Hostel

Fig 43: Disconnected Solar Water Heater in Pharmacy Hostel

Fig 44: Proposed Solar Water Heater with Evacuated Tube Collector Technology

8.7 Install Variable Speed Drives on the Refrigerant Compressors of Air conditioner used for Animal House

Replace the single speed drives on the refrigerant compressors with variable speed drives (VSD) to save electrical energy usage.

An adjustable speed drive (ASD) is a device that controls the rotational speed of motor-driven equipment. Variable frequency drives (VFDs), the most common type of ASDs, efficiently meet varying process requirements by adjusting the frequency and voltage of the power supplied to an AC motor to enable it to operate over a wide speed range. External sensors monitor flow, or pressure or temperature or some parameter and then transmit a signal to a controller that adjusts the frequency and speed to match process requirements.

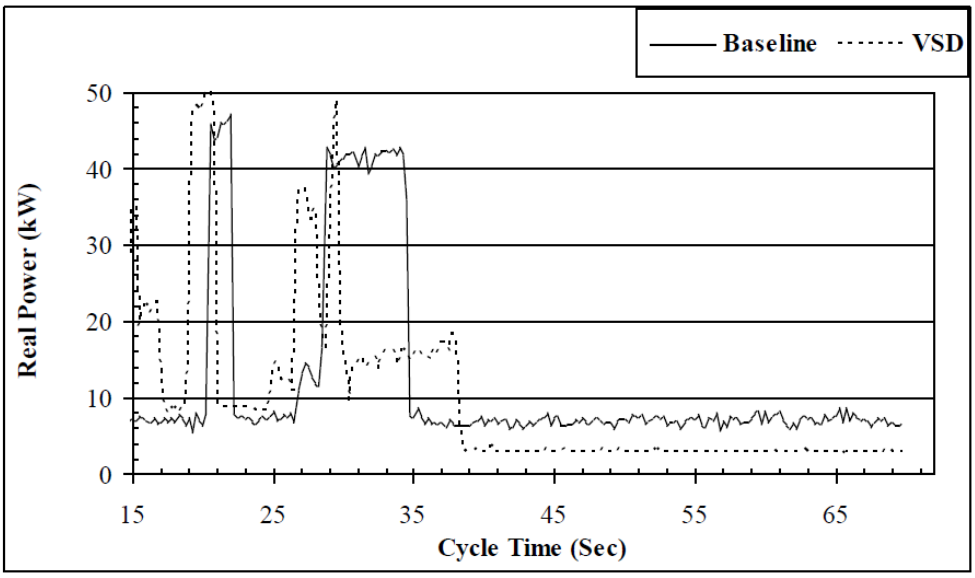


Fig 45: Real power requirement for single speed and variable speed drives

As shown in different case studies, e.g., Figure 45, the real power requirements with variable frequency drives are much less than that with single speed drives. For operations with smaller cycle times, the variable frequency drives are not efficient as they change the speed frequently, which results into inefficient operations.

Currently, the Medical college campus has two air conditioners that supply cold air to animal house at 24^{o}C. These air conditioners are used 24 hours a day throughout the year. These air conditioners operate at part loads for a vast majority of time in a calendar year because of varying ambient conditions. The operating conditions of these air conditioners are shown in Table 33.

Table 33: Air Conditioners Details

Name	Tons of Refrigeration	Input kW	Qty	Load Factor	Usage Factor
Air conditioner (AHU)	8.8	5.4*	**1**	**0.6***	**0.4***
Air conditioner (AHU)	5.5	3.4	**1**	**0.6**	**0.4**
Total	14.3	8.8	**2**	**-**	**-**

* Estimated

Limitations of conventional compressors

Traditionally the part load performance of compressors is modulated through a slide valve mechanism which controls the rate of compression of refrigerant in the compressor and thereby the cooling capacity. Because of its inherent design limiting compression ratios, the slide valve invariably either over-compress or under-compress the refrigerant, resulting in:

- Loss of efficiency.
- Higher power consumption
- High starting current

Also, many compressors work in on and off mode to adjust to the partial load conditions which creates lot of wear and tear on the compressor and its motor. The input power at partial loads for normal compressors and VFD compressors is shown in Figure 46. The VFD compressors can save up to 30% energy depending on the load and for average load of around 60%, the savings is around 15% from the Figure 46. Also, VFD drives can reduce the electrical demand by reducing the startup current requirement.

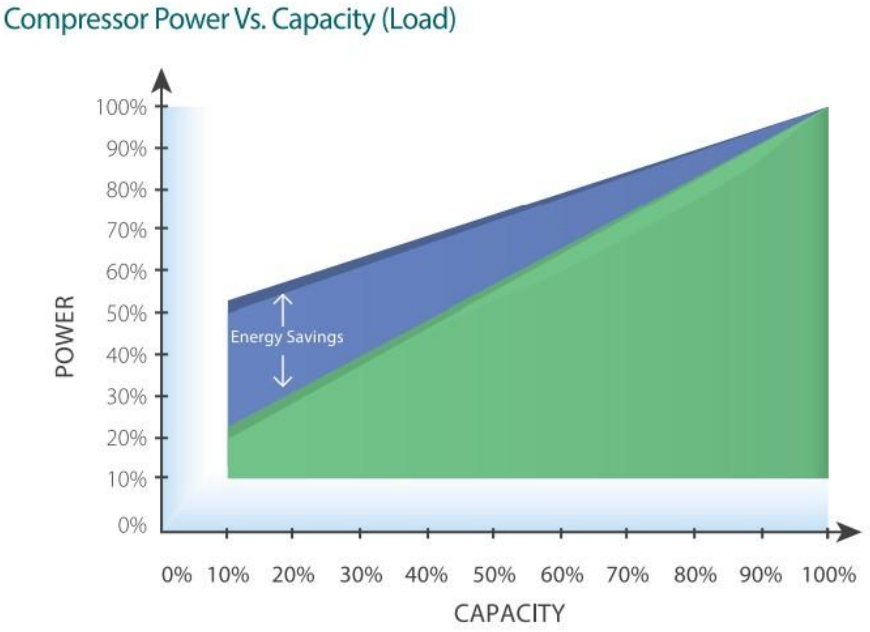


Fig 46: Input Power at Partial loads by different type of compressors[4]

Energy Savings

The energy savings can be estimated as follows.

ES = TkW x LF x UF x OH x %S

Where,

TkW = Total Input power

LF = Load factor

[4] https://www.bluestarindia.com/media/70922/vfd-screw-chiller.pdf

UF	=	Usage factor
OH	=	Operating hours per year, 8,760
%S	=	15%

The energy savings is calculated as,

ES = 8.8 x 0.60 x 0.4 x 8,760 x 0.15
= 2,775 kWh/yr.

The energy cost savings (ECS) is given as follows:

ECS = TES x $/kWh
= 2,775 kWh/yr. x ₹8.5/kWh
= ₹23,588/yr.

Implementation

The implementation of this recommendation involves purchase and installation of VSD on the compressor motors. The capital cost (CC) for the VFD is estimated as ₹ 10,000 per compressor. It is estimated that the installation cost of the VSD drive will be 50% of the capital cost. The installation cost (IC) and capital cost (CC) for the installations can be estimated as,

IC = 2 drives × 5,000
= ₹ 10,000

CC = 2 drives × 10,000
= ₹ 20,000

Therefore, total implementation cost (IC) is given as,

IC = CC + LC
= ₹20,000 + ₹10,000
= ₹30,000

The simple payback period (PP) can be calculated as,

PP = (IC / ECS) x 12 months/yr.
= (₹ 30,000/₹ 23,588) x 12
= 16 months

The cost savings of ₹ 23,588/yr. will pay for the implementation cost of ₹ 30,000 within 16 months.

Note: It may be noted that the non-linear loads on motors and VFDs impose power quality problems. The facility is encouraged to periodically check for problems such as harmonics. These undesirable characteristics should be corrected as soon as possible.

Fig 47: Existing Air Conditioners in the facility that can be fitted with VFD

Fig 48: A Sample VFD

8.8 Paint the roof with white Reflective Roof-Top Coating to reduce heat load on two Air conditioners of 50 tons capacity in JSS Ramanuja Road Campus Building

White roofing can reduce the heat gain of a roof, lower the surface temperature and lessen the cooling load of the building. White roofs also extend the life of the roof since the material will expand and contract less from changing temperatures. White roofs are also easy to maintain as they can be recoated, eliminating the need for tearoff over the life of the building. Due to the high solar reflectance, white roofs are sometimes called "cool roofs."

Ceilings can be hot in summers, but not for those living in apartments (not the top floor). But for most single-family homes or apartments at the top of the building, the ceilings face direct sun. Most construction materials are good conductors of heat. That means a room that is directly facing heat from top remains very hot. Thus to cool it, a lot of energy is required by any air conditioner to cool it. If your electricity bills are high and you have rooms that have ceilings that that are exposed to the sun, then getting the right insulation for the ceiling should be your first target. This is especially important for people living in areas that have hot and dry climate, as sun's radiance levels are very high in such regions.

Reflective Roof-Top Coating can reduce ceiling heat

Several researches have shown that external colors of a building have significant impact on cooling load of the building. A white reflective roof coating can potentially reduce up to 60% of heat coming in from the ceiling. But the results vary in different situations. With various experiments, researchers have found savings to vary from 20% to 60% on AC load. Typical rooftop reflective coating paints are made of acrylics, hypalon, neoprene, silicone, urethane and hybrid materials. A quick search on google can provide a list of companies that make and supply reflective rooftop coating paints. Please note that the efficiency of the paint goes down with each passing year, so regular maintenance of the paint is a must to achieve maximum saving

Other benefits of Rooftop coatings

Rooftop coatings not only prevent extra heat from entering a building, but have many other benefits too:

- It can increase the life of the roof by 15 years or more.
- Dense cities with lot of swellings in a small area have tendencies of getting heated up significantly. If houses have reflective rooftops, then the amount of heat waves can be reduced.
- In general it can add to greening by reducing waste and saving electricity.

Fig 49: Existing Roof in Ramanuja Road Building and Proposed white paint for the roof

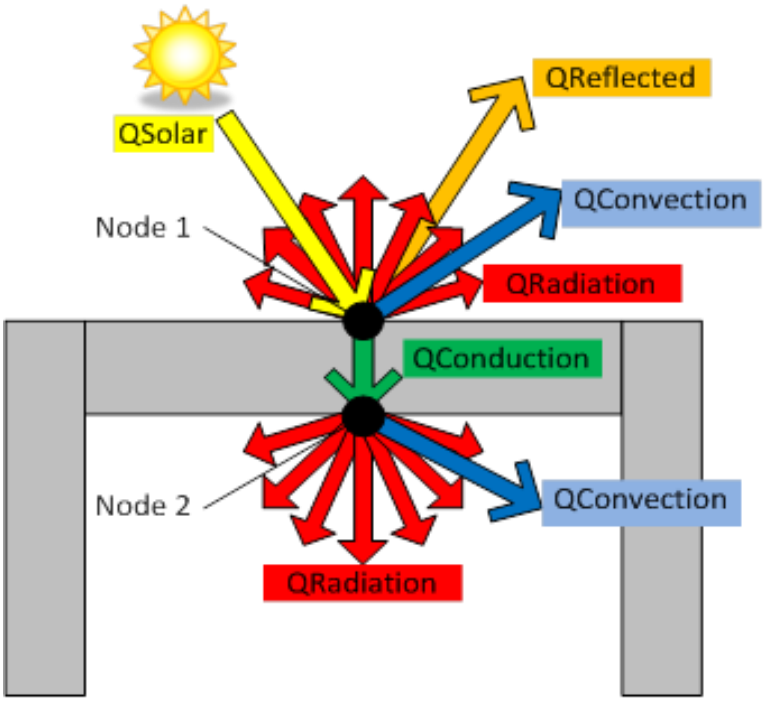


Fig 50: Heat Transfer Schematic for a Roof

The Skill lab of JSS Ramanuja road campus is fully air-conditioned and lies directly beneath the dark roof and has no insulation and hence is receiving heat from sun light that falls on the roof. The roof in JSS Ramanuja Road building is made out of bricks and is red in colour and hence it is recommended to paint the roof with white reflective coat painting. A standard white roof has an absorptivity of about 0.2, meaning 20% of the incident radiation is absorbed and the other 80% is reflected. AC load reduction of 20% is estimated for this recommendation conservatively.

The energy savings on two 50 ton AC can be estimated as follows.

ES = TkW x LF x UF x OH x %S

Where,

TkW	=	Total Input power (2 x 32 hp x 0.746 kW/hp = 48 kW)
LF	=	Load factor
UF	=	Usage factor
OH	=	Operating hours per year, 2 hrs/day x 300 days/yr = 600
%S	=	Percentage Savings, 20%

ES = 48 x 0.8 x 1 x 600 x 0.2

= 4,608 kWh/yr

The energy cost savings (ECS) is given as follows:

ECS = TES x $/kWh

= 4,608 kWh/yr. x ₹10/kWh

= ₹46,080/yr.

The implementation of this recommendation involves painting the roof with white reflective coating and the cost of the coating is estimated as ₹ 15/Sq. Ft. The total area of the roof is approximately 12,000 Sq. Ft. So, the total implementation cost will be as follows.

IC = Paint Cost / Sq. Ft. x Total Sq. Ft.

= ₹ 15/Sq. Ft. x 12,000 Sq. Ft.

= ₹180,000

The simple payback period (PP) can be calculated as,

PP = (IC / ECS) x 12 months/yr.

= (₹ 180,000/₹ 46,080) x 12

= 47 months

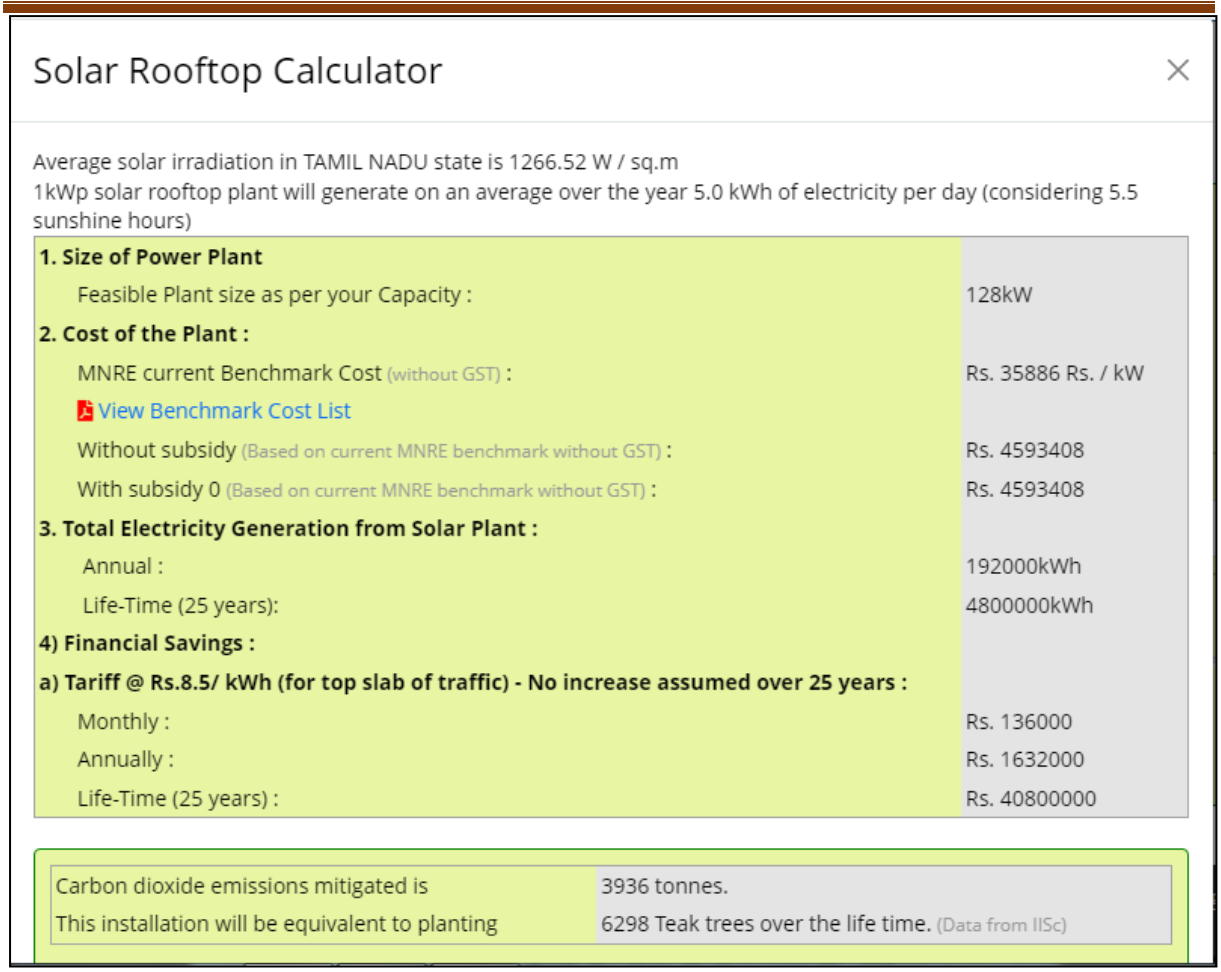
The cost savings of ₹ 46,080/yr. will pay for the implementation cost of ₹ 180,000 within 47 months.

