

# Energy Audit Report

2022-23

in compliance with the statutory requirements under  
the NAAC accreditation procedures



**Shri Dharmasthala Manjunatheshwara College of Engineering & Technology, Dharwad**

Principal Lead Auditor:

Mallikarjun A Kambalyal. CEA, ISO 50001, 14001 Lead Auditor.

Audited by:

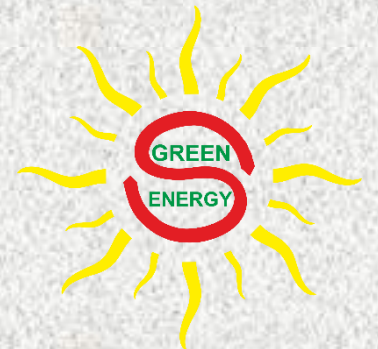
**SUNSHUBH TECHNOVATIONS PVT LTD.,**

120-2, LGF, 'A' wing, IT Park,

Hubli – 580029, Karnataka, India.

German off: Neuer Weg 166, 47803 Krefeld,

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# ELECTRICAL AUDIT REPORT 2021

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ELECTRICAL AUDIT REPORT 2021

## EXECUTIVE SUMMARY

Table of contents discussed with the Criteria 7 compliance auditor and institutions level of acceptance.

	Parameter	Issues	Auditors' observation	Benefits
<b>ENERGY AUDIT</b>				
1	Energy use	Un-balanced	Re design the load on each phase. and configuration.	Reduced load demand
2	Battery placement	Battery shell in conductor loop	closely packed placement results in low performance & self-discharge. Need ventilation.	Will increase the life span of the batteries.
3	Battery regeneration.	Disposal issues at the end of service life.	Regenerate the batteries for the next life cycle, leading to financial savings and avoided disposal.	Avoids purchase of new batteries.
4	Electrical	Old tube lights ( Few) Majority are LED	Few T12 type tube lights are still in operation. Replacing results in ROI of less than 9 months.	Reduces energy consumption.
5	Natural Lighting	Avoided by use of dark curtains	Use double layered curtains to avoid day time electrical lighting.	Avoids use of forced cooling.
6	Natural Ventilation	Few Rooms have Permanently closed ventilators.	results in room heating	Provides favourable condition for study environment.

+



## ENERGYAUDIT COMPLETION CERTIFICATE

### SUNSHUBH TECHNOVATIONS PVT LTD

#402, Hill view apartment, Adarshnagar 2<sup>nd</sup> Cr, HUBLI-580 029, Karnataka, INDIA  
Germany off: NeuerWeg 166, 47803 Krefeld, Dusseldorf.

WATER	ENERGY	POLLUTION	ORGANIC
Harvesting	Efficiency	Minimize	Farming
Conservation	Conservation	Eliminate	Worm compost
Management	Generation	Manage	Benefits

Regd: Certified Energy Auditors, GOI (EA 3485), Germany: Anbieter-Nr 1041388  
www.sunshubhrenewables.com, Email: ceo@sunshubhrenewables.com, Ph: 94492 83505, 94490 33505  
CIN : U74999KA2020PTC136321, PAN:ABECS0250Q, TAN:BLRS77362F GST No: 29ABECS025001ZX



### ENERGY AUDIT COMPLETION CERTIFICATE

I, Mallikarjun A Kambalyal, endorse and confirm that the Energy Audit has been carried out on 13<sup>th</sup> March 2023 under the instructions of Dr. K Gopinath Principal for Shri Dharmasthala Manjunatheshwara College of Engineering & Technology, Dharwad, Karnataka.

This report is generated based on the site visits and evidence collected from the site and this completion certificate is issued in compliance with *Criteria* 7.1.6.

All attempts have been made to evaluate the scope for development and inculcate green practices in the campus and extended throughout the campus. The focus is also laid to make positive impact on the society for a better living.

This report is tabled in two parts. The first forms the core discussions which are subject specific under the statutory requirements of the NAAC accreditation norms. The second section is general in nature.

Any modifications, changes, omissions after the site visit shall be exclusive.

Authorised Auditor.

Mallikarjun A. Kambalyal B.E (E&C)

Certified Energy Auditors EA-3485.

ISO 50001:2011 & ISO14001:2015 Lead Auditor.

Date: 13<sup>TH</sup> March 2023





## BUREAU OF ENERGY EFFICIENCY



Examination Registration No. : **EA-3485** Serial Number **2838**

Certificate Registration No. : **2838**

### Certificate For Certified Energy Manager

This is to certify that Mr./Mrs./Ms. **Mallikarjun A Kambalyal** Son/Daughter of Mr./Mrs. **Andanappa V Kambalyal** who has passed the National Examination for certification of energy manager held in the month of **April 2006** is qualified as certified energy manager subject to the provisions of Bureau of Energy Efficiency (Certification Procedures for Energy Managers) Regulations, 2010.

This certificate shall be valid for five years with effect from the date of award of this certificate and shall be renewable subject to attending the prescribed refresher training course once in every five years.

His /Her name has been entered in the Register of certified energy manager at Serial Number **2838** being maintained by the Bureau of Energy Efficiency under the aforesaid regulations.

Mr./Mrs./Ms. **Mallikarjun A Kambalyal** is deemed to have qualified for appointment or designation as energy manager under clause (I) of Section 14 of the Energy Conservation Act, 2001 (Act No.52 of 2001).

Given under the seal of the Bureau of Energy Efficiency, this **7<sup>th</sup>** day of **February, 2013**

Secretary  
Bureau of Energy Efficiency  
New Delhi

Dates of attending the refresher course	Secretary's Signature	Dates of attending the refresher course	Secretary's Signature
<b>28.01.2020</b>			

## *Certificate of Successful Completion*



**Intertek**

*This is to Certify that*

***MALLIKARJUN A KAMBALYAL***

*has successfully completed the*

***Intertek***

***CQI & IRCA Certified ISO 14001:2015  
Auditor Conversion Training Course***

*The Course includes the assessment and evaluation of Environmental Management Systems to conform to the requirements of ISO 14001:2015 and ISO 19011:2011*

*This course is certified by the Chartered Quality Institute (CQI) and the International Register of Certificated Auditors (IRCA)  
– IRCA REFERENCE 18093 –*

*The course meets the training requirements for individuals seeking certification under the IRCA Auditor Certification Schemes*



*Authorising Signature: Vystra Stasunova*

*Course Dates: 14<sup>th</sup> – 16<sup>th</sup> July 2017*

*Certificate Number: 47730*

*Membership Application To Be Made Within 3 Years From Last Day of Course*

121807

ISO Certified Lead Auditor. Certificate No: 47730



**bsi.**

## BSI Training Academy

This is to certify that

**Mallikarjun A. Kambalyal**

has attended and passed

**Energy Management Systems (ENMS) Auditor/Lead Auditor Training Course  
(ISO 50001:2011)**



Premanand Ramakrishnan, Director of Training

Date: 14/04/2016 - 18/04/2016

Certificate Number: ENR-00253448

This certificate is valid for 3 years from the date above for the purpose of registering as an auditor with IRCA.



Course number A17583 certified by IRCA

The British Standards Institution is incorporated by Royal Charter  
BSI India, The Mitra Corporate Suites (A-2), Plot 1 & 2 Inder Nagar Mehra Road, New Delhi 110065, India Tel: +91 11 2652 9000



By Royal Charter



...making excellence a habit.™

ISO Certified Lead Auditor. Certificate No: ENR-00253448



## ACKNOWLEDGEMENT

SUNSHUBH TECHNOVATIONS PVT LTD. is pleased to express its sincere gratitude to the management of Shri Dharmasthala Manjunatheshwara College of Engineering & Technology, Dharwad, for entrusting SUNSHUBH TECHNOVATIONS PVT LTD. with the assignment on Green Earth practices based on Educate, Practice, Advocate & Manage the resources in their educational organization.

We also wish to thank the officials and the maintenance staff for the help rendered during the energy flow study.

We would fail if we neglect to appreciate the sincere efforts put in by the Faculty

Dr. K Gopinath Principal.

Dr. S M Joshi. NAAC Project Co-Ordinator

and the Students who against all odds have kept the college premises clean to the possible limits. Without the crucial and significant support from the fellow teaching team the energy savings and carbon footprint reduction would not be a reality.

With the motivational support of the management, ground realistic support from teaching team and sincere efforts of the students in incorporating the change (habits) and instructions, the college could effectively declare the reduction in Carbon footprint and optimize the waste reductions.

We are not in a position to compute the carbon foot print at this point of time as the basic information from each of the students is yet to be collected; however, we will discuss the Carbon Foot print in the follow up compliance report.

Wishing the team, a great success we deeply express our gratitude and heartfelt "THANKYOU" for allowing us to assess the energy flow scenario there by the GREEN STATUS.

We acknowledge the involvement of

List of HoDs & IQAC Coordinator

Dr. S M Joshi NAAC Coordinator

Supported by all the department team head.

<u>Department</u>	<u>Coordinator</u>
Chemical Engineering	Prof. Rashmi
Civil Engineering	Dr. Fernandez
Computer Science and Engineering	Prof. Nita G K
Electronics and Communication Engg	Prof. Vijay Kumar
Electrical and Electronics Engineering	Dr. Shelavadi
Information Science and Engineering	Dr. Rajashekharappa)
Master of Business Administration	Dr. Mahesh
Mechanical Engineering	Dr. K N Patil
Physics	Dr. Bahubali
Chemistry	Dr. Shashidhar
Mathematics	Dr. Varsha Joshi

Mallikarjun A. Kambalyal. B.E.(E&C).

Certified Energy Auditors (EA-3485)

SUNSHUBH TECHNOVATIONS PVT LTD.



## LIMITATIONS

Our recommendations are in the interest of conservation of Electrical Energy and Green Culture i.e., the reduction in CARBON FOOTPRINT. The compliance to the recommendations will be subjected to meeting the safety and Environmental rules and guidelines.

The core objective of the institute is to educate. The institute is into technical education and more often the practical sessions draw power. The extent of power drawn is unpredictable and dynamic in nature.

Hence the power analysis needs to be carried out over longer duration.

Under such situation, the energy bills are relied upon to define the energy consumption.

## AUTHENTICATION & DATE OF ENERGY AUDIT

This Energy Audit has been carried out on 13<sup>th</sup> March 2023 under the instructions of Dr. K Gopinath Principal, and in the presence of Dr. S M Joshi. NAAC Project Co-Ordinator.

## ENERGY AUDIT OBJECTIVES

Energy Audit was initiated in the beginning of 1970's, with the motive of inspecting the work executed within an organization, whose exercises could cause risk to the health of inhabitants and the environment. It exposes the genuineness of the proclamation made by the organisation with the concern on health issues. As a consequence of their operations with respect to environmental pollution it is the duty of the organisation to carry out the green audit of the ongoing processes for various reasons, such as,

To make sure whether one is performing in accordance with the relevant rules and regulations,

To improve the procedures and aptness of material in use,

To analyse the potential duties and to determine a way which can lower the cost and to the revenue.

Through green audit one gets adoration as to how to improve the condition of the environment. There are various factors that were forced upon and determine the growth of/or conduct of green audit. Incidents like,

Decades old Bhopal gas tragedy, that has left its residual effect which still haunts us.

Our buildings catching fire due to various reasons,

Industries blowing off taking valuable human lives etc

People going sick, feeling tired, after long hours of operations in the organization,

Increased demand of generators due to inconsistent power supply, which has resulted or lead into recent floods and droughts,

are some of the situations to ponder about.

To address various issues in context with human health, green audit is assigned to "Criteria 7" of NAAC (National assessment and accreditation council) accreditation. NAAC is a self-governing organization in India that declares the institutions as Grade "A", Grade "A+", or Grade "A++", according to the scores assigned at the time of accreditation.

The other intention of organising green audit is to update the environment conditions in and around the institutions i.e., within the compound and outside the compound. It is carried out with the aid of performing certain

tasks like waste management, energy consumed, diesel burnt it performing the objective of the organization. Lastly to self-assess the net carbon footprint of the conduct of process in the organization.

The goals of green audit

The purpose of carrying out green audit is securing the environment and cut down the threat posed to human health.

To Make sure that rules and regulations are complied with.

To avoid the environmental interruptions that are more difficult to handle and their corrections call for high cost.

To suggest the best protocol for adding to sustainable development.

To execute the process of the organisation utilising minimum natural resources and efficient use of those resources contributing to minimum waste generation.

How is the green audit conducted

Pre-audit

Planning

selecting the team of auditors both internal and external

schedule the audit facility

acquire the background information

visit areas under audit

**On site conditions:**

Understand the scope of audit

Analyse the strengths and weaknesses of the internal controls

Conduct audit with end user comfort focused and making it easy to perform.

Collect necessary evidence so that the stakeholders stand to understand how and where they are going wrong in the process of their conduct.

Post audit draw the report based on the data collected.

On confirmation of the preliminary report, draw a final report of the observations and inference with accuracy more near to implementable way.

Discuss various remedial measures for alternatives if required.

Prepare an action plan to overcome the shortcomings with continual observation on the action plan initiated.

Steps under green audit

**Water audit:** Water is one of the cheapest commodities next to the Air we breathe. Although we Indians, use less water in comparison to western countries. However, the extent of pollutants that we leave behind has polluted all the resources including the deep well.

Rainwater harvesting is one of the best techniques that can be adopted by harvesting the rainwater and using it at the time of scarcity. the audit team to observe and investigate the relevant methods that can be adopted and implemented and draw the balance of use of water.

**Waste management audit:** The point of generation of waste, the type of waste generated, i.e., hazardous, recyclable and organically compostable wastes and segregating method at the point of generation for easy and best way to handle the same. Evaluating such methods to minimise the use of resources in the process of their management.

**Energy audit:** It deals with use of energy in the conduct of the process. The priority is topmost for conservation over efficiency; hence, energy auditor should always consider not to use the energy if necessary. At best it can be used judiciously.

**Environmental quality audit:** It analyses air quality, noise level and the programs undertaken by the institution for plantation creating awareness of trees around us and how nature provides us with remedial measures within its framework.

**Health audit:** In the process of use of resources and conduct of the activities, they can develop impact on human health, that might be off minutely harmful, cause permanent disorder or may even cause death.



Occupational health hazards are discussed in detail and the stakeholders are informed of the same and required necessary remedial measures indicated.

**Renewable energy:** To make the organisation net zero carbon emission by use of renewable resources including energy such as solar wind biogas geothermal energies are put into ooh utilisation.

**Carbon handprint:** The net impact of all the above energy audits should be to make an organisation contribute zero emissions which are caused by use of water, generation of waste, use of energy, environmental damage, health damage. Finally, to explore if the campus can move in the direction where in it contributes to third-party emissions minimisation.

**Benefits of green audit:** To draw home the benefits, the system has been separated out into various audits as listed above. In doing so, and if audit findings are effectively implemented there are many advantages that can be practised in the process

Recognise the cost saving methods through waste minimising and managing technologies.

Point out the prevailing and forth coming complications.

Authenticate conformity with the legal requirements.

Empower the organisation to frame a better environmental performance.

Portray a good image of the institution which helps build better relationships with the group's organisations, stakeholders in and around its operations

Enhance the alertness for environmental guidelines duties and conduct of preparedness for any eventualities due to environmental disasters.

## ABOUT ENERGY AUDIT

Shri Dharmasthala Manjunatheshwara College of Engineering & Technology, Dharwad. has asked SUNSHUBH TECHNOVATIONS PVT LTD., Hubli., to conduct the Green Energy Audit for their Institution.

In this context, the management of the Institute represented by Dr. K Gopinath. Principal entrusted us the task of conducting the feasibility study to reduce energy consumption and adopt green habits.

SUNSHUBH TECHNOVATIONS PVT LTD. represented by Mr. Mallikarjun A. Kambalyal made a detailed study and readings of various appliances were taken and carried out the ENERGY audit along with the safety parameters.