8.9 Install Solar PV Rooftop in JSS College of Pharmacy, Ooty Campus

Average solar irradiation in TAMIL NADU state is 1266.52 W / sq.m. 1kWp solar rooftop plant will generate on an average over the year 5.0 kWh of electricity per day (considering 5.5 sunshine hours). Calculations to Install Solar PV Rooftop in JSS College of Pharmacy, Ooty Campus is shown in Table 34.

Table 34: Calculations to Install Solar PV Rooftop

Recommended Size of Power Plant	128 kW
Cost of the Plant: MNRE current Benchmark Cost (without GST) :	Rs. 35886 / kW
Total cost (without subsidy) in Rs.	Rs. 45,93,408/-
Total Electricity Generation from Solar Plant annually in kWh	1,92,000 per year
Annual Financial Savings in Rs.: Tariff @ Rs.8.5/ kWh (for top slab of traffic) - No increase assumed over 25 years	16,32,000
Carbon dioxide emissions mitigated is	3,936 tonnes.
installation will be equivalent to planting	6,298 Teak trees over the life time
Simple Payback period	(45,93,408/16,32,000)*12 =34 months



Solar Rooftop Calculator

Average solar irradiation in TAMIL NADU state is 1266.52 W / sq.m
1kWp solar rooftop plant will generate on an average over the year 5.0 kWh of electricity per day (considering 5.5 sunshine hours)

1. Size of Power Plant	
Feasible Plant size as per your Capacity :	128kW
2. Cost of the Plant :	
MNRE current Benchmark Cost (without GST) :	Rs. 35886 Rs. / kW
View Benchmark Cost List	
Without subsidy (Based on current MNRE benchmark without GST) :	Rs. 4593408
With subsidy 0 (Based on current MNRE benchmark without GST) :	Rs. 4593408
3. Total Electricity Generation from Solar Plant :	
Annual :	192000kWh
Life-Time (25 years):	4800000kWh
4) Financial Savings :	
a) Tariff @ Rs.8.5/ kWh (for top slab of traffic) - No increase assumed over 25 years :	
Monthly :	Rs. 136000
Annually :	Rs. 1632000
Life-Time (25 years) :	Rs. 40800000

Carbon dioxide emissions mitigated is	3936 tonnes.
This installation will be equivalent to planting	6298 Teak trees over the life time. (Data from IISc)

Fig 51: Solar Roof Top PV Power Plant Calculator

General Recommendations

- All Classrooms and labs to have Display Messages regarding optimum use of electrical appliances in the room like lights, fans, computers, and projectors. Save electricity. Display the stickers of save electricity, save nature everywhere in the campus. So that all stakeholders encouraged to save the electricity.
- Use motion sensor in corridors, passage, library, and toilets.
- All projectors to be kept OFF or in idle mode if there will be no presentation slides.
- All computers to have power saving settings to turn off monitors and hard discs, say after10 minutes/30 minutes.
- Lights in toilet area may be kept OFF during daytime.
- Need to replace FTL by smart LED Tube Need to replace ordinary bulb by LED bulb.
- Need to replace ordinary CRT monitor by LED.
- Need to replace ordinary refrigerator by BEE power saver refrigerator if possible.
- Install circuit breakers for each floor of the building to improve electrical safety.
- Check the quality of wiring and replace if required.
- Check old circuit breakers and replace them if required.
- Conduct functionality tests on earthing and earthing pits.

Executive Recommendations

- Energy auditing inside the premises has to be done on a regular basis and report should be made public to generate awareness.
- Need to create energy efficiency/ renewable energy awareness i.e., solar, wind, Biogas energy. College Facility should take initiative to arrange seminars, lectures, paper presentation competition etc., for general awareness.
- Regular electric lines installed above the ground are getting damaged due to wind and rain by trees in some areas of the campus (Figure 52) and these areas are staying darker in the night due to this reason and hence it is recommended to improve street light facility in these dark regions of the campus by installing underground cables.

Fig 52: Trees touching the electric lines in the Medical College campus

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APPENDIX

Fig 53: Pre-audit discussion between JSS Consultants and JSS AHER staff

Fig 54: JSS Consultants Energy Audit Team that visited JSS AHER Campus, Mysuru

Fig 55: JSS Consultants Energy Audit Team that visited JSS Pharmacy Campus, Mysuru

Fig 56: JSS Consultants Energy Audit Team that visited JSS Ramanuja Road Campus, Mysuru

Fig 57: JSS Consultants Energy Audit Team that visited JSS Pharmacy College, Ooty

Fig 58: Organic wet waste stacked in JSS Pharmacy College, Ooty Campus – candidate for Bio-Digester

Fig 59: Torn Insulation on 50 Ton AC in JSS Ramanuja Road Campus, Mysuru

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7.1.5

Geotagged photos of the green campus initiatives

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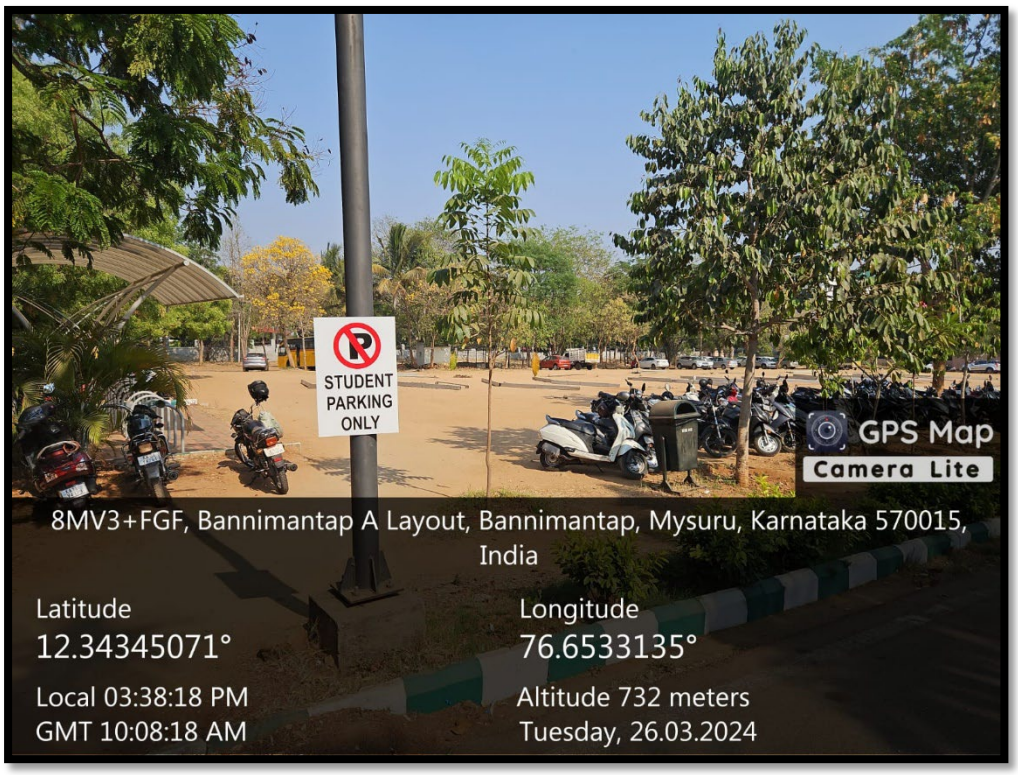
Restricted entry of automobiles

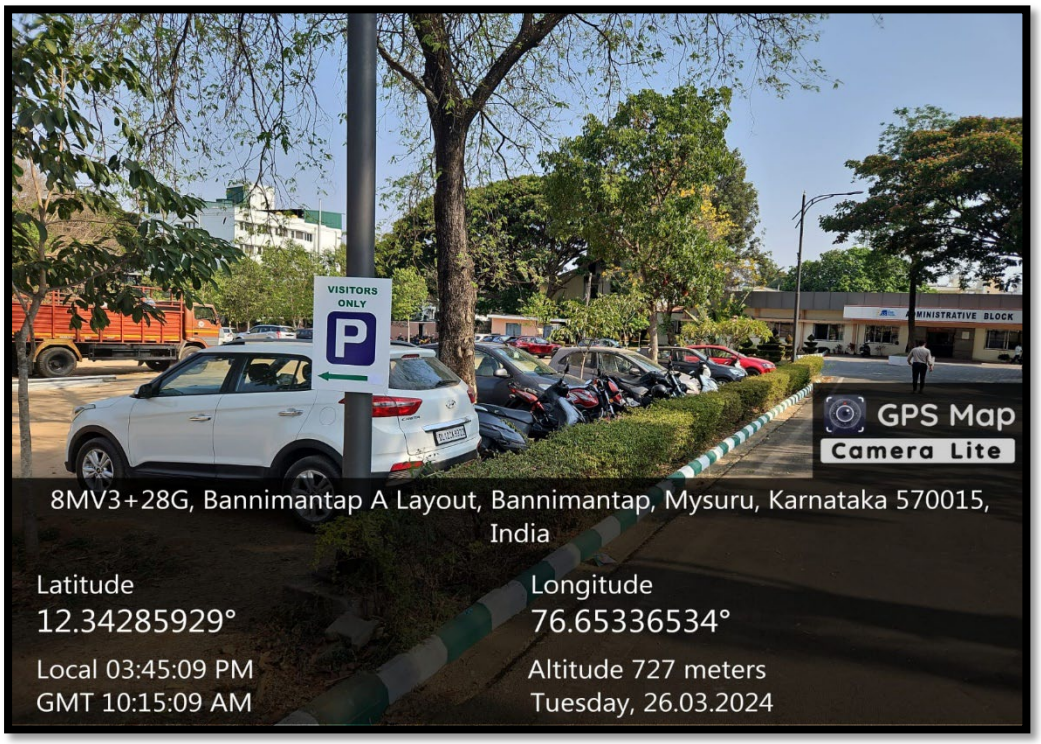
Signages for restricted entry of vehicles at entry gate of JSS AHER campus, Mysuru

Signages for ban on triple riding & speed limit of vehicles at entry gate of JSS AHER campus, Mysuru

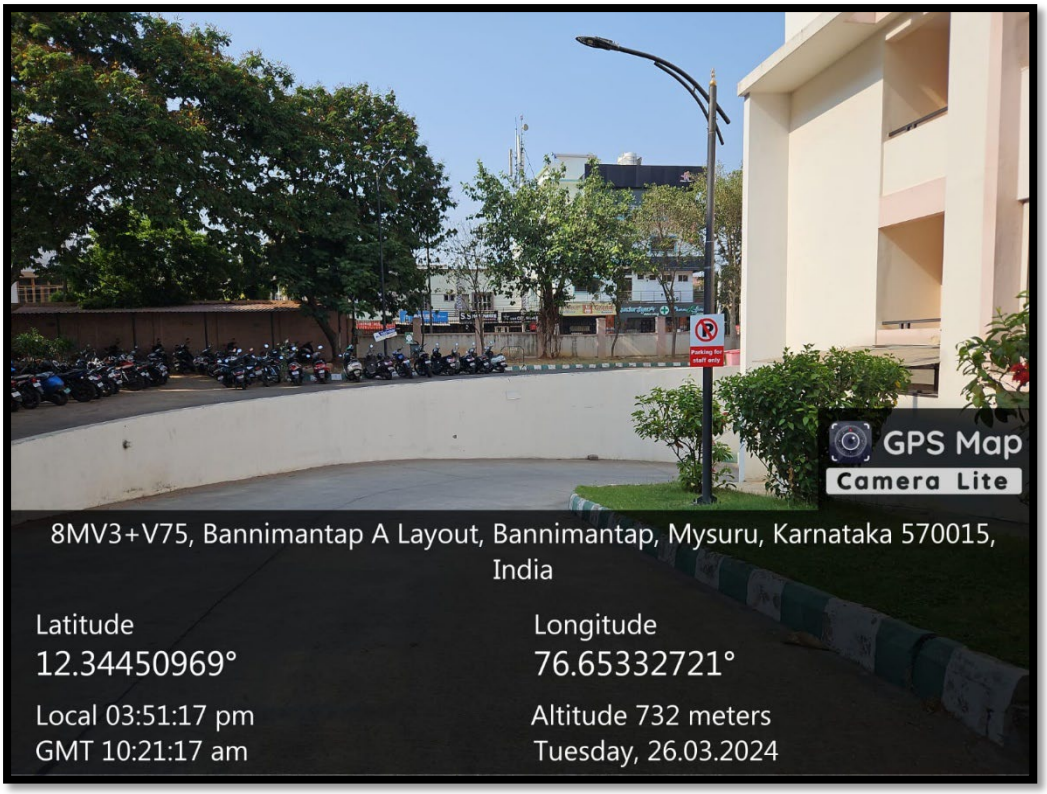
Signages for restricted entry of vehicles at entry gate of JSS College of Pharmacy campus, Mysuru



Signages for student vehicle parking at JSS MI campus, JSS AHER, Mysuru



Signages for visitor's vehicle parking at JSS MI campus, JSS AHER, Mysuru



Signages for staff vehicle parking at JSS Guest House Basement, JSS AHER, Mysuru

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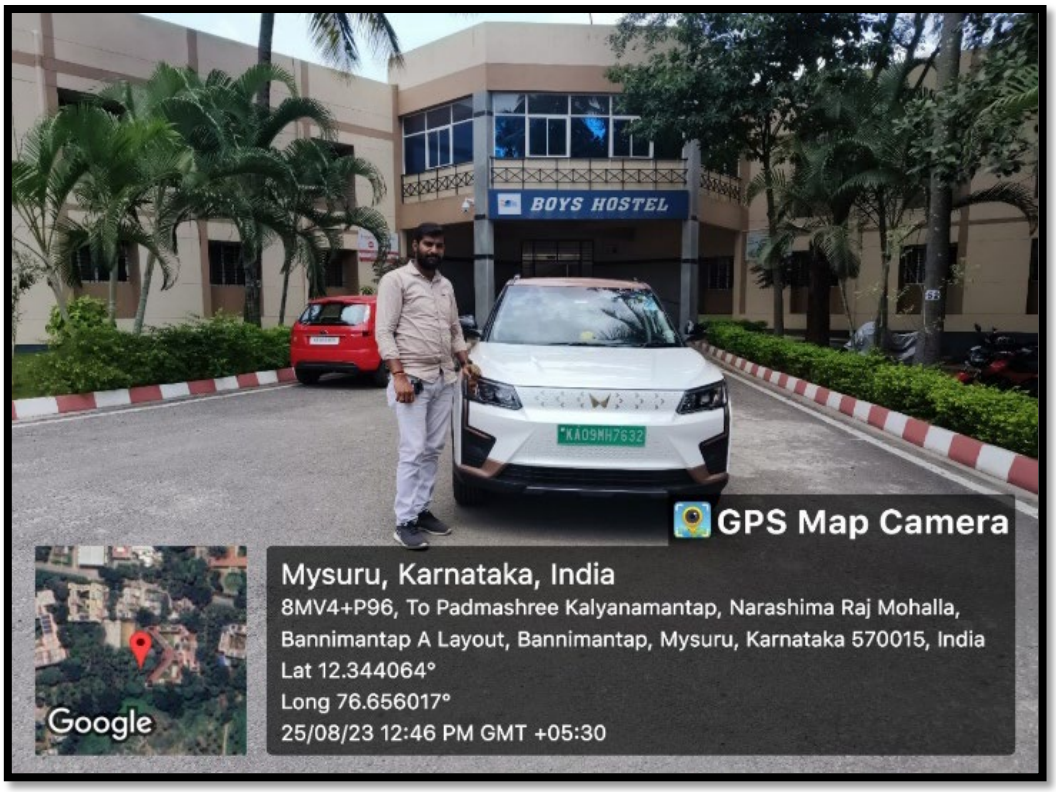
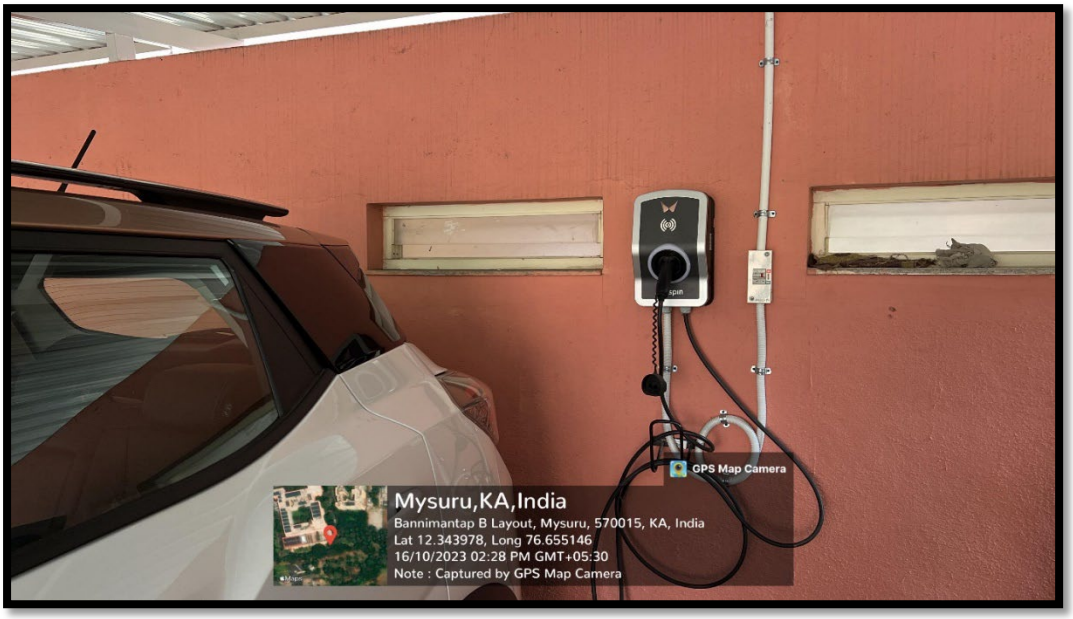
Battery-powered vehicles

Usage of battery powered vehicles in the campus, JSS AHER, Mysuru



Use of battery powered vehicles in JSS CPM campus, JSS AHER



Electric Vehicle (EV) charging port at JSS CPM campus, JSS AHER, Mysuru

Battery powered vehicles in the campus, JSS Hospital, JSS AHER, Mysuru

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Pedestrian-friendly pathways

Pedestrian friendly pathways inside the JSS AHER campus

Pedestrian friendly pathways inside the JSS AHER campus

Pedestrian friendly pathways inside the JSS AHER campus

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Ban on Use of Plastics

Signage - Ban on use of plastics inside the JSS Dental College & Hospital campus, JSS AHER

Signage - Ban on use of plastics inside the JSS AHER campus premises

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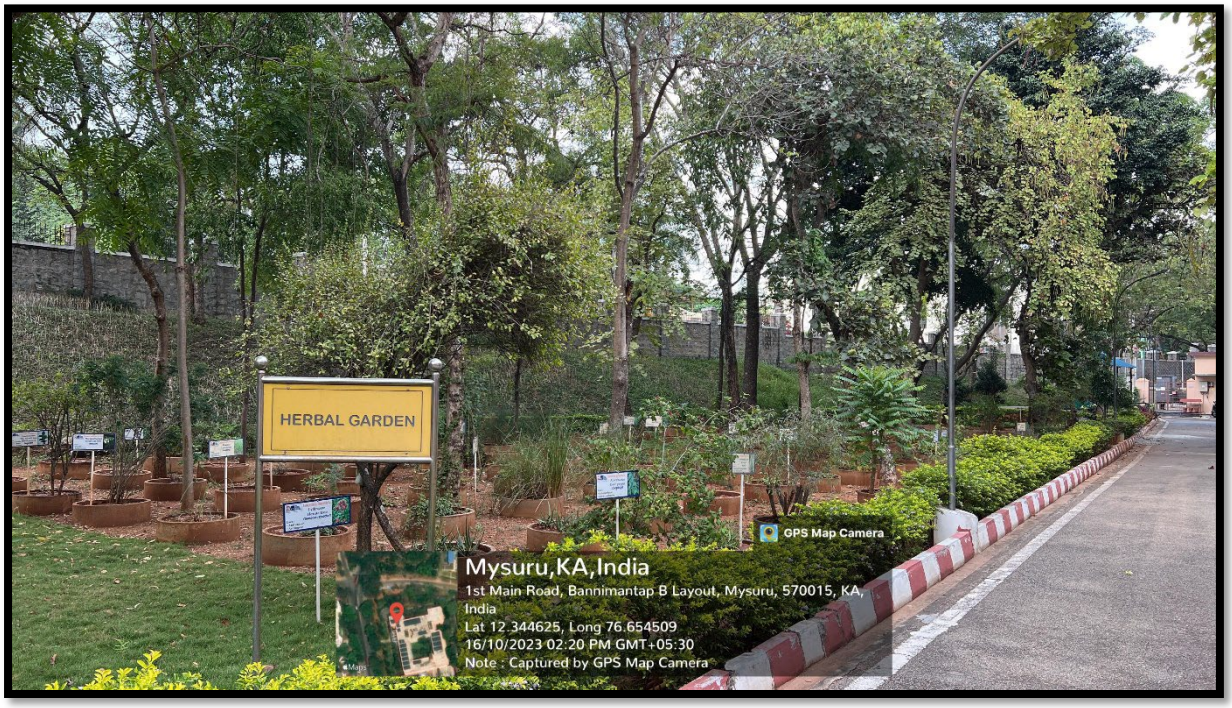
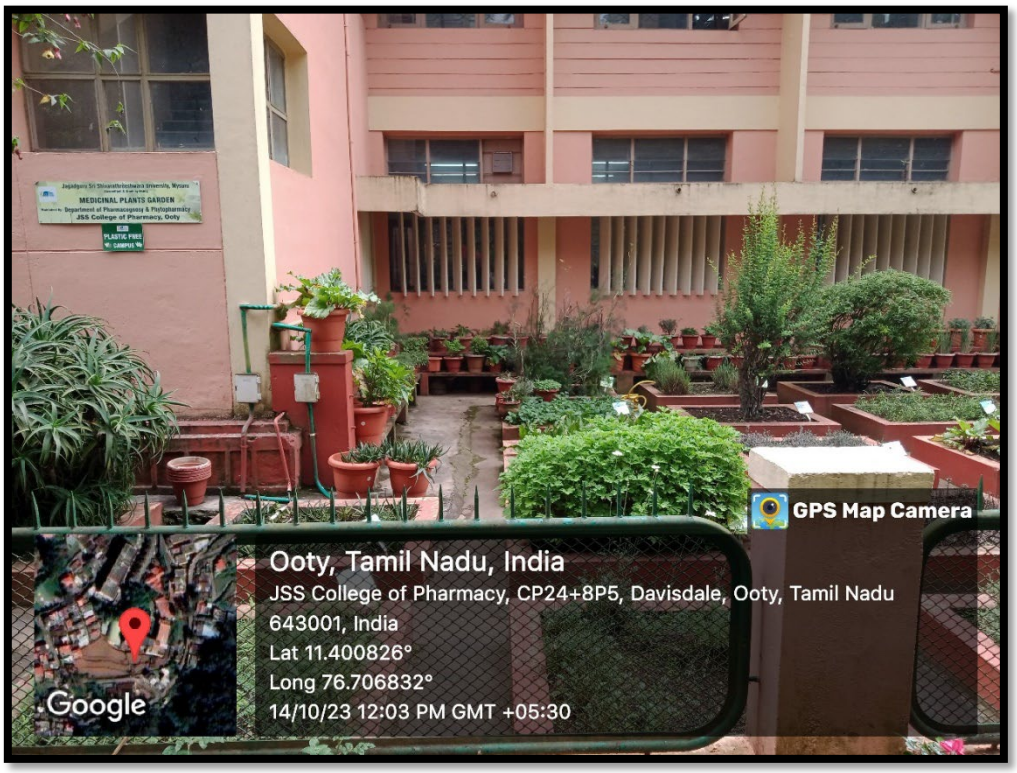
Landscaping with trees and plants

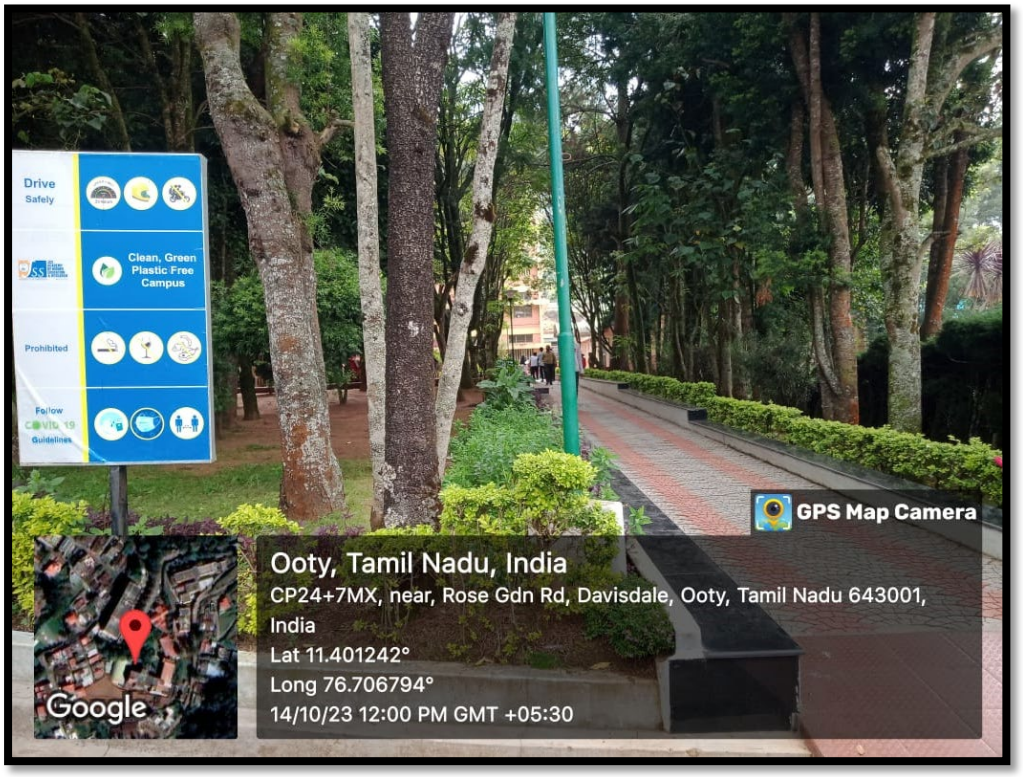


Herbal garden at JSS College of Pharmacy, Mysuru campus, JSS AHER

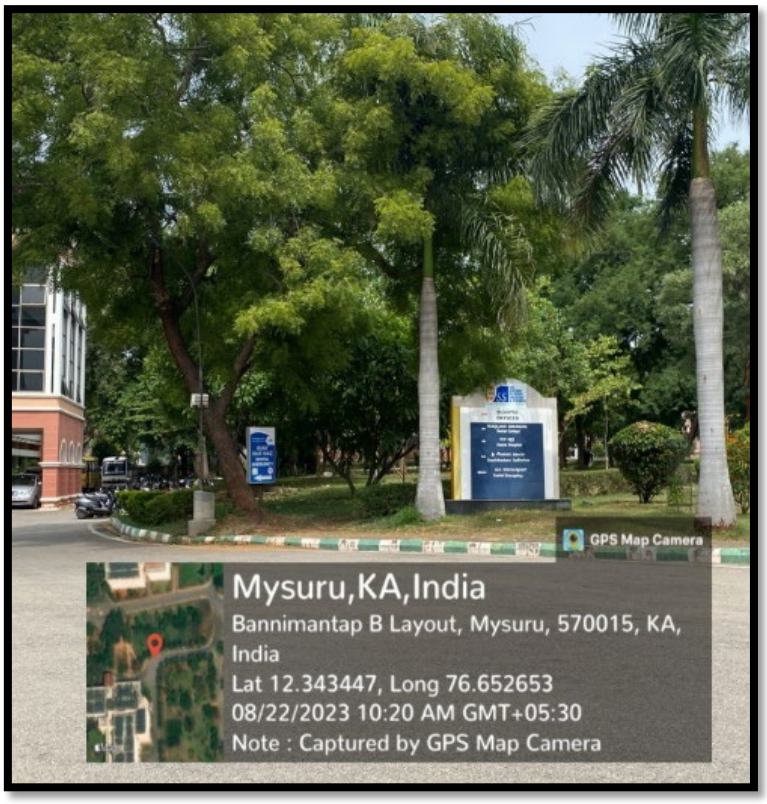


Herbal garden at JSS College of Pharmacy, Ooty campus, JSS AHER

Green campus maintenance at JSS CPM campus, JSS AHER



Green campus maintenance at JSS CPO campus, JSS AHER



Green campus maintenance at JSS DCH campus, JSS AHER

Green campus maintenance at JSS CPO campus, JSS AHER

Green campus maintenance at JSS SLS Ooty campus, JSS AHER

Bird view of Green campus at JSS MC, JSS AHER

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Bicycle Parking

Bicycle facility at JSS AHER campus

Use of bicycles in the campus to reduce carbon emission

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7.1.2

Geotagged Photos of facilities for alternate sources of energy and energy conservation measures