Based on the information available and the requirements put before us, it was decided to submit the report in accordance with 7<sup>th</sup> criteria apart from meeting social responsibilities.

ENERGY AUDIT where in pollution Preventive measures are necessary

ELECTRICAL ENERGY EFFICIENCY – CONSERVATION within the college

We hope the points presented are self-explanatory, if there is need for any clarification, we are open for discussions.

## LIST OF INSTRUMENTS

During the process of the Audit, the following lists of instruments were used (wherever applicable).

Sr No.	INSTRUMENT	MAKE	APPLICATION
1	Digital Power Analyser (PC Interfaced)	SCHIVAN ARNOX	Electrical Machinery.
2	Accessories -3000 Amps	ARNOX	Higher load UPTO 3000 Amps,
3	Accessories -200 Amps	ARNOX	UPTO 200 Amps,
4	Thermal Imager	FLIR	Identify loose contacts and bearing losses
5	Power Analyser (Manual)	MECO	Electrical Machinery.
6	Infrared Thermometer	METRAVI	Thermal (Fuel) Energy.
7	Digital (Contact) Temperature & Humidity Meter.	METRAVI	Electrical Machinery. (A/C's And Cooling Towers)
8	Digital Tachometer	METRAVI	Electrical Machinery.(A/C's And Cooling Towers)
9	Lux Meter	METRAVI	General & Task Lighting.
10	Sound Level Meter	METRAVI	Electrical Machinery. Generator Sound Proofing
11	Digital Anemometer	METRAVI	Electrical Machinery.(A/C's And Cooling Towers)
12	Digital KW Meter	METRAVI	Electrical Machinery.
13	Digital Power Factor Meter	METRAVI	Electrical Machinery.
14	Ultrasonic flow meter		Measure liquid flow.
15	Portable Vibration Meter.	METRAVI	Effect Of Filtration - Sewing System. Structural Stability
16	Live cable detector probe	-	Detect hidden cables for safety audit.
17	Power Analyser – EMM 5	Beluk	For remote communication and detailed audit.
18	Power Analyser – ELITE PRO	Beluk	Power Analyser.
19	ETV meter, KWh & PF meters for site recording.	Secure	
20	PTs for Transformer audits.	KALPA	On field auditing of transformer loading and imbalance evaluation.

Only appropriate instruments will be used wherever necessary.

## ONGOING STATUS

It's an optimistic & highly dedicated team effort lead by the Principal & the senior staff who have dedicated all their wits & free time to initiate Green Carpet the entire college premises. It is also a fact that there do exist, few short comings which however is unintentional & on being trained & educated the campus should look for continued minimized waste generation. With all due appreciation to the management, staff involved & cooperation by the students, we have made few suggestions which on implementation, will reduce, demand for water & electrical power. It will also reduce the existing level of pollution to bear minimum.

There is high potential among the students to be educated and spread the knowledge of going ZERO waste generation in their respective colonies and society they dwell in, contributing positively to the cause of

**NO WASTE – NO POLLUTION – NO HEALTH HAZ-  
ARD.**



## GREEN ENERGY PLEDGE (proposed)

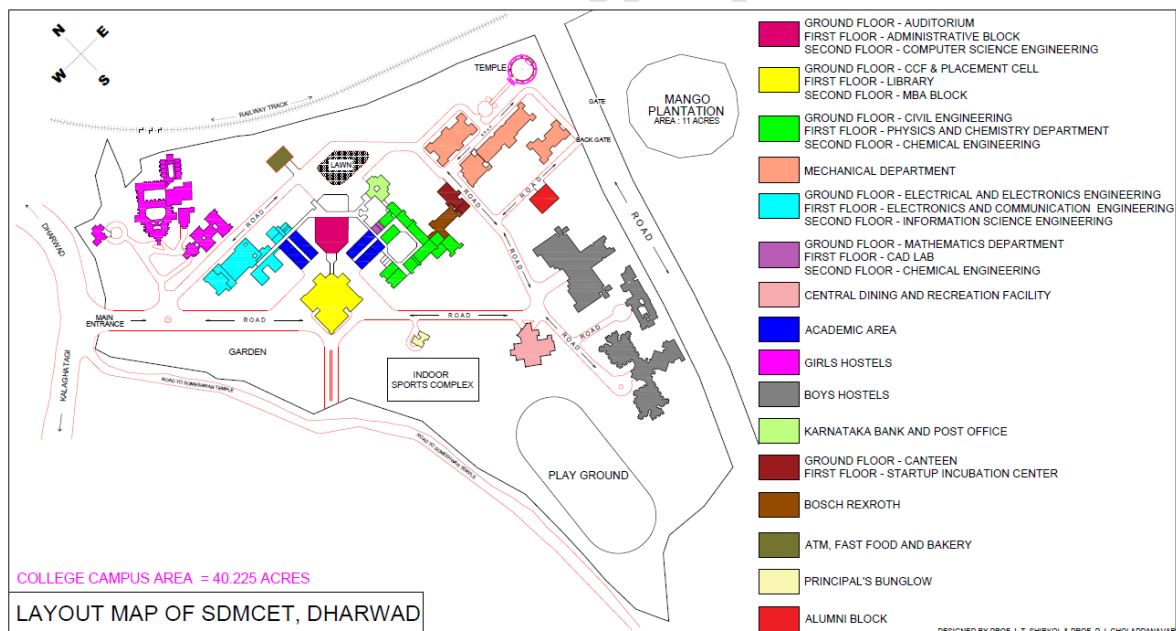
We the Principal, the staff and students, adopt responsible practices in our daily activities with due regard to the environment. We set and continually review objectives and targets for achieving our goal to protect our entire college premises from all pollutions primarily. We seek to comply with safety and environmental regulations to implement inhouse standards to improve our environmental performance. We commit ourselves to the safe operation of all our working habits, be it in classrooms, library, canteen, on road, off road, in-campus out-campus as well as at our place of stay. We adhere to reduce environmental load by efficiently using resources, saving energy, reducing waste, encouraging material recycle, with special emphasize to minimising emissions of greenhouse gases, ozone depleting substance and particle matter. we endure to minimise environmental loads and adopt environmentally friendly technologies when ordering and purchasing necessary products and resources. We endure to attend educational programs and promulgate our close friends and colleagues to follow suite We endure to ensure that we recognize the essence of this Energy policy by actively and aggressively conducting workshops and training to all in environmental concepts. We make wide ranging social contribution to close association with the students, teaching staff, administrative staff, housekeeping staff by disclosing environmental information and supporting environmental consumption.

-Sd-

Principal

*(Indicative templet for display at all prominent areas, waiting rooms, canteen, library, relaxing areas in the campus.)*

## ABOUT THE INSTITUTE



Shri Dharmasthala Manjunatheshwara College of Engineering & Technology, Dharwad.

We understand from the institutes web site that the management has laid a well-defined VISION, MISSION and laid the VALUES. As seen from the website...



#### Vision:

To develop competent professionals with human values.



#### Mission

- To have contextually relevant Curricula.
- To promote effective Teaching Learning Practices supported by Modern Educational Tools and Techniques.
- To enhance Research Culture.
- To involve the Industrial Expertise for connecting Classroom contents to real-life situations.
- To inculcate Ethics and soft-skills leading to overall personality development.



#### Core Values

- Competency
- Commitment
- Equity
- Team work
- Trust

## CONSIDERATIONS

Before we present our report, the factors that are considered for positive impact recommendations are,

Climatic conditions under which the institute is located.

The core of activities carried out in the campus.

The energy consumption pattern.

Sources of electrical power to address the needs of the campus.

Dharwad climate (India)

Data and graphs for weather & climate in Dharwad.