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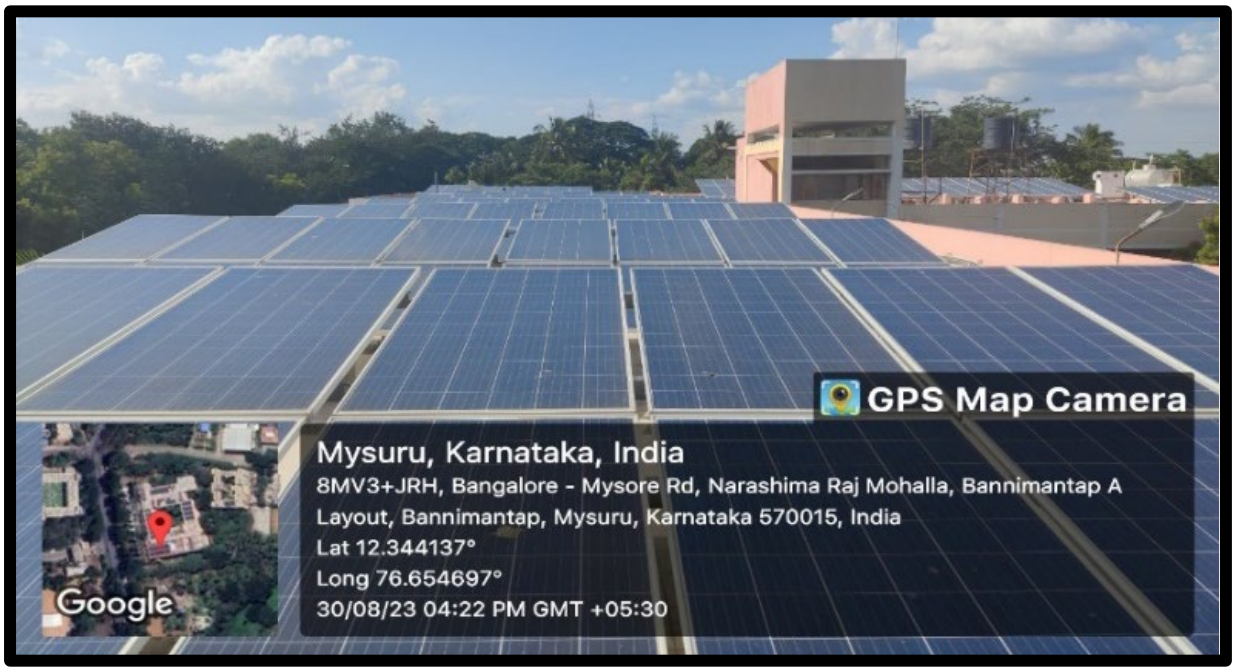
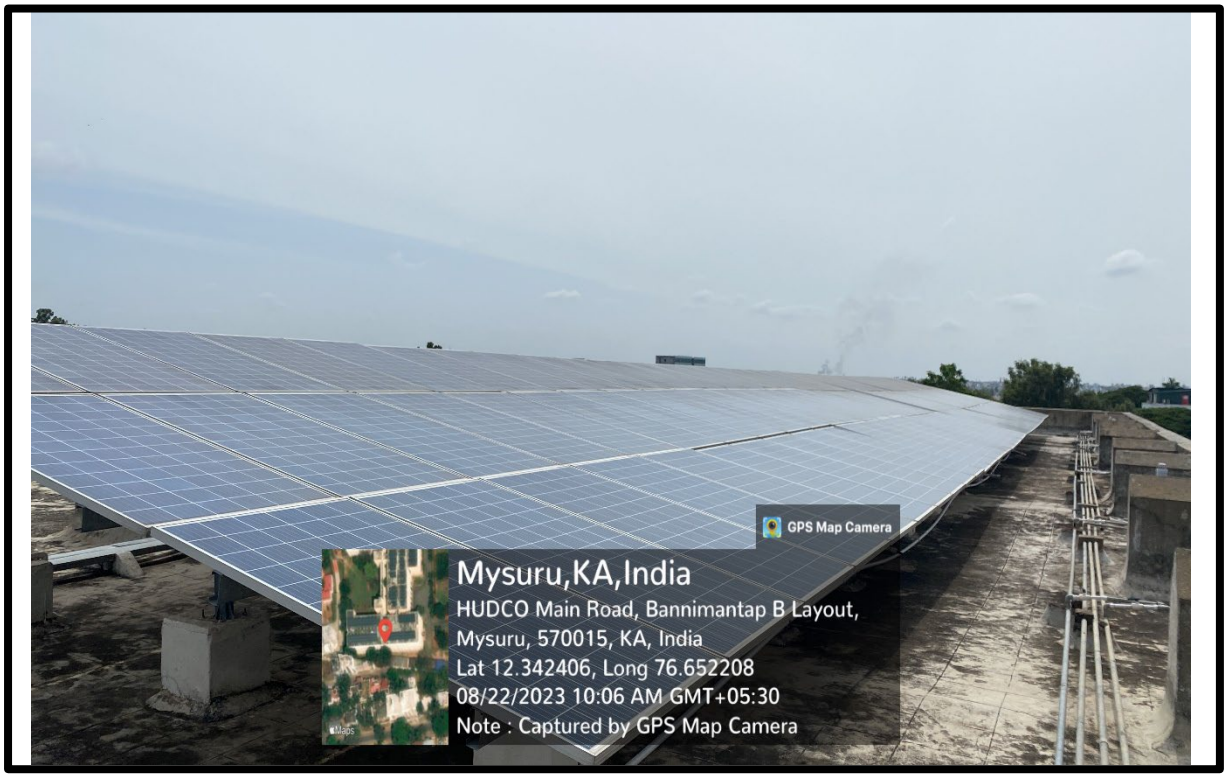
Solar Energy/ Solar Lights

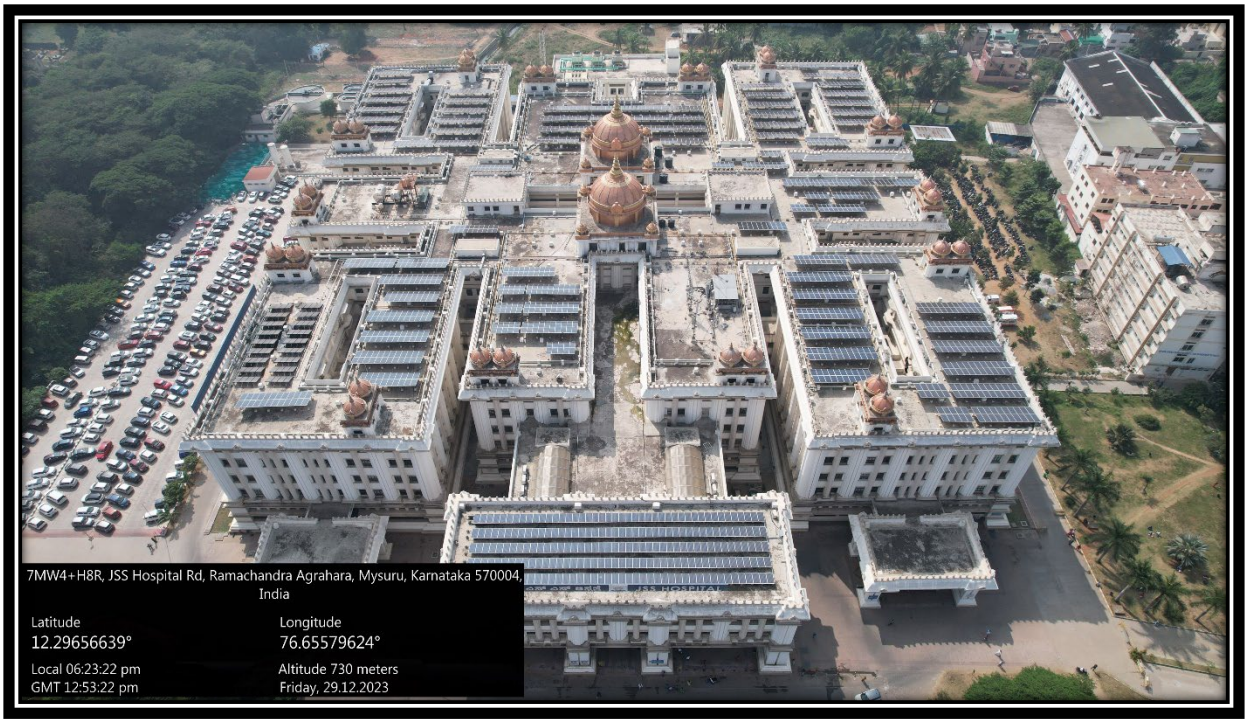
Rooftop Solar panel – JSS Medical College, JSS AHER, Mysuru



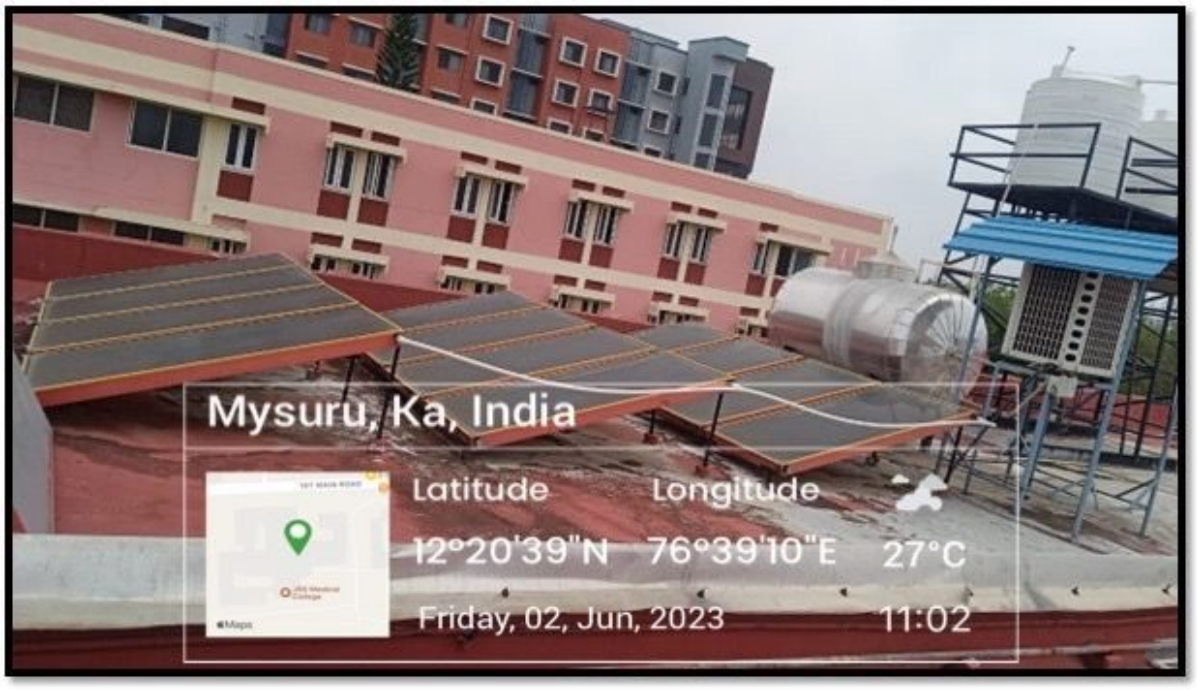
Rooftop Solar panel – JSS College of Pharmacy, Mysuru



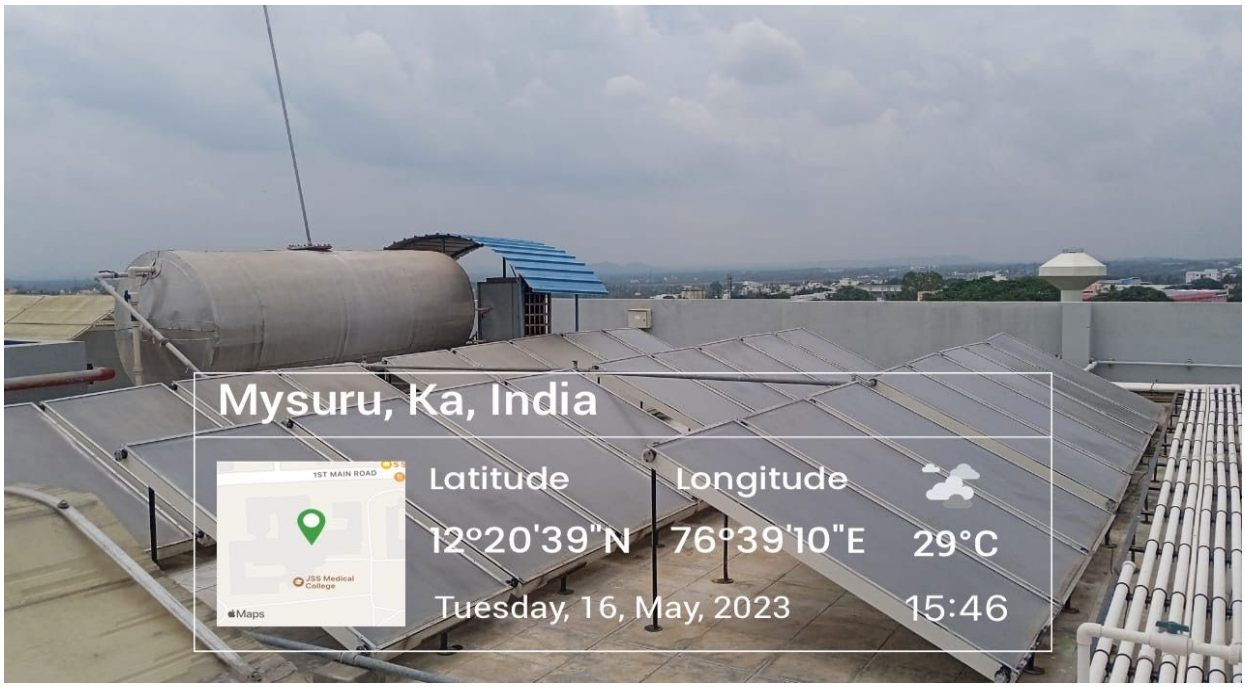
Rooftop Solar panel – JSS Dental College & Hospital, JSS AHER, Mysuru



Rooftop Solar panel – JSS Hospital, JSS AHER, Mysuru



Solar energy powered water heater at hostel block, JSS AHER, Mysuru



Solar energy powered water heater at hostel block, JSS AHER, Mysuru

Biogas Plant

Biogas plant at Hostel Block, JSS AHER, Mysuru

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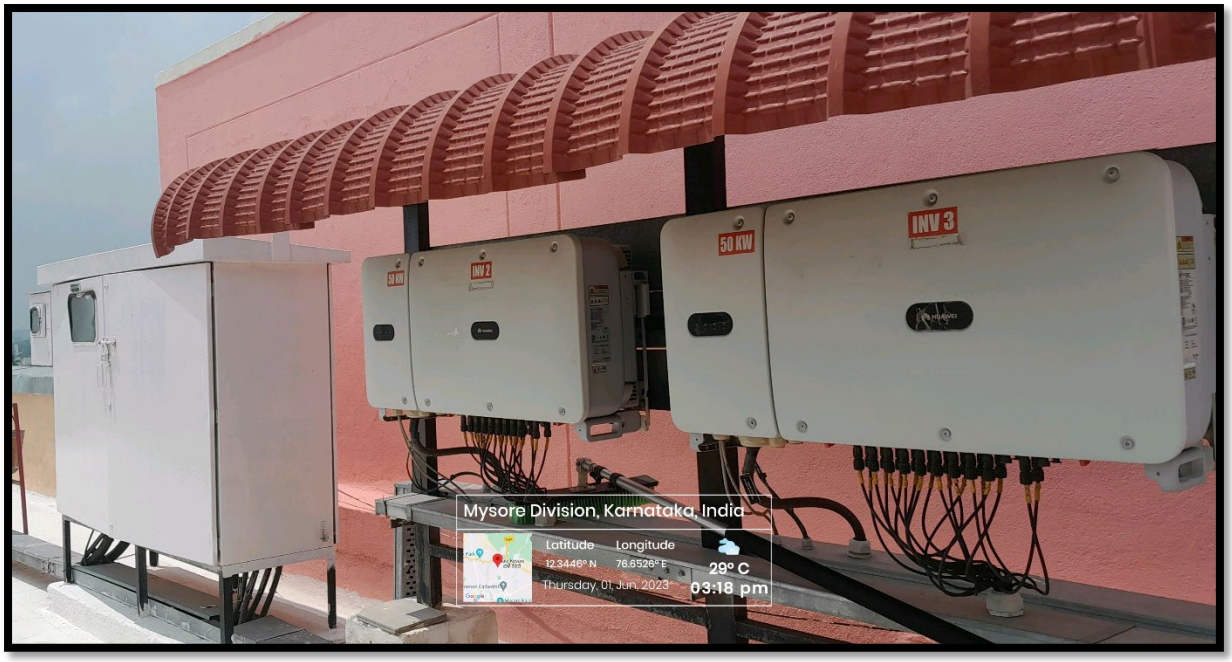
Wheeling to the grid