>>[weather by month // weather averages Dharwad](#)

>>[climate graph // weather by month Dharwad](#)

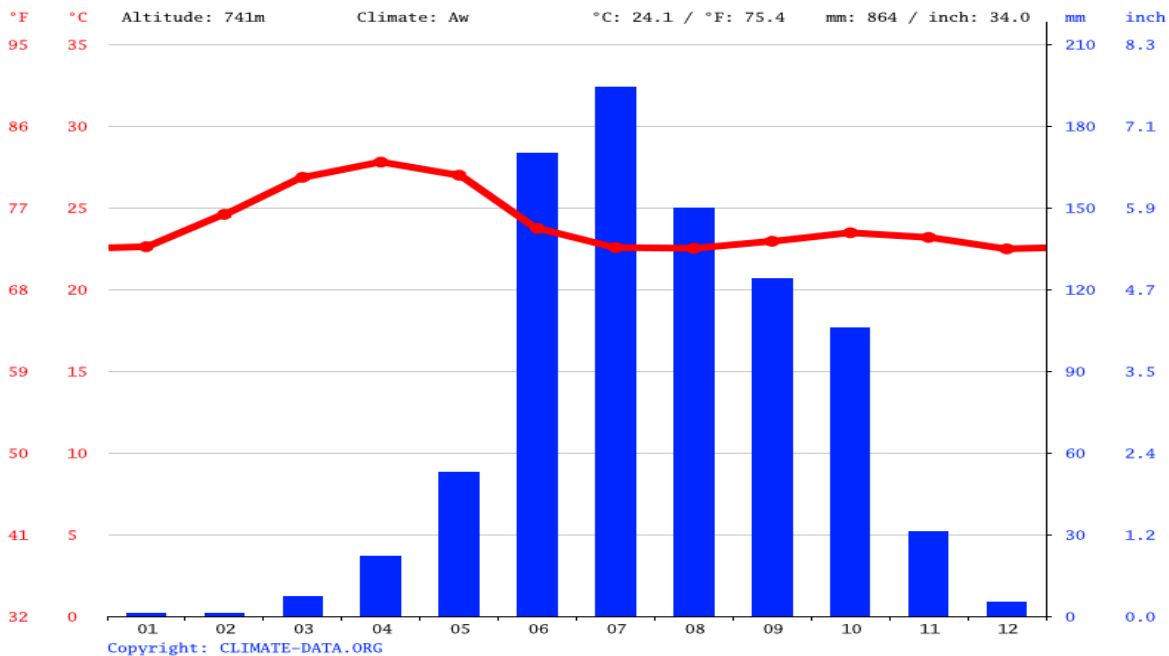
>>[average temperature Dharwad](#)

>>[weather Dharwad](#)

This city has a tropical climate. In winter, there is much less rainfall than in summer. The Köppen-Geiger climate classification is Aw. The temperature here averages 24.1 °C | 75.4 °F. In a year, the rainfall is 864 mm | 34.0 inches.

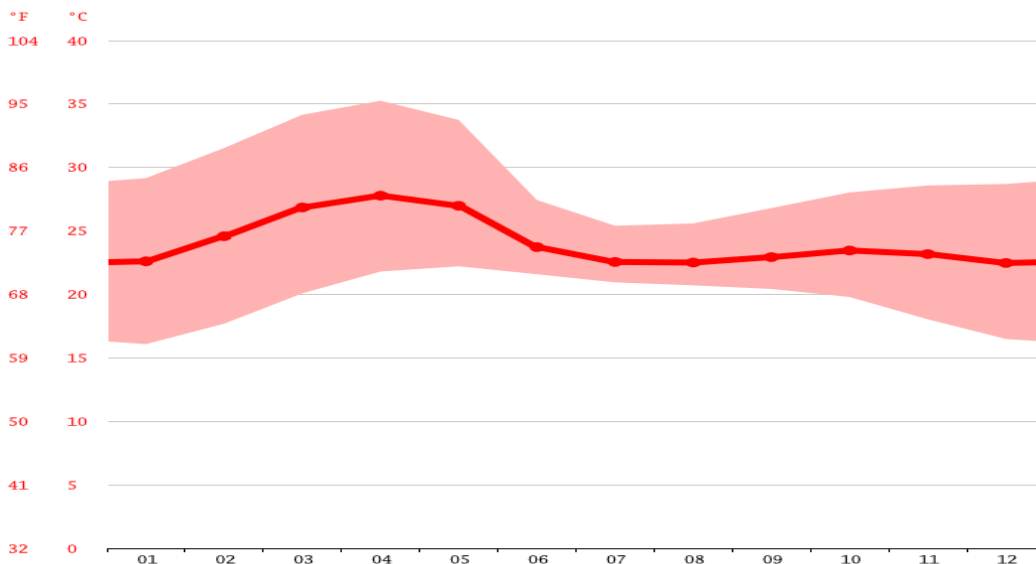
This region, situated near the equator line, is characterized by difficult-to-define summer seasons. The best time to visit is January, February, March, May, June, July, August, September, October, November, December.

Climate graph // weather by month Dharwad



The least amount of rainfall occurs in January. The average in this month is 1 mm | 0.0 inch. Most precipitation falls in July, with an average of 194 mm | 7.6 inch.

Average temperature Dharwad



The temperatures are highest on average in April, at around 27.8 °c | 82.0 °f. In December, the average temperature is 22.5 °c | 72.5 °f. It is the lowest average temperature of the whole year.

Weather by month // weather averages Dharwad

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C	22.6 °C	24.6 °C	26.9 °C	27.8 °C	27 °C	23.7 °C	22.6 °C	22.5 °C	22.9 °C	23.5 °C	23.2 °C	22.5 °C
Min. Temperature °C	16.1 °C	17.7 °C	20.1 °C	21.8 °C	22.2 °C	21.6 °C	20.9 °C	20.7 °C	20.4 °C	19.8 °C	18 °C	16.5 °C
Max. Temperature °C	29.2 °C	31.5 °C	34.2 °C	35.3 °C	33.7 °C	27.4 °C	25.4 °C	25.6 °C	26.8 °C	28 °C	28.6 °C	28.7 °C
Precipitation / Rainfall mm	1	1	7	22	53	170	194	150	124	106	31	5
Humidity(%)	44%	40%	41%	53%	63%	83%	87%	86%	83%	74%	58%	48%
Rainy days (d)	0	0	1	4	8	18	20	19	14	10	3	1
avg. Sun hours (hours)	9.8	10.2	10.4	10.4	9.6	6	5.4	5.4	6.1	7.8	8.8	9.3

Data: 1991 - 2021 Min. Temperature °C , Max. Temperature °C , Precipitation / Rainfall mm (in), Humidity, Rainy days. Data: 1999 - 2019: avg. Sun hours

The variation in the precipitation between the driest and wettest months is 193 mm | 8 inches. The average temperatures vary during the year by 5.3 °C | 9.6 °F.

The month with the highest relative humidity is July (86.75 %). The month with the lowest relative humidity is February (39.91 %). The month with the highest number of rainy days is July (26.90 days). The month with the lowest number of rainy days is February (0.23 days).



## DISCUSSIONS ON EXECUTIVE SUMMARY

Energy Use Evaluation (Audit) in the College campus.

The energy consumption details as made available are tabled below.

Energy bills for the operating year 2022-23							
S.NO	MONTH	CONTRACT DEMAND in KVA	RECORDED DEMAND	CONSUMPTION		Solar energy exported.	POWER FACTOR
				GRID KHW	SOLAR KHW		
1	April	250	145	45375	37805	5450	0.98
2	May	250	172	49538	35014	5188	0.99
3	June	250	161	39413	30289	2450	0.99
4	July	250	118	34913	23385	2225	0.99
5	August	250	64	18325	25321	4163	0.99
6	September	250	135	28000	24474	4463	0.99
7	October	250	154	43838	34526	10300	0.99
8	November	250	127	37750	32269	7675	0.98
9	December	250	163	50600	33532	6763	0.98
10	January	250	150	44750	39885	10738	0.99
11	February	250	151	47188	38993	7763	0.99
12	March	250					

## BALANCED LOAD



In the face of it, on preliminary observation, we find the load goes unbalanced and needs correction.

Since the energy consumption is dynamic in nature, energy use analysis needs to be drawn over a longer period and hence it is not appropriate to define the actual energy consumption pattern.

Balanced load helps in minimising stress on the switchgear and prevents early failure of switchgear.

## ENERGY USE

### LIGHTING

Energy is commonly used for general lighting in educational institutions. In recent times the evolution of lighting technology has seen drastic transformation. The incandescent bulb - T12 Tube light - T8 Tube light - T5 Tube light - CFL - LED and off late the Organic LED have shown drastic reduction in energy demand.



Parallely Induction Lights are also to be viewed with for large area coverage with Nil or No glare requirements.

As an Engineering college, it is important that the college set an example on various properties and educate the students on there significance. We have discussed few aspects of lighting to kickstart the debate.

While we discuss the energy use for lighting, we should prioritise conservation over efficiency.



## TYPES OF LIGHTING

Lighting is classified by intended use as general, accent, or task lighting, depending largely on the distribution of the light produced by the fixture.

Task lighting is mainly functional and is usually the most concentrated, for purposes such as reading or inspection of materials. For example, reading poor-quality reproductions may require task lighting levels up to 1500 lux (150 foot-candles), and some inspection tasks or surgical procedures require even higher levels.

Accent lighting is mainly decorative, intended to highlight pictures, plants, or other elements of interior design or landscaping.

General lighting (sometimes referred to as ambient light) fills in between the two and is intended for general illumination of an area. Indoors, this would be a basic lamp on a table or floor, or a fixture on the ceiling. Outdoors, general lighting for a parking lot may be as low as 10-20 lux (1-2 foot-candles) since pedestrians and motorists already used to the dark will need little light for crossing the area.

## METHODS

Downlighting is most common, with fixtures on or recessed in the ceiling casting light downward. This tends to be the most used method, used in both offices and homes. Although it is easy to design, it has dramatic problems with glare and excess energy consumption due to large number of fittings. The introduction of LED lighting has greatly improved this by approx. 90% when compared to a halogen downlight or spotlight. LED lamps or bulbs are now available to retro fit in place of high energy consumption lamps.

Up lighting is less common, often used to bounce indirect light off the ceiling and back down. It is commonly used in lighting applications that require minimal glare and uniform general illuminance levels. Up lighting (indirect) uses a diffuse surface to reflect light in a space and can minimize disabling glare on computer displays and other dark glossy surfaces. It gives a more uniform presentation of the light output in operation. However indirect lighting is completely reliant upon the reflectance value of the surface. While indirect lighting can create a diffused and shadow free light effect it can be regarded as an uneconomical lighting principle.

Front lighting is also quite common, but tends to make the subject look flat as it casts almost no visible shadows. Lighting from the side is the less common, as it tends to produce glare near eye level.

Backlighting either around or through an object is mainly for accent. Backlighting is used to illuminate a background or backdrop. This adds depth to an image or scene. Others use it to achieve a more dramatic effect.

## FIXTURE

Lighting fixtures come in a wide variety of styles for various functions. The most important functions are as a holder for the light source, to provide directed light and to avoid visual glare. Some are very plain and functional, while some are pieces of art in themselves. Nearly any material can be used, so long as it can tolerate the excess heat and is in keeping with safety codes.

An important property of light fixtures is the luminous efficacy or wall-plug efficiency, meaning the amount of usable light emanating from the fixture per used energy, usually measured in lumen per watt. A fixture using replaceable light sources can also have its efficiency quoted as the percentage of light passed from the "bulb" to the surroundings. The more transparent the lighting fixtures are, the higher efficacy. Shading the light will normally decrease efficacy but increase the directionality and the visual comfort probability.

Colour temperature for white light sources also affects their use for certain applications. The colour temperature of a white light source is the temperature in kelvins of a theoretical black body emitter that most closely matches the spectral characteristics of the lamp. An incandescent bulb has a colour temperature around 2800 to 3000 kelvins; daylight is around 6400 kelvins. Lower colour temperature lamps have relatively more energy in the yellow and red part of the visible spectrum, while high colour temperatures correspond to lamps with more of a blue-white appearance. For critical inspection or colour matching tasks, or for retail displays of food and clothing, the colour temperature of the lamps will be selected for the best overall lighting effect.

The institute has taken good initiatives in incorporating various measures to adopt to new technologies available.

The institute uses LED lights in most of the rooms. At places where they are not in use, they are planned to be replaced by LED lights as and when they fuse out. The class rooms are very well illuminated.

The street lights, waranda lights are all seen to be LED lights. The focus has been energy conservation at top priority.

As Engineering college, it is obvious that the information on other aspects of lighting is brought to the notice of all the staff members. We have illustrated few of the aspects that has adverse affect on the visibility and hampers the task being performed.

Energy savings on use of new technology:

We have illustrated and discussed in detail using one case study.

### ACTION

Every teaching staff and the field supervisors should be educated on these critical aspects.

### BENEFITS

The strain on the eyes reduces drastically, observations can through better knowledge as the colour contrast is crisp and clear. The institute saves on energy abuse.

Thus its an win-win situation for all the members involved.

COST : NIL, no additional investment is required, just operation of switching habits.

More information on VISIBILTY concerns. These observations are shared here as it benefits the engineering fraternity in their course of design, teaching and opens areas for REASEARCH avenues.

Light pollution is the presence of anthropogenic and artificial light in the day or night environment. It is exacerbated by excessive, misdirected or obtrusive use of light, but even carefully used light fundamentally alters natural conditions.

Light pollution is caused by inefficient or unnecessary use of artificial light. Specific categories of light pollution include light trespass, over-illumination, glare, light clutter, and skyglow. A single offending light source often falls into more than one of these categories.

Every day, people are exposed to hours of artificial light from computers, office lights and even 24-hour lighting in hospitals.

Now, new research in animals shows that excessive exposure to "light pollution" might be worse for you than previously known, taking a toll on muscles and bones.

Researchers at Leiden University Medical Centre in the Netherlands tracked the health of rats exposed to six months of continuous light



compared with a control group of rats living under normal conditions -- 12 hours of light, followed by 12 hours of dark.

During the study, reported in *Current Biology*, the rats exposed to continuous light had less muscle strength and showed signs of early-stage osteoporosis. They also got fatter, and some markers of immune system health worsened.

While earlier research found excessive light exposure might affect cognition, the new research showed a surprising effect on muscles and bones.

"Not only did motor performance go down on tests, but the muscles themselves just atrophied, and mice physically became weaker after just two months," said Chris Colwell, a sleep specialist at the University of California-Los Angeles, who was not involved with the study.

The good news is the effects of light exposure appear to be reversible. When the study rats returned to their natural light-dark cycle, their health returned to normal after two weeks.

The data suggest more research is needed into the health effects of artificial light. One concern is the health of patients in hospital intensive care units, people in nursing homes and babies in neonatal units -- places where artificial lights often are kept on for 24 hours a day.

"We keep the sickest people in our society under constant light conditions," Colwell said.

The research also might have implications for people exposed to the blue wavelength light emitted from computers, which might be more disruptive to the body than the light that comes from traditional artificial lights.

## VENTILATION

We have two observations to look at.

1. Natural ventilation
2. Forced air circulation.



## CLOSED VENTILATORS

### FANS

Closed ventilators should be altered and good amount of opening is provided at the top, i.e., near to the ceiling. It helps natural draft and avoids use of circulating fans.

Institute has installed good number of air circulating fans.

The following analysis report on three fans, one normal (conventional) fan, two BLDC fans was carried out. The detailed discussion on the energy consumption, air circulation, and financial implications was considered and detailed discussions are drawn.

The institute can consider to quantify the CAPEX and the savings before taking appropriate steps.

# **PERFORMANCE ANALYSIS**

## **BLDC FAN WITH REMOTE CONTROL**

Analysed by:

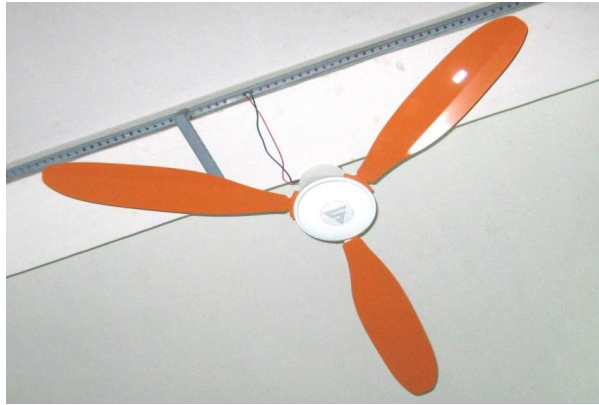
**SUNSHUBH REEWABLES & RESEARCH CENTRE.**

(Presently Sunshubh Technovations Pvt Ltd.)