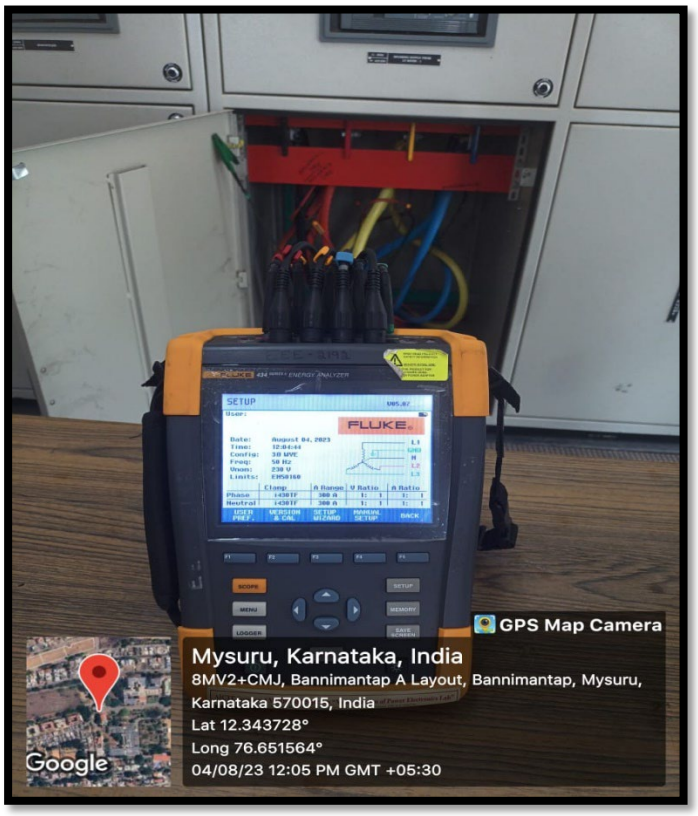


Wheeling to the grid at JSS Medical College, JSS AHER Mysuru

Wheeling to the grid at JSS Dental College & Hospital, JSS AHER, Mysuru

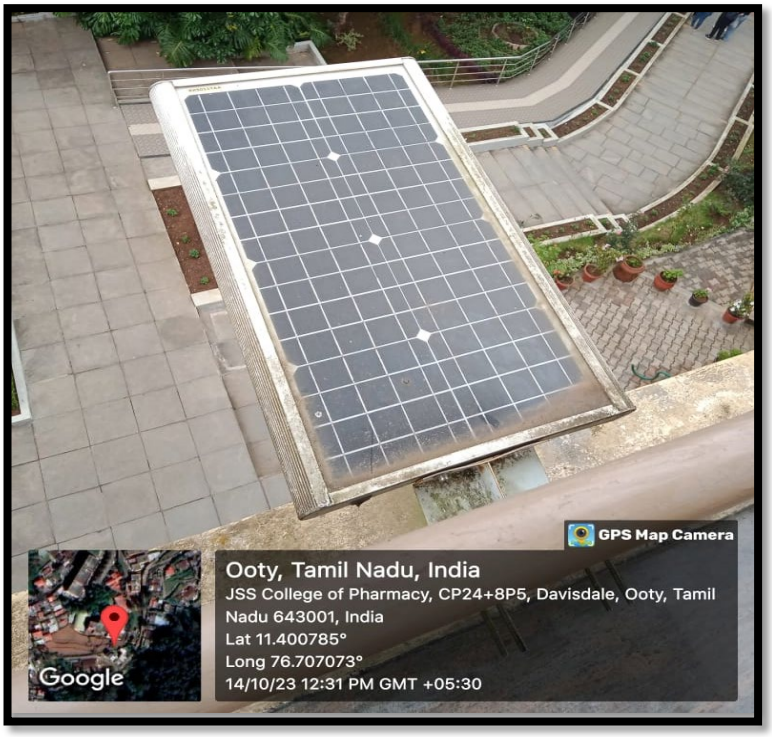
Wheeling to the grid at JSS College of Pharmacy, Mysuru, JSS AHER, Mysuru

Wheeling to the grid at JSS AHER, Mysuru

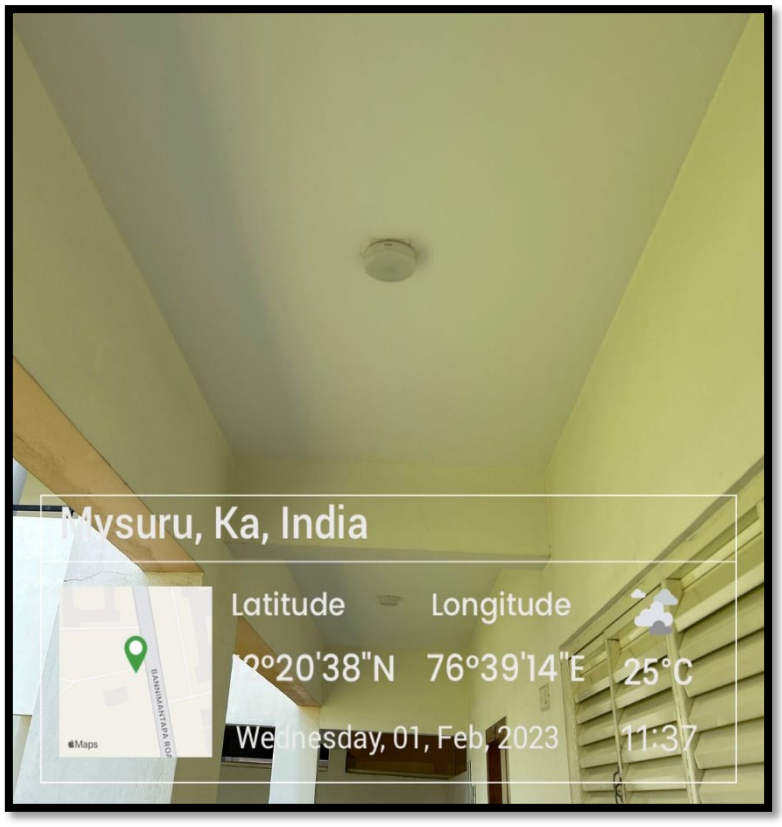


Wheeling to the grid (analyser) at JSS AHER, Mysuru

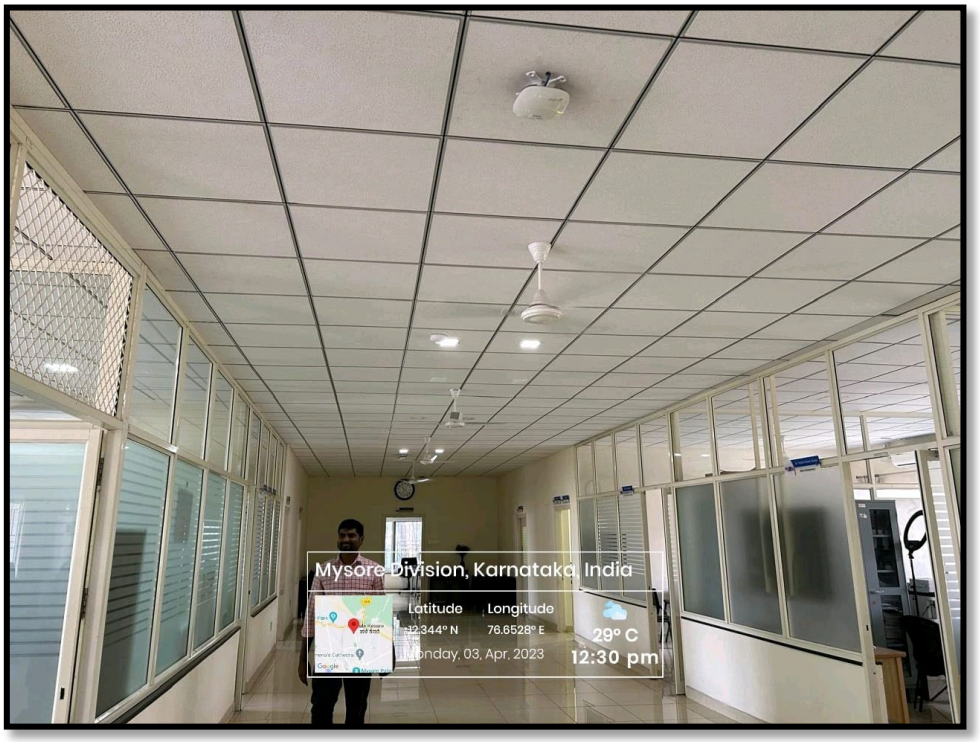
Sensor Based Energy Conservation



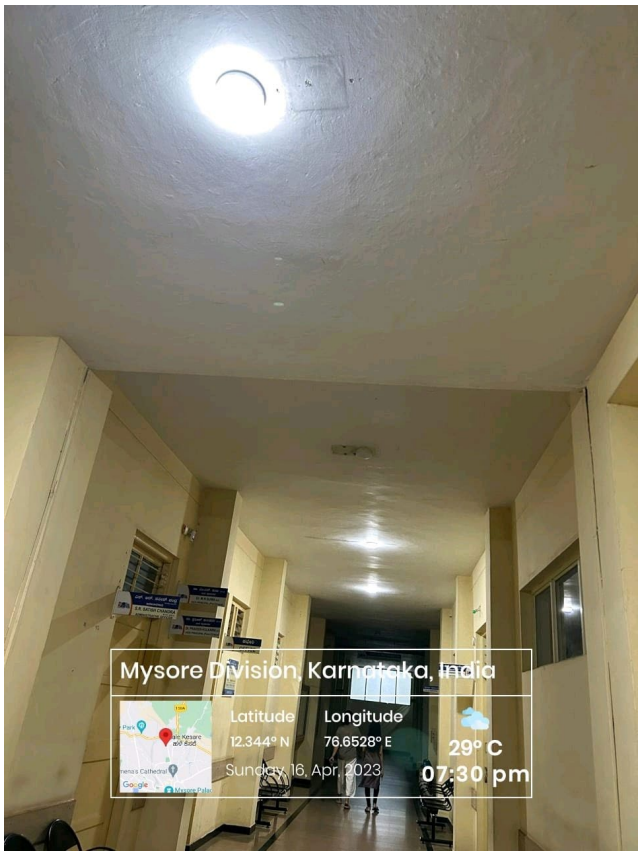
Solar Motion Sensor Light at JSS College of Pharmacy, Ooty, JSS AHER, Mysuru



Motion sensor-based LED bulbs at JSS guest house, JSS AHER, Mysuru

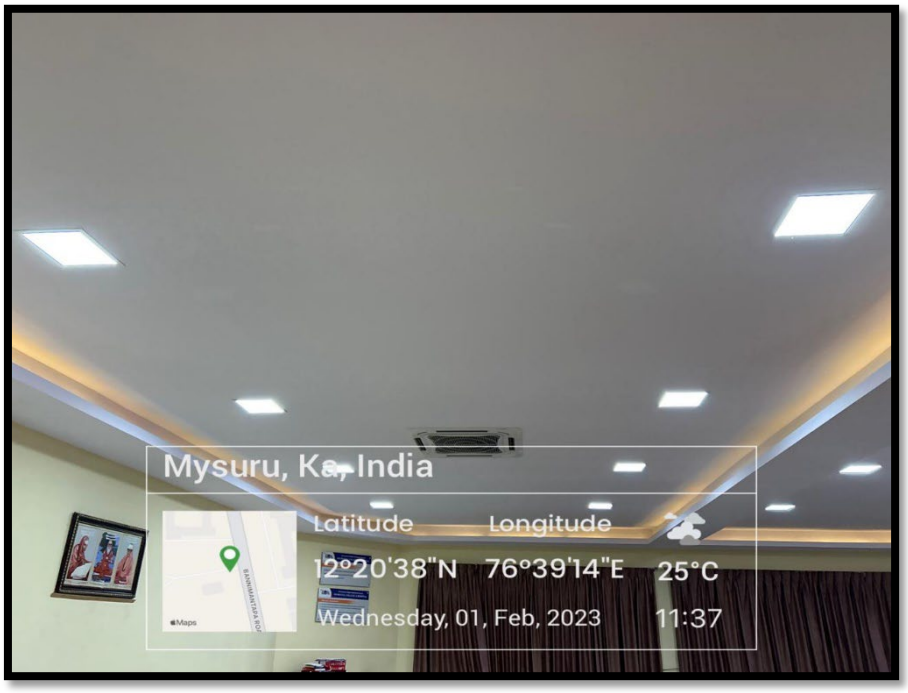


Motion sensor-based LED bulbs at JSS AHER admin block, JSS AHER, Mysuru



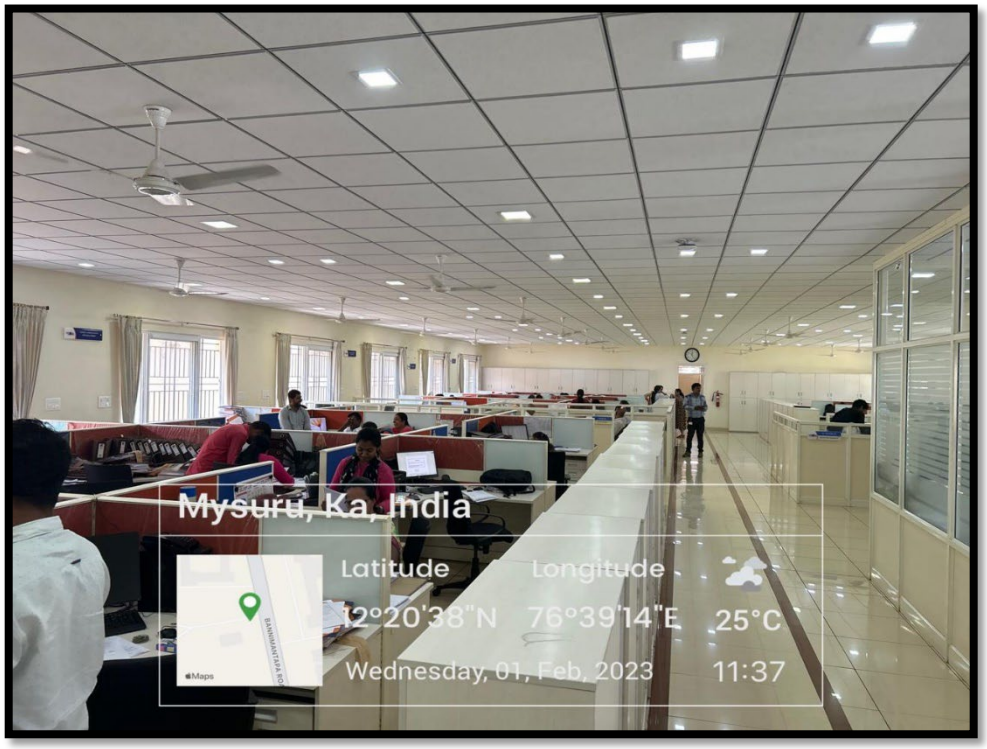
Motion sensor-based LED bulbs at JSS Medical College, JSS AHER, Mysuru

Use of LED bulbs/Power efficient equipment



LED bulbs JSS Dental College, JSS AHER, Mysuru

LED bulbs at JSS Hospital, JSS AHER, Mysuru



LED bulbs at administrative block, JSS AHER campus

LED bulbs at JSS Hospital, Mysuru

LED Bulbs at SLSM classrooms, JSSAHER

LED Bulbs at Sri Rajendra Auditorium, JSS College of Pharmacy, Mysuru

Power efficient equipment

Sun Tunnels at School of Life Sciences, Mysuru, JSS AHER

BLDC fans at Library, JSS AHER

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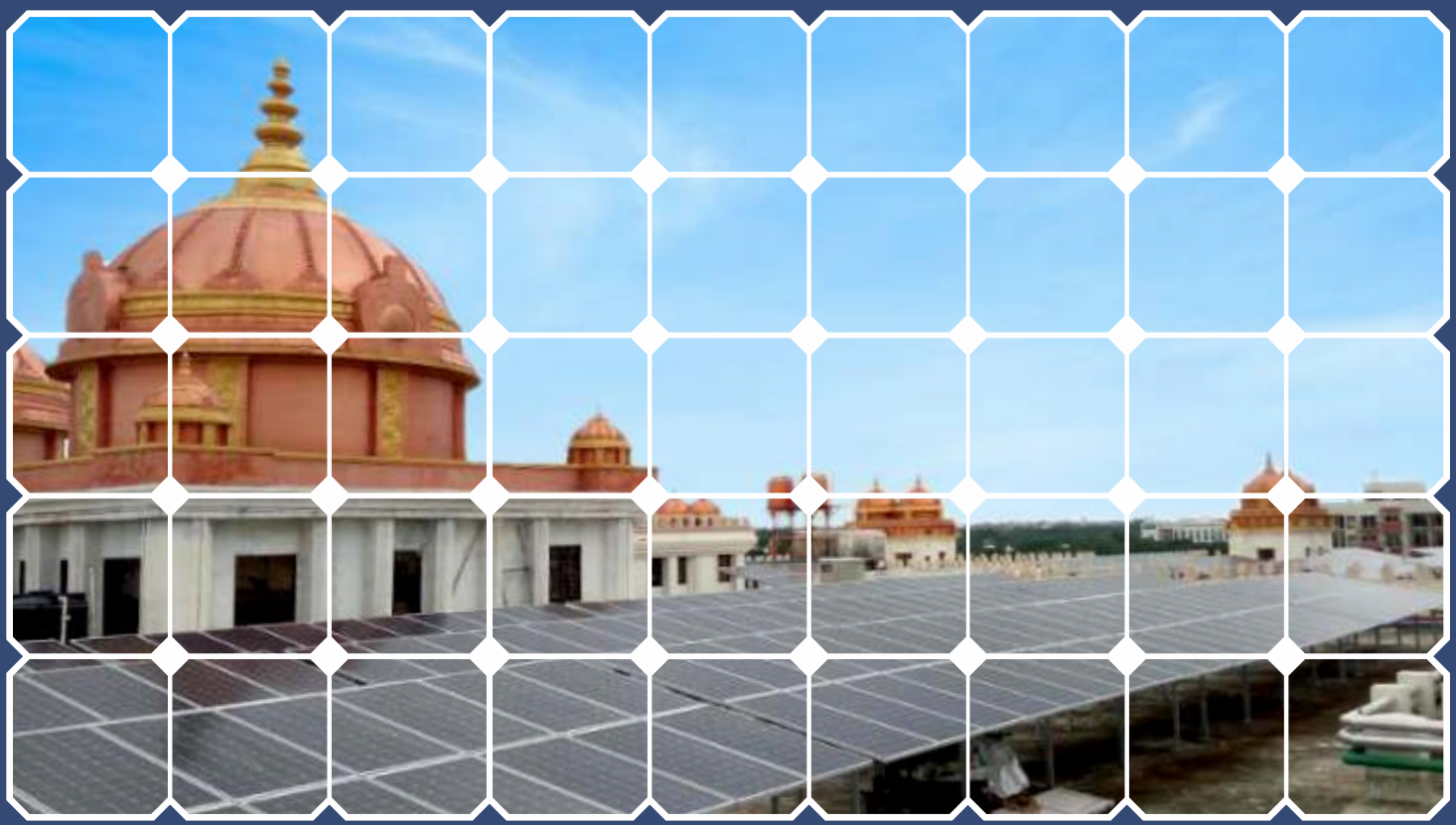
Green Energy
initiative in JSS Institutions