Place: Energy Efficiency Park, 'A' wing, Lower ground Floor, IT PARK,  
HUBLI – 580029, Karnataka, India.

Ph: 9449033505, [ceo@sunshubhrenewables.com](mailto:ceo@sunshubhrenewables.com)

Make : SUPERFAN



Make ; GORILLA FAN



Comparison of Ceiling Fans of various brands with **BLDC** (Brush Less Direct Current fan with Remote.)

Extracted from Excel File.

Cost of Electrical Energy (Unit) in Rs.	7	Operating speed: Select - 1 to 5	5	Operating Hours Select - 1 to 24	15
Make		<b>GORILLA FAN</b>	Open market/featured (As per specifications)	<b>GORILLA FAN</b>	Open market/standard
First Cost		3500	2500	3500	1500
Warranty		3 years	1 year	3 years	1 year
Watts at selected speed		30	60	30	61
RPM		360.7	300	360.7	300
Operating Sound level in decibel (dB)		54.6	NM	54.6	59.4
Floor Temperature (Thermography)		Off - 32.3°C	Off - 32.8°C	Off - 32.3°C	Off - 33.7°C
		On - 32.1°C	On - 32.7°C	On - 32.1°C	On - 33.4°C
Operating hours		15	15	15	15
Watt-hour		450	915	450	915
For 30 Days in watts		13500	27450	13500	27450
Units/ Month		13.5	27.45	13.5	27.45
UNIT RATE		94.5	192.15	94.5	192.15
Savings		97.65		97.65	

Difference		1000		2000	
Return on additional Cost		10 Months		20 Months	

### Extracted from Excel File.

Cost of Electrical Energy (Unit) in Rs.	7	Operating speed Select - 1 to 5	5	Operating Hours Select - 1 to 24	15
Make		SUPERFAN	Open market/featured (As per specifications)	SUPERFAN	Open market/standard
First Cost		3500	2500	3500	1500
Warranty		5 years	1 year	5 years	1 year
Watts at selected speed		39	60	39	61
RPM		388.4	300	388.4	300
Operating Sound level in decibel (dB)		62.1	NM	62.1	59.4
Floor Temperature (Thermography)		Off - 33.7°C	Off- 32.8°C	Off - 33.7°C	Off - 32.8°C
		On - 33.4°C	On - 32.7°C	On- 33.4°C	On - 32.7°C
Operating hours		15	15	15	15
Watt-hour		585	915	585	915
For 30 Days in Watts		17550	27450	17550	27450
Units/ Month		17.55	27.45	17.55	27.45
UNIT RATE		122.85	192.15	122.85	192.15



Savings		69.3		69.3	
Difference		1000		2000	
Return on additional Cost		14 Months		29 Months	

### Extracted from Excel File.

GORILLA FAN		Specifi- cation:	Watts : 28	P.f : 0.95	Span : 1200mm	Speed : 350rpm	Air delivery : 220 CMM							
SPEED	RPM	LOAD in WATTS	POWER FACTOR	AIR FLOW in Km/hr			Average Air flow inkm/hr	Calculated Km/hr -> m/s	AIR FLOW in m/s			Aver- age Air flow in m/s	Calcu- lated m/s -> Km/hr	Calculated Air delivery in m3/m
1	178.4	6	0.94	5.4	4.4	3.8	4.5	1.25	1.4	1.3	1.2	1.35	4.86	94.68
2	207.4	10	0.96	5.8	5.5	4.6	5.3	1.47	1.6	1.5	1.3	1.46	5.28	102.4
3	240.4	13	0.98	7.3	6.7	6.2	6.7	1.87	1.7	1.8	1.6	1.7	6.12	119.23
4	286.1	22	0.99	7.5	7.3	7.1	7.3	2.02	2.4	2	1.8	2.06	7.44	144.48
5	316.7	32	0.99	9.7	9.1	8.9	9.2	2.56	2.5	2.3	2.6	2.46	8.88	172.54
SUPER FAN		Speci- fica- tion:	Watts : 35	P.f : 0.94	Span : 1200mm	Speed : 385rpm	Air delivery : 230 CMM							
SPEED	RPM	LOAD in WATTS	POWER FACTOR	AIR FLOW in Km/hr			Average Air flow in km/hr	Calculated Km/hr -> m/s	AIR FLOW in m/s			Aver- age Air flow in m/s	Calcu- lated m/s -> Km/hr	Calculated Air delivery in m3/m
1	129.8	4	0.9	2.4	2.6	2.7	2.56	0.71	0.7	0.6	0.8	0.7	2.52	49.09
2	205.7	8	0.96	4.7	3.9	4.4	4.33	1.2	1.2	1.3	1.1	1.2	4.32	84.16
3	264.1	15	0.98	6.8	6.5	6.7	6.66	1.85	1.8	1.6	1.7	1.7	6.12	119.23
4	327.1	25	0.99	8.9	9.2	8.6	8.9	2.47	2.4	2.1	2.6	2.36	8.52	165.53

5	388.4	38	0.99	10.4	11	10.5	10.63	2.95	2.9	2.7	2.8	2.8	10.08	196.39
<b>NORMAL FAN</b>														
SPEED	RPM	LOAD in WATTS	POWER FACTOR	AIR FLOW in Km/hr			Average Air flow in km/hr	Calculated Km/hr -> m/s	AIR FLOW in m/s			Average Air flow in m/s	Calcu- lated m/s -> Km/hr	Calculated Air delivery in m3/m
high	302	62	0.99	8.6	8.2	8.5	8.43	2.34	2.5	2.6	2.1	2.4	8.64	162.92

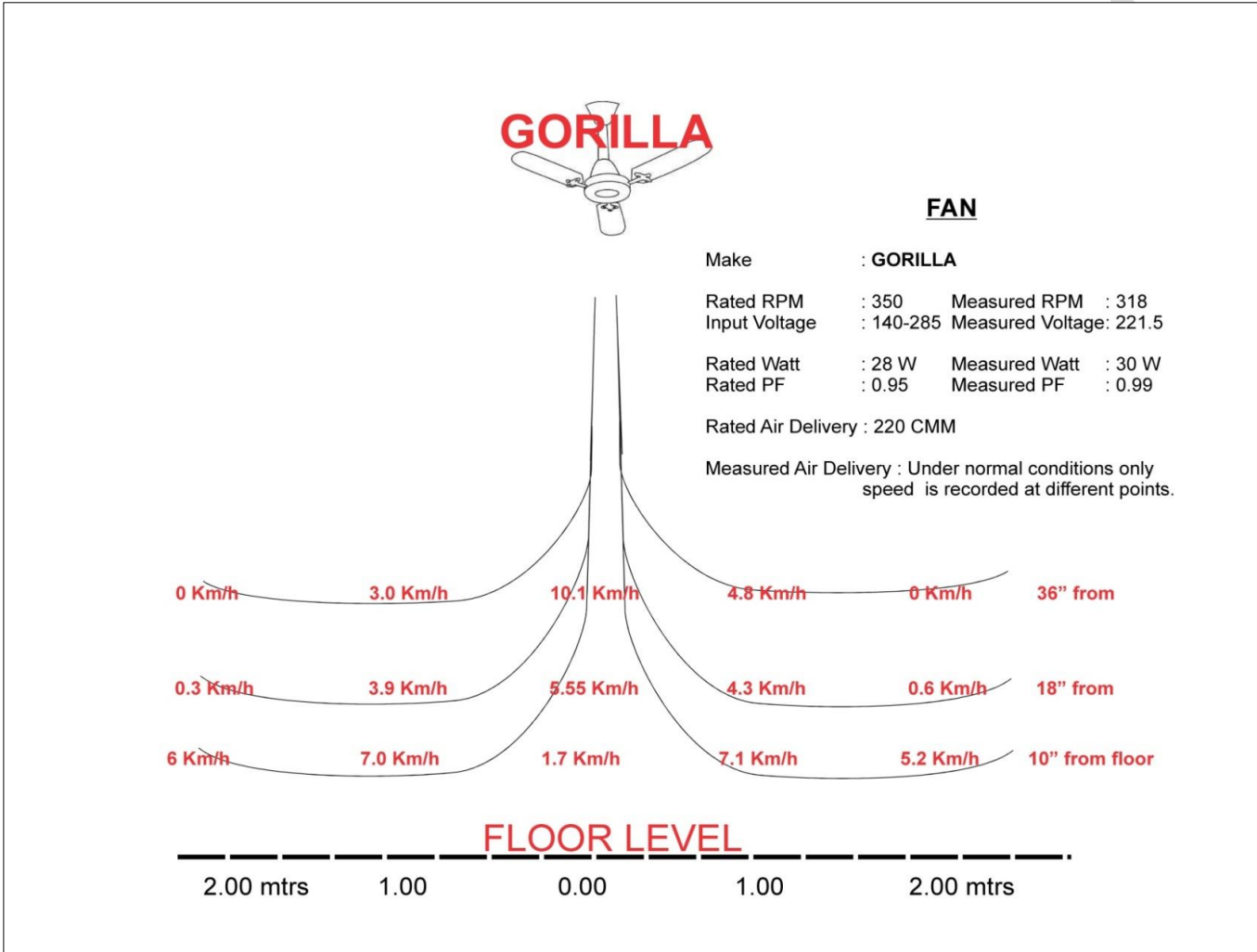
Performance analysis under room conditions. Free natural air circulation in hall of size 25'X30' , at a height of 6ft below the fan.