Total Capacity 3.191 MW

No. of Institutions Covered: 29

Life Span 25 years

Reduction in CO_2 Harmful Gas:
11,010 MT per year

Energy Generated:
1500 units/Per KW of solar unit per year

29 institutions of JSS MVP are installed with SRTPs with a total capacity of 3190 KWs, generating 47.88 Lakh Units of power per year. The resultant effect on energy savings is Rs. 16.8 crores per year during the supplier's credit period for 15 years and Rs. 37.80 crores per year during the non-supplier's credit period for 10 years. The average savings per year for 15 years with the present tariff is Rs. 1.11 crores per year. The average savings per year for 25 years with the present tariff is Rs. 2.18 crores per year.

JSS Institutions covering Twelve Colleges, One Hospital, Three Public Schools, One Boy's and One Girl's Hostels, One JSS Dasoha Bhavana, Two Mangala Mantapas, Two ITI's and Three Polytechnics, One Commercial Complex, One GINSERV (Incubation Center) are covered under SRTP Installations. The details are furnished in a separate document.

Projects in the Offing

3 MW Capacity Ground Mounted Solar project is proposed in Kelageri, Dharwad/ Chamarajanagara to supply 45 lakhs units of power per year to JSS Hospital, Mysuru and other JSS Institutions under group captive scheme.

A 25-acres plot has been earmarked for this purpose in Kelageri, Dharwad / Chamarajanagar.

Green Energy benefits

- Reduction in Co_2 is 11,010 MTs per year
- Savings of Petrol in measurement of liters is 14,40,078 per year
- Equivalent Diesel burned in MTs per year is 12,54,667
- Equivalent Coal burned in MTs per year is 16,93,442
- Carbon sequestered trees seedling grown for 10 years equivalent is 53,029 no's
- The remaining JSS Institutions will have nearly 3 MW Capacity solar installations in about 20 additional institutions.

Green Energy Effects

Sl. No.	Name of the Institution	Carbon Dioxide Equivalent in Metric tons Per year	Petrol in liters consumed Equivalent Per year	Diesel in liters consumed Equivalent Per year	Coal burned in kgs Equivalent Per year	Carbon sequestered trees seedling grown for 10 years Equivalent In no's
1.	JSS Hospital, Mysuru	848l	3,61,356	3,14,832	4,24,932	13,308
2.	JSS Noida 23 acres plot	163	69,561	60,605	81,799	2,562
3.	JSS Noida 5 acres plot	149	63,538	55,358	74,717	2,340
4.	JSS Public School, Noida	85	36,136	31,483	42,493	1,331
5. 6.	JSS Medical College/ JSS Dental College, Mysuru	513	2,18,620	1,90,473	2,57,084	8,051
7.	JSS Pharmacy College, Mysuru	140	59,624	51,947	70,114	2,195
8.	JSS Public School, Mysuru	52	22,060	19,220	25,942	812
9.	JSS Boys Polytechnic, Mysuru	63	26,830	23,376	31,551	988
10.	JSS Polytechnic for Women, Mysuru	76	32,197	28,051	37,861	1,185
11.	SJCE Biotechnology, Mysuru	192	81,685	71,168	96,056	3,008
12.	SJCE Admin Block, Mysuru	119	50,518	44,013	59,405	1,860
13.	JSS PDA Academic Block, Mysuru	99	38,078	33,176	44,777	1,402
14.	JSS PDA Girls' Hostel	64	27,102	23,612	31,870	998
15.	JSS College, Ooty road, Mysuru	192	81,685	71,168	96,056	3,008
16.	JSS College, Nanjangud	31	13,249	11,543	15,580	488
17.	JSS Mangala Mantap, Nanjangud	31	13,249	11,543	15,580	488
18.	JSS Law College, Mysuru	57	24,692	21,513	29,037	909
19.	JSS Women's College Saraswathipuram, Mysuru	192	81685	71,168	96,056	3,008
20.	JSS Commercial Complex (Law College), Mysuru	31	13,249	11,543	15,580	488
21.	JSS College, Gundlupet	30	12,949	11,281	15,226	477
22.	JSS School, Suttur	36	15,658	13,642	18,413	576
23.	JSS Suttur Girls Hostel	20	8,732	7,608	10,269	321
24.	JSS Suttur Boys Hostel	47	20,175	17,578	23,725	743

Sl. No.	Name of the Institution	Carbon Dioxide Equivalent in Metric tons Per year	Petrol in liters consumed Equivalent Per year	Diesel in liters consumed Equivalent Per year	Coal burned in kgs Equivalent Per year	Carbon sequestered trees seedling grown for 10 years Equivalent In no's
25.	JSS Suttur Mangala Mantap	31	13,249	11,543	15,580	488
26.	JSS Dasoha Bhavan, Suttur	20	8,732	7,608	10,269	321
27.	JSS ITI, Mariyala	51	8,732	55,358	74,717	2,340
28.	JSS ITI, Thandya	20	21,982	19,152	25,850	810
29.	GINSERV, Bengaluru	35	14,755	12,855	17,351	543
	Grand Total	**11,010**	**14,40,078**	**12,54,667**	**16,93,442**	**53,029**

JSS Institutions come under the following categories under HT & LT consumers.

* The calculation is limited to one lakh units for aided/unaided colleges & two lakhs units for commercial units.

Category	Supplier Credit Period	Non Supplier Credit Period
	Savings/unit in Rs.	Savings/unit in Rs.
Commercial	3.66	9.86
*Aided	2.06	7.81
Unaided	2.48	8.68

SRTP Brochure Installation Data

Sl. No.	Name of the Institution	Capacity Solar Grid Kw	Expected generation of power in units per year	Expected Savings Rs. in Lakhs/ Per year	Suppliers Credit period Expected savings Rs. in crores (15 years)	Non Suppliers Credit period Expected Savings Rs. in crores (10 years)	Total Expected savings Rs. in crores (25 years)
1.	JSS Hospital, Mysuru	800	12,00,000	26.30	3.94	9.53	13.47
2.	JSSATE Noida 23 acres plot	154.1	2,31,000	5.73	0.85	2.0	2.86
3.	JSSATE Noida 5 acres plot	140.7	2,11000	5.20	0.78	1.82	2.60
4.	JSS Public School, Noida	80	1,20,000	2.97	0.44	1.04	1.48
5.	JSS Medical College	264	3,96,000	9.47	7.42	3.40	4.82
6.	JSS Dental College, Mysuru	220	3,30,000	7.89	1.18	2.83	4.01
7.	JSS Pharmacy College, Mysuru	132	1,98,000	4.73	0.71	1.70	2.41
8.	JSS Public School, Mysuru	48.84	73,260	1.60	0.24	0.58	0.82
9.	JSS Polytechnic, Mysuru	59.4	89,100	1.95	0.29	0.70	1.0
10.	JSS Polytechnic for Women, Mysuru	71.28	1,06,920	2.34	0.35	0.84	1.20
11.	SJCE Biotechnology, Mysuru	180.84	2,71,260	5.94	0.89	2.15	3.04
12.	SJCE Admin Block, Mysuru	111.84	1,67,760	3.67	0.55	1.33	1.88
13.	JSS PDA Academic Block, Mysuru	84.3	2,16,450	4.74	0.71	0.72	1.43
14.	JSS PDA Girls Hostel, Mysuru	60.0	2,16,450	4.74	0.71	0.72	1.43
15.	JSS College, Ooty road, Mysuru	180.84	2,71,260	7.43	1.11	2.29	3.41
16.	JSS College, Nanjangud	29.43	44,145	1.19	0.17	0.39	0.57
17.	JSS Mangala Mantapa, Nanjangud	29.38	44,070	1.19	0.17	0.39	0.57
18.	JSS Law College, Mysuru	54.925	82,387.50	1.07	0.16	0.61	0.77

Sl. No.	Name of the Institution	Capacity Solar Grid Kw	Expected generation of power in units per year	Expected Savings Rs. in Lakhs/ Per year	Suppliers Credit period Expected savings Rs. in crores (15 years)	Non Suppliers Credit period Expected Savings Rs. in crores (10 years)	Total Expected savings Rs. in crores (25 years)
19.	JSS Women's College Saraswathipuram, Mysuru	180.84	2,71,260	4.73	0.71	2.02	2.73
20.	JSS Commercial Complex (Law College), Mysuru	29.44	44,160	0.57	0.08	0.33	0.41
21.	JSS College, Gundlupet	29.25	43,875	1.13	0.16	0.38	0.55
22.	JSS School, Suttur	34.98	52,470	1.20	0.18	0.45	0.63
23.	JSS Suttur Girls Hostel	19.80	29,700	0.68	0.10	0.25	0.35
24.	JSS Suttur Boys Hostel	44.88	67,320	1.54	0.23	0.57	0.81
25.	JSS Suttur Mangala Mantapa	29.38	44,070	1.01	0.15	0.37	0.53
26.	JSS Dasoha Bhavana, Suttur	19.80	29,700	0.68	0.10	0.25	0.35
27.	JSS ITI, Thandya	19.80	29700	1.61	0.2418	0.6217	0.8635
28.	JSS RUDSETI, Mariyala	48.75	73,125	0.68	0.89	0.2534	0.3578
29.	GINSERV, Bengaluru	33	49,500	4.71	-	-	1.17
	Grand Total	**3191.79**	**47.88**	**111**	**16.8**	**37.80**	**55.09**

All the firms have entered into PPA (Power Purchase Agreement) with the management for putting up SRTP installations. The execution of the projects is completed. The capacities implemented for different institutions are as under:

	Capacity of SRTP installation in Kws	Name of the Institute assigned
M/S Sangam Rooftop Solar Pvt. Ltd., Mumbai	19.80	1. JSS ITI, Thandya, Nanjangud
	19.80	2. Dasoha Bhavana & Math, Suttur
	29.38	3. JSS Siddananja Deshikendra Mangala Mantapa, Suttur
	19.80	4. Akkamahadevi Girls Hostel, Suttur
	29.44	5. Commercial Complex of JSS Law College Premises, Mysuru
	29.38	6. JSS Anubhava Mantapa, Nanjangud
	29.43	7. JSS College, Nanjangud
	29.25	8. JSS College, Gundlupet
	44.88	9. Basaveshwara Boys Hostel, Suttur
	34.98	10. JSS School, Suttur
	48.75	11. JSS RUDSETI, Mariyala
	54.92	12. JSS Law College, Commercial Complex, Mysuru
	180.84	13. JSS College, Ooty Road, Mysuru
	616.5	14. JSS Technical Institutions Campus, Mysuru
	180.84	15. JSS Women's College, Saraswathipuram, Mysuru
Total	**1367.99**	

M/s Clean Max Environ Energy Solutions Pvt. Ltd., Mumbai	154.1	1. JSS ATE 23 Acres Plot, Noida
	140.7	2. JSS ATE, 5 Acres Plot, Noida, New Delhi
	80	3. JSS Public School, Noida, New Delhi
	264	4. JSS Medical College, Mysuru
	220	5. JSS Dental College, Mysuru
	132	6. JSS Pharmacy College, Mysuru
Total	**990.8**	

	Capacity of SRTP installation in Kws	Name of the Institute assigned
M/s Mytrah Energy (India) Pvt. Ltd., Hyderabad	800	JSS Hospital, Mysuru
Total	**800**	
Sunny Portal	33	GINSERV, Bengaluru
Grand Total (in MWs)	**3.191**	
Approximate investment for SRTP installation 3.191 MW x Rs. 5 crores per MW = Rs. 15.95 crores		

THIS CERTIFIES THAT

JSS College of Pharmacy

HAS ACHIEVED AN

EDGE ADVANCED CERTIFICATE

CERTIFICATE NUMBER

GP1-IND-22042010134811

EDGE ADVANCED

Exemplifying achievement in the following areas:

78%
Energy Savings

68%
Water Savings

56%
Less Embodied Carbon in Materials

77.04 tCO_2/year
Operational CO_2 Emissions

84.25 tCO_2/year
Operational CO_2 Savings

Edge

DEVELOPED BY

JSS Academy of Higher Education and Research

CERTIFIED BY

Sintali

Thomas Saunders, Managing Director
DATE OF ISSUE: 07-JUL-2025

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path to a sustainable future

THIS CERTIFIES THAT

JSS College of Pharmacy
JSS Mysore
Mysore,
India

DEVELOPED BY

JSS Academy of Higher Education and Research

HAS ACHIEVED AN

EDGE ADVANCED CERTIFICATE

CERTIFICATE NUMBER

GP1-IND-22042010134811

WAS AUDITED BY

Gouri Rathod
EDGE Software Version: v3.0.0

CERTIFIED BY

Sintali

Thomas Saunders, Managing Director

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path to a sustainable future

DATE OF ISSUE

07-JUL-2025

ENERGY MEASURES

Reduced Window-to-Wall Ratio
Reflective Roof
Exterior Shading Devices
Natural Ventilation
Onsite Renewable Energy Generation

WATER MEASURES

Water-efficient Showerheads
Water-efficient Faucets in Bathrooms
Efficient Water Closets
Water-efficient Faucets in Kitchen
Water-efficient Landscaping
Waste Water Treatment and Recycling System

MATERIALS

Material-efficient Bottom Floor Slab - X - Re-use of Existing Floorslab
Material-efficient Floor Slabs - X - Re-use of Existing Floorslab
Material-efficient Floor Finish - X - Re-use of Existing Flooring
Material-efficient Roof Slab - X - Re-use of Existing roof
Material-efficient Exterior Walls - X - Re-use of Existing Wall
Material-efficient Interior Walls - X - Re-use of Existing Wall
Material-efficient Window Frames - X - Re-use of Existing Window Frames
Material-efficient Window Glazing - X - Re-use of Existing Glazing
Material-efficient Floor Insulation - X - No Insulation

www.edgebuildings.com

The EDGE standard requires 20% efficiencies in energy, water and materials compared to a local benchmark. Predicted efficiencies are not a guarantee of future operational performance. Energy savings may be associated with virtual energy for comfort depending on the presence of heating and cooling systems. Virtual energy does not contribute savings to utility bills.

This certificate is issued by the Certifier based on information provided by the client and the audit by the Auditor, and is subject to the terms and conditions of the Certifier. Contact edge@ifc.org if the above measures are not consistent with your observation on the project.