### Cost Benefit Analysis ( @ Rated Specification )

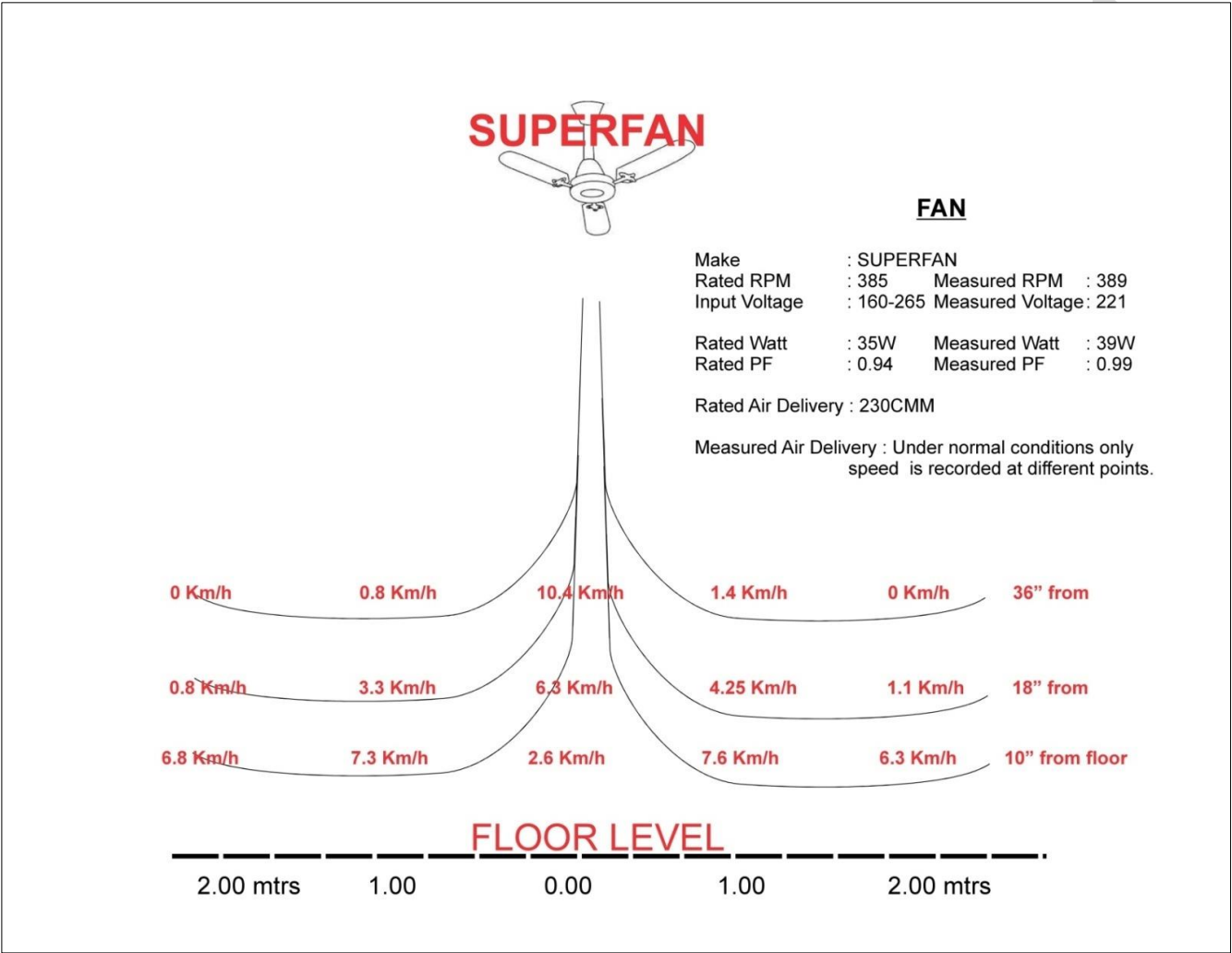
Make	Gorilla	Superfan	Open market/featured	Open Market standard fan
<b>First Cost</b>	3500/-	3500/-	2500/-	1500/-
Warranty	3 years	5 years	1 year	1year
Watts	28 W	35 W	60W	60W
Operating hours	15 hr/day	15 hr/day	15 hr/day	15 hr/day
Watt-hour	450 Wh	525 Wh	900 Wh	900 Wh
For 30 Days	13.5 Kwh	15.75 Kwh	27 Kwh	27 Kwh
At 5 Rs/unit	Rs. 67.50	Rs. 78.75	Rs. 135	Rs. 135
Savings	--	Rs. 11.25	Rs. 67.50 ( Loss)	Rs. 67.50 ( Loss)
Difference	--	--	Rs. 1000	Rs. 2000
Return on additional Cost	--	--	15 Month	30 Month
<b>Features:</b>				
Appearance	Basic	Decorative	Decorative	Basic
Remote control	Yes	Yes	No	No
Timer & Sleep	Yes	No	No	No
<p>This statement is drawn based on open market value; the costing can vary from brand to brand. The price of Super fan &amp; Gorilla Fan is the company price.</p> <p>Please refer to the fan air flow diagram measured at various points in the following pages.</p>				