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Project Details

Project Name
JSS Pharmacy College

Number of Distinct Buildings
1

Number of EDGE Subproject(s) associated
1

Total Project Floor Area (m²)
11,505.39

Project Owner Name
JSS College of Pharmacy

Project Owner Email
jsscpmy@jssuni.edu.in

Project Owner Phone
Mobile -

Share project name and basic information to potential investors or banks?
No

Is this Project created for Training Purpose?
No

Address Line1
J

Address Line2

City
Mysore

State/ Province
Karnataka

Postal Code

Country
India

Project Number
1000994515

Do you intend to certify?
Yes

Associated Subproject(s)
Total associated subprojects: 1
The complete list of Associated Subprojects is available in the last section of this document.

Subproject Details

Subproject Name
JSS College of Pharmacy

Building Name
Pharmacy College

Subproject Multiplier for the Project
1

Certification Stage
Post-Construction

Status
Certificate Issued

Auditor
Gouri Rathod

Certifier
Sintali

File Number
22042010134811

Address Line1
JSS Mysore

Address Line2

City
Mysore

State/ Province

Postal Code

Country
India

Subproject Type
Existing Building

Year of Construction(YYYY)
1990

Building Utility Data

Annual Measured Electricity Consumption (kWh/Year)

Annual Measured Water Consumption (m^3/Year)

Annual Measured Natural Gas Consumption (m^3/Year)

Annual Measured Diesel Consumption (m^3/Year)

Annual Measured LPG Consumption (Kg/Year)

Existing Building Energy Performance Index (kWh/m^2/year)
-

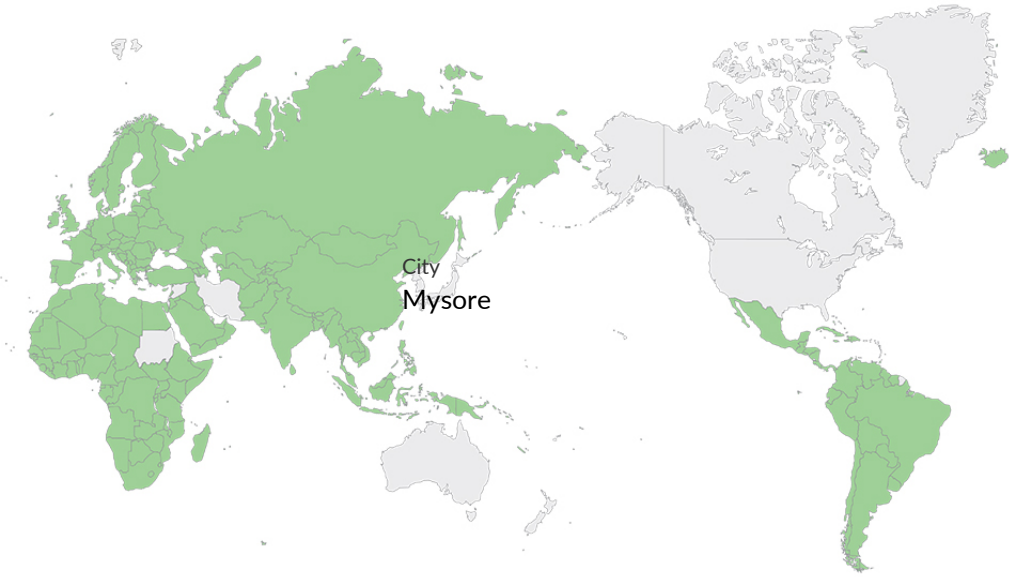
Existing Building Water Usage Index(m^3/Person/Day)
-

Existing Building GHG Emissions (tCO_2/Year)
-

Location

Country
India

City
Mysore



Building Type

Primary Building Type
Education

Subtype
University

Building Data

	Default	*User Entry*
Gross Internal Area (m²)	~~15,000~~	11,505.39
No. of Floors Above Grade	~~6~~	3
No. of Floors Below Grade	~~1~~	1
Floor-to-Floor Height (m)	~~3.0~~	3.6
Aggregate Roof Area (m²)	~~2,876~~	3,877.3

Operational Details

	Default	*User Entry*
Working Days (Days/Week)	~~5.00~~	6
No. of Holidays (Days/Year)	~~60.00~~	60
Hours of Operation (Hrs/Day)	~~6.00~~	7.5
Occupancy Density (m²/Person)	~~5~~	11.2

Building Costs

Cost of Construction (Lakh INR/m²)
0.6

Estimated Sale Value (Lakh INR/m²)
0.9

Area and Loads Breakdown

Gross Internal Area (m²)
11,505.4

Default (m²)	*User Entry (m²)*
Classrooms ~~1,725.8~~	1,162
Workshops ~~1,150.5~~	1,058.3
Meeting Rooms ~~575.3~~	189.62
Office/Administration Rooms ~~575.3~~	1,212.4
Auditoriums ~~575.3~~	426.4
Library ~~1,150.5~~	681.06
Worship Places 575.3	0
Corridors ~~575.3~~	1,771
Restrooms ~~575.3~~	299.7
Other Space Types ~~575.3~~	2,131.54
Cafeteria 575.3	24.85
Labs ~~1,150.5~~	2,235.19
Computer Rooms ~~575.3~~	39.93
Sports Room 575.3	0
Indoor Car Parking ~~575.3~~	273.4

Default	*User Entry*
Area with Exterior Lighting (m²) ~~4,500~~	9,194.36
External Carparking Area (m²) ~~2,959~~	201

Water End Uses

Irrigated Area (m²) ~~1,500~~	6,750
Swimming Pool Type (m²) ~~Indoor Heated Pool and Outdoor Unheated Pool~~	None
Swimming Pool (m²) 20	
Car Washing No	No
Washing Clothes No	No
Process Water No	No
Dishwasher ~~Yes~~	No
Pre Rinse Spray Valve ~~Yes~~	No

Detailed Loads Input

Activities	Space Conditioning Type	EDGE Default Space Conditioning	Default Heating and Cooling Set-point Temperature	Occupancy (m^2/ Person)	Plug Loads (W/m^2)	Process Loads (W/m^2)	Fresh Air Requirement (L/s-m^2)	Fresh Air Requirement (L/s/Person)	Fresh Air Requirement (ACH)	People Sensible Heat (W/Person)	People Latent Heat (W/Person)
Classrooms	No Conditioning Provided	AC & Htg		2.2	5.10						
Workshops	No Conditioning Provided	AC & Htg		2.6	5.00						
Meeting Rooms	Only Space Cooling	AC & Htg	C 24˚C	0.0	15.00						
Office/Administration Rooms	No Conditioning Provided	AC & Htg		15.2	0	5.30					
Auditoriums	Only Space Cooling	AC & Htg	C 24˚C	0.0	9.80						
Library	No Conditioning Provided	AC & Htg		340.5	0.60						
Worship Places	No Conditioning Provided	AC & Htg		0	0						
Corridors	No Conditioning Provided	AC & Htg		0	0						
Restrooms	No Conditioning Provided	NON AC & NO HTG		0	2.5						
Other Space Types	No Conditioning Provided	NON AC & NO HTG		305	0						
Cafeteria	No Conditioning Provided	NON AC & NO HTG		21.2	0						
Labs	No Conditioning Provided	NON AC & NO HTG		223.5	17.45						
Computer Rooms	No Conditioning Provided	NON AC & NO HTG		20.0	0	30.10					
Sports Room	No Conditioning Provided	NON AC & NO HTG		0	0						
Indoor Car Parking	No Conditioning Provided	NON AC & NO HTG		0.0	0						

Kitchen & Food Preparation

Kitchen ✔ Pantry Coffeehouse/Café

Description	Default	User Selection	Unit
No. of Meals /day	1.00		Meals/Person/day
Total People having on site meal	40%		%
Food Prepared on Site	50%		%
People using pantry	40%		%
People using coffeehouse	50%		%
Energy per meal	1.60		kWh/meal

Building Dimensions

Default Building Length (m)	*User Entry (m)*	*Façade Area Exposed to Outside Air (%)*
North ~~27.4~~	100.5	100
North East 27.4	0	100
East ~~27.4~~	113.38	100
South East 27.4	0	100
South ~~27.4~~	104.19	100
South West 27.4	0	100
West ~~27.4~~	113.49	100
North West 27.4	0	100

Building HVAC System

Select Input Type

Simplified Inputs

Does the Building Design Include an AC system?

Yes

Does the Building Design Include a Space Heating System?

No

Does the Building Design Include Purchased Chilled Water and Heating Supply (District Cooling or Heating)?

None

Applicable Baseline

EDGE

Fuel Usage

	Default	*User Entry*
Hot Water	~~Electricity~~	None
Space Heating	Electricity	Electricity
Generator	Diesel	Diesel
% of Electricity Generation Using Diesel	2.00%	0
Fuel Used for Cooking	Electricity	Electricity

CO_2 Emissions Factor

	Default	*User Entry*
Electricity (kg of CO_2/kWh)	0.61	
Diesel (kg of CO_2/kWh)	0.25	
Natural Gas (kg of CO_2/kWh)	0.18	
LPG (kg of CO_2/kWh)	0.24	
Coal (kg of CO_2/kWh)	0.32	
Fuel Oil (kg of CO_2/kWh)	0.25	

Cost Input

	Default	*User Entry*
Electricity (INR/kWh)	7.67	
Diesel (INR/Lt)	64.39	
Natural Gas (INR/kg)	45.79	
LPG (INR/kg)	45.79	
Coal (INR/kg)	5.8	
Fuel Oil (INR/Lt)	21.8	
Water (INR/KL)	45.79	
Conversion from USD (INR/USD)	71.54	

Climate Data

Default	*User Entry*	*Default*	*User Entry*
Elevation (m) 785		Latitude (degrees) 12	
Rainfall (mm/year) 1,194		ASHRAE Climate Zone 1B	1B

Temperature (˚C)

Default (Monthly Max.)	*User Entry (Monthly Max.)*	*Default (Monthly Max.)*	*User Entry (Monthly Max.)*
Jan 29.7	Jan	Jul 32.2	Jul
Feb 32.1	Feb	Aug 31.0	Aug
Mar 34.5	Mar	Sep 30.9	Sep
Apr 35.2	Apr	Oct 29.8	Oct
 34.4		Nov 29.5	Nov
Jun 32.8	Jun	Dec 28.5	Dec

Default (Monthly Min.)	*User Entry (Monthly Min.)*	*Default (Monthly Min.)*	*User Entry (Monthly Min.)*
Jan 14.5	Jan	Jul 18.7	Jul
Feb 17.0	Feb	Aug 18.4	Aug
Mar 18.7	Mar	Sep 18.9	Sep
Apr 20.4	Apr	Oct 17.9	Oct
 19.8		Nov 16.5	Nov
Jun 19.2	Jun	Dec 14.7	Dec

Climate Data

Relative Humidity (%)

Default (Monthly Avg.)	*User Entry (Monthly Avg.)*	*Default (Monthly Avg.)*	*User Entry (Monthly Avg.)*
Jan 72.3%	Jan	Jul 79.8%	Jul
Feb 75.3%	Feb	Aug 81.8%	Aug
Mar 76.7%	Mar	Sep 83.3%	Sep
Apr 80.2%	Apr	Oct 78.7%	Oct
78.2%		Nov 78.0%	Nov
Jun 82.5%	Jun	Dec 76.4%	Dec

Wind Speed (m/sec)

Default (Monthly Avg.)	*User Entry (Monthly Avg.)*	*Default (Monthly Avg.)*	*User Entry (Monthly Avg.)*
Jan 1.5	Jan	Jul 2.9	Jul
Feb 1.5	Feb	Aug 2.6	Aug
Mar 1.4	Mar	Sep 2.0	Sep
Apr 1.5	Apr	Oct 1.3	Oct
2.2		Nov 1.4	Nov
Jun 3.0	Jun	Dec 1.5	Dec

Results

Final Energy Use (kWh/Month)
10,642

Final Water Use (m^3/Month)
740

Final Operational CO_2 Emissions (tCO_2/Month)
6.42

Final Embodied Carbon (Kg CO_2e/m^2)
181

Final Utility Cost (INR/Month)
62,837

Subproject Floor Area (m^2)
11,505.39

Energy Savings (MWh/Year)
138.06

Water Savings (m^3/Year)
18,786.78

Operational CO_2 Savings (tCO_2/Year)
84.25

Embodied Carbon Savings (tCO_2e)
2,648.14

Utility Cost Savings in USD (USD/Year)
35,657.25

Utility Cost Savings in Local Currency (Lakh/Year)
25.509

Base Case EPI (kWh/m^2/year)
24.0

Improved Case EPI (kWh/m^2/year)
12.0

Total Building Construction Cost (Crore INR)
70.2

Incremental Cost (Crore INR)
1.55

% Increase in cost
2.21%

Payback in Years (Yrs.)
6.1

Number of People Impacted (No./Year)
1,059

Base Case - Refrigerant Global Warming Potential (tCO_2e/Year)
2.2

Improved Case - Refrigerant Global Warming Potential (tCO_2e/Year)
2.2

ENERGY SAVINGS

EDGE ADVANCED

Energy Efficiency Measures 78.33%

Meets EDGE Energy Standard

Net Carbon Emissions: 79.2 tCO_2e/Year

Energy Efficiency Measures 78.33%

- ✓ EEM01* Window-to-Wall Ratio: 26.41%
  Base Case Value: 30%
  WWR (%): 26.41
- ✓ EEM02 Reflective Roof: Solar Reflectance Index 93
  Base Case Value: 45
  SRI: 93.00

  EEM03 Reflective Exterior Walls: Solar Reflectance Index 85

- ✓ EEM04 External Shading Devices: Annual Average Shading Factor (AASF) 0.36
  Base Case Value: No Shading
  AASF: 0.36
- ✓ EEM05* Insulation of Roof: U-value 2.91 W/㎡·K
  Base Case Value: 1.91 W/㎡·K
  U-Value (W/㎡·K): 2.91
- ✓ EEM06* Insulation of Ground/Raised Floor Slab: U-Value 3.33 W/㎡·K
  Base Case Value: 0.49 W/㎡·K
  U-Value (W/㎡·K): 3.33
  Edge Insulation Type: None

  EEM07 Green Roof

- ✓ EEM08* Insulation of Exterior Walls: U-Value 1.65 W/㎡·K
  Base Case Value: 1.86 W/㎡·K
  U-Value (W/㎡·K): 1.65
- ✓ EEM09* Efficiency of Glass: U-Value 5.7 W/㎡·K, SHGC 0.8 and VT 0.7
  Base Case Value: 5.7 W/㎡·K & SHGC 0.8 & VT 0.7
  U-Value (W/㎡·K): 5.70 VT (Factor): 0.70
  SHGC: 0.80

  EEM10 Air Infiltration of Envelope: 50% Reduction

- ✓ EEM11 Natural Ventilation
  Base Case Facade Opening: 0%

  EEM12 Energy Efficient Ceiling Fans

- ✓ EEM13* Cooling System Efficiency: COP (W/W) 3.11
  Base Case System: Air Cooled DX Split System
  Base Case COP: 2.78
  Select System: Air Cooled DX Split System
  COP (W/W): 3

  EEM14 Variable Speed Drives

Energy Efficiency Measures 78.33%

EEM15 Fresh Air Pre-conditioning System: Efficiency 65%

EEM18 Domestic Hot Water (DHW) System : Solar 50%, Heat Pump 50%, Boiler 0%

EEM19 Domestic Hot Water Preheating System

EEM20 Economizers

EEM21 Demand Control Ventilation Using CO_2 Sensors

EEM22 Efficient Lighting for Internal Areas

✓ EEM23 Efficient Lighting for External Areas
Base Case Value: 65 L/W
Efficiency Type:Luminous Efficacy
Luminous Efficacy (L/W): 65

EEM24 Lighting Controls

EEM25 Skylights

EEM26 Demand Control Ventilation for Parking Using CO Sensors

EEM30 Submeters for Heating and/or Cooling Systems

EEM31 Smart Meters for Energy

EEM32 Power Factor Corrections

✓ EEM33 Onsite Renewable Energy: 64.5% of Annual Energy Use
Base Case: No Onsite Renewable Energy

Renewable Energy System Type	Default Annual Energy Use (%)	User Entry Annual Electricity Use (%)	Annual Energy Use (kWh/Year)
Solar Photovoltaic	25%	64.5	230,358
Wind Turbine	0%	0	-
Biomass	0%	0	-
Other	0%	0	-

EEM34 Other Energy Saving Measures

EEM35 Offsite Renewable Energy Procurement: 100% of Annual Operational CO_2

EEM36 Carbon Offsets: 100% Annual Operational CO_2

EEM37 Low-Impact Refrigerants

WATER SAVINGS

Water Efficiency Measures 67.92%

Meets EDGE Water Standard

Water Efficiency Measures 67.92%

✓ WEM01* Water-efficient Showerheads: 6 L/min
Base Case Value: 8 L/min
Bath Type: No Shower
Hot Water Provision: No

✓ WEM02* Water-efficient Faucets for all Bathrooms: 1.8 L/min
Base Case Value: 8 L/min
Faucet Type: Faucets with Aerators
Flow Rate (L/min): 1.8
Hot Water Provision: No

✓ WEM04* Efficient Water Closets for All Bathrooms: 6 L/High volume flush and 3.99 L/Low volume flush
Base Case Value: Dual Flush,6 L/High volume flush and 4 L/Low volume flush
Type Of Water Closet: Dual Flush
High Volume Flush (L/min): 6.00
Low Volume Flush (L/min): 3.99

WEM06 Water-efficient Bidet: 2 L/min

✓ WEM07 Water-efficient Urinals: 4 L/flush
Base Case Value: 4 L/flush
Flush Volume (L/flush): 4

✓ WEM08* Water-efficient Faucets for Kitchen Sinks: 2.5 L/min
Base Case Value: 10 L/min
Hot Water Provision: No
Flow Rate (L/min): 2.5

Water Efficiency Measures 67.92%

WEM10 Water-efficient Pre-rinse Spray Valves for Kitchen: 2 L/min

WEM12 Swimming Pool Covers: 30% Area Covered

✓ WEM13 Water-efficient Landscape Irrigation System: 2.74 L/㎡/day
Base Case Value: 6 L/㎡/day
Average Water Use (L/㎡/day): 2.74

WEM14 Rainwater Harvesting System: 1939 m² of Catchment Area

✓ WEM15 Waste Water Treatment and Recycling System: 100% Treated
Base Case Value: No Water Recycling System
System Type: Grey and Black Water Recycling System
Sewage Treatment Plant Technology: Conventional Activated Sludge (CAS)
Portion of Waste Water Treated (%): 100
Recycled Water End-uses

Flushing	No	Car Washing	No
Wash Basin	No	Swimming Pool	No
Shower	No	Irrigation	Yes
Kitchen	No	Equipment	No
Laundry	No	HVAC	No
Cleaning & Washing	No		

WEM16 Condensate Water Recovery: 100% Recovery

WEM17 Smart Meters for Water

EMBODIED CARBON SAVINGS

Materials Efficiency Measures 56.00%

Meets EDGE Material Standard

Materials Efficiency Measures 56.00%

Improved Case Selection		Building Material	Proportion %	Thickness (mm)	U-Value (W/m²·K)	Embodied Carbon(kg/m²)
MEM01*	Bottom Floor Construction Base Case Material: Concrete Slab | In-situ Reinforced Conventional Slab Thickness : 100mm & Steel : 35kg/m²	Type 1 X - Re-use of Existing Floorslab	100 %	150	3.33	
MEM02*	Intermediate Floor Construction Base Case Material: Concrete Slab | In-situ Reinforced Conventional Slab Thickness : 300mm & Steel : 35kg/m²	Type 1 X - Re-use of Existing Floorslab	100 %	150		
MEM03*	Floor Finish Base Case Material : Tiled | Ceramic Tiles Thickness : 10mm	Type 1 X - Re-use of Existing Flooring	100 %	10		
MEM04*	Roof Construction Base Case Material : Concrete Slab | In-situ Reinforced Conventional Slab Thickness : 300mm & Steel : 35kg/m²	Type 1 X - Re-use of Existing roof	100 %	150	2.91	
MEM05*	Exterior Walls Base Case Material: Concrete Blocks | Solid Blocks of Dense Concrete Thickness : 250mm	Type 1 X - Re-use of Existing Wall	100 %	225	1.65	
MEM06*	Interior Walls Base Case Material: Concrete Blocks | Solid Blocks of Dense Concrete	Type 1 X - Re-use of Existing Wall	100 %	200		

Materials Efficiency Measures 56.00%

Improved Case Selection		Building Material	Proportion %	Thickness (mm)	U-Value ($W/m^2 \cdot K$)	Embodied Carbon(kg/m^2)
MEM07*	Window Frames Base Case Material : Aluminium	Type 1 X - Re-use of Existing Window Frames	100 %			
MEM08*	Window Glazing Base Case Material: Single Glazing Thickness : 8mm	Type 1 X - Re-use of Existing Glazing	100 %	8	2.87	
MEM09*	Roof Insulation Base Case Material: X - No insulation Thickness : 0mm	Type 1 X - No Insulation	100 %	0.001		
MEM10*	Wall Insulation Base Case Material : X - No insulation Thickness : 0mm	Type 1 X - No Insulation	100 %	0.001		
MEM11*	Floor Insulation Base Case Material: Polystyrene Foam Spray or Board Insulation Thickness : 54.9mm	Type 1 X - No Insulation	100 %	0.001		

EDGE Certification Checklist

Building Type	Certification Stage	Subproject Name
Education	Post-Construction	JSS College of Pharmacy

Water Measures		Construction Audit Requirements
WEM01	Low Flow Showerheads	✔ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✔ On site test results using actual water pressure on site, which will supersede the standard design flow rate values; with average flow rate sampled from multiple locations, floors, or units, as applicable, measured at the highest flow per minute, using a timer and a measurement container; and
		✔ Date-stamped photographs of the showerhead(s) taken during or after installation showing the make and model; or
		✔ Purchase receipts for the showerheads showing the make and model.
		✔ Existing building projects If some of the documents required above are not available, other evidence of construction details, such as existing building drawings or photographs can be submitted.
WEM02	Low-Flow Faucets for Private Bathrooms	✔ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✔ On site test results using actual water pressure on site, which will supersede the standard design flow rate values; with average flow rate sampled from multiple locations, floors, or units, as applicable, measured at the highest flow per minute, using a timer and a measurement container; and
		✔ Date-stamped photographs of the faucet(s) taken during or after installation showing the make and model; or
		✔ Purchase receipts for the faucet(s) showing the make and model.
		✔ Existing building projects If some of the documents required above are not available, other evidence of construction details, such as existing building drawings or photographs can be submitted.
WEM04	Low-Flow Water Closets for Private Bathrooms	✔ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✔ Date-stamped photographs of the water closet(s) taken during or after installation showing the make and model; or
		✔ Purchase receipts for the water closet(s) showing the make and model.
		✔ Existing building projects If some of the documents required above are not available, other evidence of construction details, such as existing building drawings or photographs can be submitted.
WEM07	Low Flow Urinals	✔ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✔ Date-stamped photographs of the urinal(s) taken during or after installation showing the make and model; or

WEM07	Low Flow Urinals	✓ Purchase receipts for the urinal(s) showing the make and model. ✓ Existing building projects If some of the documents required above are not available, other evidence of construction details, such as existing building drawings or photographs can be submitted.
WEM08	Low-Flow Faucets for Kitchen Sink	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and ✓ On site test results by the auditor of the flow rate at the highest flow per minute, using a timer and a measurement container; and ✓ Date-stamped photographs of the faucet(s) or flow restrictor(s) taken during or after installation showing the make and model; or ✓ Purchase receipts for the faucet(s) or flow restrictor(s) showing the make and model. ✓ Existing building projects If some of the documents required above are not available, other evidence of construction details, such as existing building drawings or photographs can be submitted.
WEM13	Water-Efficient Landscape Irrigation System	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and ✓ Date-stamped photographs of the planted species, landscaping area and irrigation system if applicable; or ✓ Purchase receipts for the vegetation and irrigation system if applicable. ✓ Existing building projects If some of the documents required above are not available, other evidence of construction details, such as existing building drawings or photographs can be submitted.
WEM15	Waste Water Treatment and Recycling System	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and ✓ Date-stamped photographs of the installed system; or ✓ Purchase receipts for the water treatment and storage system; or ✓ Contract with the management company if the system is centralized or off-site. ✓ Existing building projects If some of the documents required above are not available, other evidence of construction details, such as existing building drawings or photographs can be submitted.
Energy Measures		**Construction Audit Requirements**
EEM01	Window to Wall Ratio	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and ✓ As-built façade drawings; or ✓ External and internal photographs of the building showing all the elevations Date-stamped photographs of the building interior and exterior showing all the elevations.

EEM01	Window to Wall Ratio	✓ Existing building projects If the documents required above are not available, other evidence of construction details, such as existing building drawings or photos taken during renovation can be submitted.
EEM02	Reflective Paint/Tiles for Roof	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✓ Date-stamped photographs of the roof(s) showing the claimed products on site; or
		✓ Purchase receipts showing the installed products.
		✓ Existing building projects If the documents required above are not available, other evidence of construction details, such as existing building drawings or photos taken during renovation can be submitted.
EEM04	External Shading Devices	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✓ Date-stamped photographs of all facades showing the shading devices on site; or
		✓ Purchase receipts showing the installed products.
		✓ Existing building projects If the documents required above are not available, other evidence of construction details, such as existing building drawings or photos taken during renovation can be submitted.
EEM05	Insulation of Roof	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✓ Date-stamped photographs of the roof(s) taken during construction at a point when any insulation materials claimed were visible on site; or
		✓ Purchase receipts showing the installed products.
		✓ Existing building projects If the documents required above are not available, other evidence of construction details, such as existing building drawings or photographs can be submitted.
EEM06	Insulation of Ground/Exposed Slab	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✓ Date-stamped photographs of the floor(s) taken during construction at a point when any insulation materials claimed were visible on site; or
		✓ Purchase receipts showing the installed products.
		✓ Existing building projects If the documents required above are not available, other evidence of construction details, such as existing building drawings or photographs can be submitted.
EEM08	Insulation of External Wall	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✓ Date-stamped photographs of the exterior wall(s) taken during construction at a point when any insulation materials claimed were visible on site; or
		✓ Purchase receipts showing the installed products.

EEM08	Insulation of External Wall	✓ Existing building projects If the documents required above are not available, other evidence of construction details, such as existing building drawings or photographs can be submitted.
EEM09	Efficient Glass	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✓ Date-stamped photographs of the glazing units installed; or
		✓ Purchase receipts showing the brand and product installed.
		✓ Existing building projects If the documents required above are not available, other evidence of construction details, such as existing building drawings or photographs can be submitted.
EEM11	Natural Ventilation	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✓ Date-stamped photographs showing that the plan layouts and location of openings as specified at the design stage have been constructed.
		✓ Existing building projects If some of the documents required above are not available, other evidence of construction details, such as existing building drawings or photographs can be submitted.
EEM13	Efficient Water Cooled Screw Chiller	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✓ Date-stamped photographs of the space cooling equipment taken during or after installation showing the make and model; or
		✓ Purchase receipts for the space cooling equipment showing the make and model; or
		✓ Contract with the management company showing the efficiency of the space cooling system, if the system is under separate management or off-site.
		✓ Existing building projects If some of the documents required above are not available, other evidence of construction details, such as existing building drawings or photographs can be submitted.
EEM23	Energy-Efficient Lighting for External Areas	✓ Documents from the design stage if not already submitted. Include any updates made to the documents to clearly reflect As-Built conditions; and
		✓ Date-stamped photographs of the installed lighting; it is not necessary to take photos of every single installed lamp, but the auditor is responsible for checking and verifying a reasonable proportion; or
		✓ Purchase receipts for the lighting.
		✓ Existing building projects If some of the documents required above are not available, other evidence of construction details, such as existing building drawings or photographs can be submitted.
EEM33	Onsite Renewable Energy System	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✓ Photographs of the installed system; or
		✓ Purchase receipts and delivery notes of the system; or

EEM33	Onsite Renewable Energy System	✓ Contract with the energy management company if the system is owned by a third party.
		✓ Existing building projects If some of the documents required above are not available, other evidence of construction details, such as existing building drawings or photographs can be submitted.
Material Measures		Construction Audit Requirements
MEM01	Bottom Floor Construction	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✓ Date-stamped photographs of the floor slabs taken during construction showing the claimed products on site; or
		✓ Purchase receipts showing the installed products.
		✓ If the documents required above are not available, other evidence of construction details, such as existing building drawings or photos taken during renovation can be submitted.
MEM02	Intermediate Floor Construction	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✓ Date-stamped photographs of the floor slabs taken during construction showing the claimed products on site; or
		✓ Purchase receipts showing the installed products.
		✓ Existing building projects If the documents required above are not available, other evidence of construction details, such as existing building drawings or photos taken during renovation can be submitted.
MEM03	Floor Finish	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✓ Date-stamped photographs of the flooring during or after installation showing the claimed products on site; or
		✓ Purchase receipts showing the installed products.
		✓ Existing building projects If the documents required above are not available, other evidence of construction details, such as existing building drawings or photos taken during renovation can be submitted.
MEM04	Roof Construction	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✓ Date-stamped photographs of the roof(s) taken during construction showing the claimed products on site; or
		✓ Purchase receipts showing the installed products.
		✓ Existing building projects If the documents required above are not available, other evidence of construction details, such as existing building drawings or photos taken during renovation can be submitted.
MEM05	Exterior Walls	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and

MEM05	Exterior Walls	✓ Date-stamped photographs of the floor slabs taken during construction showing the claimed products on site; or
		✓ Purchase receipts showing the installed products.
		✓ Existing building projects If the documents required above are not available, other evidence of construction details, such as existing building drawings or photos taken during renovation can be submitted.
MEM06	Interior Walls	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✓ Date-stamped photographs of the floor slabs taken during construction showing the claimed products on site; or
		✓ Purchase receipts showing the installed products.
		✓ Existing building projects If the documents required above are not available, other evidence of construction details, such as existing building drawings or photos taken during renovation can be submitted.
MEM07	Window Frames	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✓ Manufacturer's data sheets showing the make and model, material and U-value of the installed window frames; and
		✓ Date-stamped photographs of the window frames during or after installation showing the make and model; or
		✓ Purchase receipts showing the make and model of the installed window frames.
		✓ This measure includes exterior glass doors.
		✓ Existing building projects If the documents required above are not available, other evidence of construction details, such as existing building drawings or photos taken during renovation can be submitted.
MEM08	Window Glazing	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✓ Manufacturer's data sheets showing the make and model, U-value and SHGC of the installed glass; and
		✓ Date-stamped photographs of the glazing during or after installation showing the make and model; or
		✓ Purchase receipts showing the make and model of the installed windows/glass.
		✓ ? This measure includes exterior glass doors.
		✓ Existing building projects If the documents required above are not available, other evidence of construction details, such as existing building drawings or photos taken during renovation can be submitted.
MEM09	Roof Insulation	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and
		✓ Manufacturer's data sheets showing the brand and product name and insulating properties of the installed insulation; and

MEM09	Roof Insulation	✓ Date-stamped photographs of the insulation during construction showing the product; or ✓ Purchase receipts showing the brand and product installed. ✓ Existing building projects If the documents required above are not available, other evidence of construction details, such as existing building drawings or photos taken during renovation can be submitted.
MEM10	Wall Insulation	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and ✓ Manufacturer's data sheets showing the brand and product name and insulating properties of the installed insulation; and ✓ Date-stamped photographs of the insulation during construction showing the product; or ✓ Purchase receipts showing the brand and product installed. ✓ Existing building projects If the documents required above are not available, other evidence of construction details, such as existing building drawings or photos taken during renovation can be submitted.
MEM11	Floor Insulation	✓ Documents from the design stage if not already submitted. Include any updates made to the design stage documents to clearly reflect as-built conditions; and ✓ Manufacturer's data sheets showing the brand and product name and insulating properties of the installed insulation; and ✓ Date-stamped photographs of the insulation during construction showing the product; or ✓ Purchase receipts showing the brand and product installed. ✓ Existing building projects If the documents required above are not available, other evidence of construction details, such as existing building drawings or photos taken during renovation can be submitted.

Associated Subproject(s)

Sr No.	Associated Subproject Name	Country	City
1	JSS College of Pharmacy	India	Mysore