Air

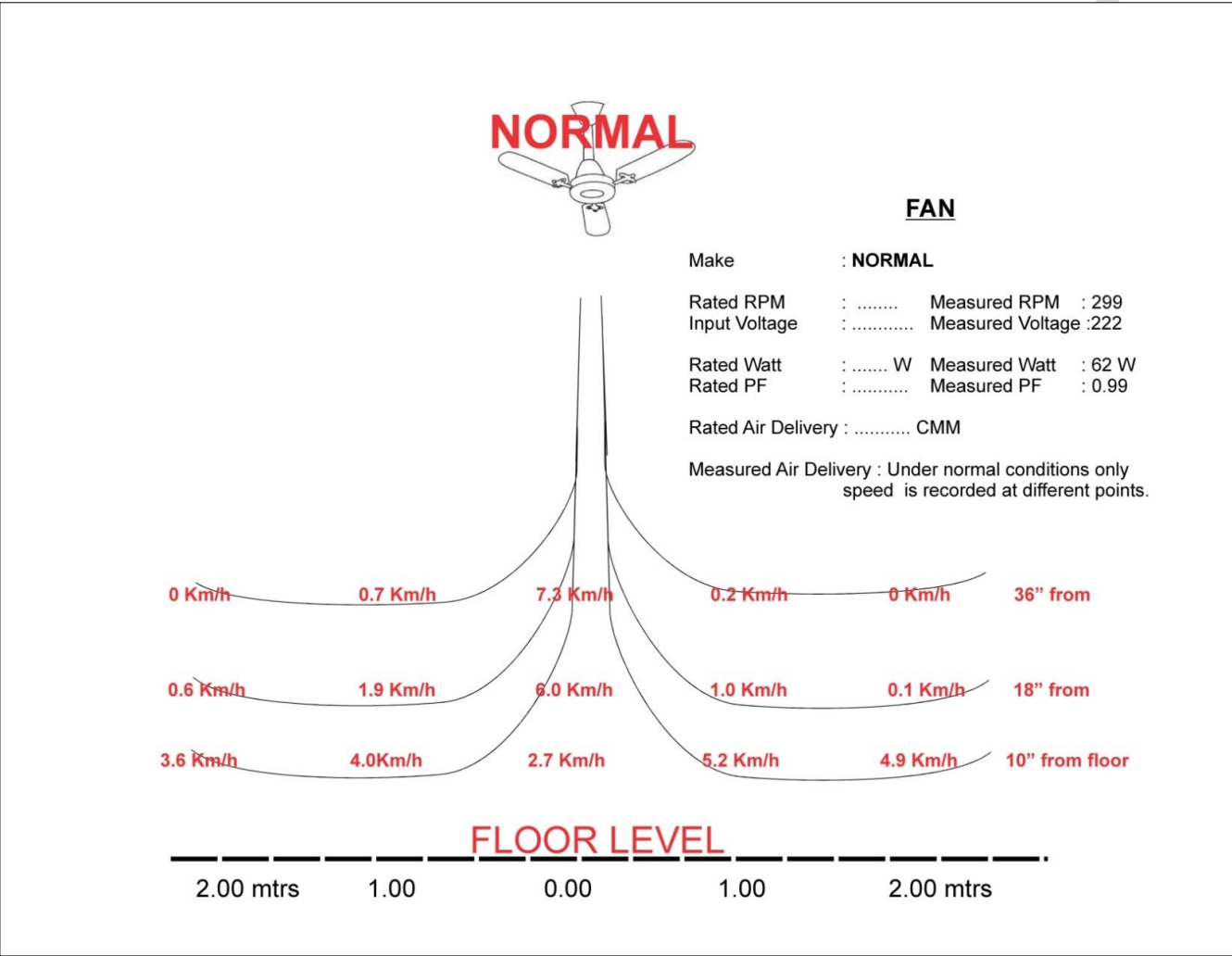
## Flow Analysis



ELECT



ELECT





## SENSOR

It is important to understand the significance of the Energy use implication. The use of electrical power has been observed to be unnecessary. The administration has taken initiative to keep all unwanted and unused appliances switched off. Further to the discussion, the institute has executed two rooms on trial basis for evaluation.

## SOLUTION:

It is therefore required to install Light Intensity Sensors in all the rooms.

Lighting improvements should be carried out by using LED luminaries or The Induction Light systems in lieu of normal tube lights., it is advised to install 40W Induction lamps in all classrooms to avoid glare.

Source : Can be locally procured, However the load-based selection is key aspect in its installation. To set the visibility, the intensity of natural light is much stronger and hence LUX based setting doesn't work. Hence the technical supervision is key aspect.



## NEED BASED LIGHTING

During the audit, it is suggested that the lights be put off when there is no need. Every minute of energy saved results into monetary savings and environmental benefits.



It is important that all the rooms have Occupancy sensors and smart lighting systems. In some of the large sized rooms occupied by few students, all the lights in the room are illuminated. Hence it is important that we have multiple level switching systems.

## USE OF NATURAL LIGHTING

where possible, we should avoid blocking natural ingress of light and reduce use of electrical lights.



In order to use natural lighting, it is suggested to use light coloured curtains. However, when need for use of projector arises the dark curtains are required. Hence, to meet the requirements and in the interest of energy conservation it becomes necessary to look for two layer curtains.

The rule of visibility and glare should be on priority while considering the selection of curtains.

Aspects of classroom lighting and decor that can promote discomfort and impair task performance through glare, and imperceptible 100 Hz flicker

from fluorescent lighting, were examined in a sample of UK schools. In 90 classrooms, across eleven secondary schools and six local education authorities' variables measured included flicker, illuminance at desks, and luminance of whiteboards. Results showed that 80% of classrooms are lit with 100 Hz fluorescent lighting that can cause headaches and impair visual performance. Mean illuminance (from excessive day- and artificial lighting) was in excess of recommended design illuminance in 88% of classrooms, and in 84% exceeded levels beyond which visual comfort decreases. Lighting could not be adequately controlled due to classroom design and infrastructure. Ceiling-mounted data-projectors directed at whiteboards mounted vertically on the wall resulted in specular reflection from the whiteboard, visible as a glare spot with luminance high enough to cause discomfort and disability glare. The intensity of the glare spot varied between different brands of whiteboard. Ambient lighting, needed for close work at pupils' desks, reduced image contrast. Venetian blinds in 23% of classrooms had spatial characteristics appropriate for inducing pattern glare. There was significant variation between schools and local authorities. These findings may provide insights into small-scale reports linking pupils' attainment, behaviour and learning to classroom lighting, and may also help explain some of the benefits of coloured overlays for pupils' reading. Please refer to the full article from the below link.

Curtesy : [https://www.researchgate.net/publication/222403570\\_Lighting\\_and\\_discomfort\\_in\\_the\\_classroom](https://www.researchgate.net/publication/222403570_Lighting_and_discomfort_in_the_classroom)

## BATTERIES MANAGEMENT SYSTEM

In compliance with Category 7.1.1, 7.1.2, 7.1.3 and 7.1.5

The institution uses around 31 UPS systems totalling to 308.5 KVA. These batteries are connected to 547 Batteries with 23962 AmpH. The net UPS connected load is in excess of the contract demand which is 300KVA from the utility. Considering the average combined efficiency @ 90%, the energy consumed by the UPS system results into 30KW. This is over 20% of the energy consumed.

Shri Dharmasthala Manjunatheshwara College of Engineering & Technology, Dharwad.

List of UPS and Batteries in operation	No of UPS: 1039
1 Battery disposal	Batteries are purchased on buy pack policies
2 Annual budget for procurement of batteries purchased in last three years	Amount for 2022-23: 1,40559.01 Amount for 2021-22: 142522.74 Amount for 2020-21: 124740.00 Amount for 2019-20: 120510.00

Let us discuss the best possible use of the available resources.

Part 1.

The management need to assess, If we need to have UPS backup to this scale?

Possibilities of considering the option of providing centralised power backup with 23962 AH battery which gets a 287.5 KW of energy. This option should power the complete institutes energy needs.

Can the Batteries be charged using the solar energy?

In present day techno-commercial discussions, Mono-perk solar panels prove to be cost effective with better space management.

Part 2.

The batteries are placed over metal stand as seen below.



It is important to provide proper insulated base and prevent each of the batteries coming in contact to extract the maximum power backup.

This initiative should also prolong the life of the batteries.



The batteries disposal is an environment threat. The lead which is a major component has serious adverse effects. The acidic fumes damage the electronic components and when disposed to environment through uncertified local rag-pickers either as scrap or buyback option, the institute stands to be morally responsible to such environmental pollution.

Hence the disposal of the batteries should be prolonged. This is possible by putting into use the Battery regenerative system

However, much before the regeneration It is good practice to make room for cross ventilation for the batteries to be placed in cool place.

The benefits include –

In normal operating mode, the batteries are known to last for 5 to 6 years.

With good working practice, they would last for almost three times the life.

Prolonged life of the Batteries.

Avoids acid fumes accumulation on the Batteries.

Increased life of all electronic gadgets around the Battery bank.

Delayed discarding of the Batteries avoids environment pollution and Revenue outflow for the organization.

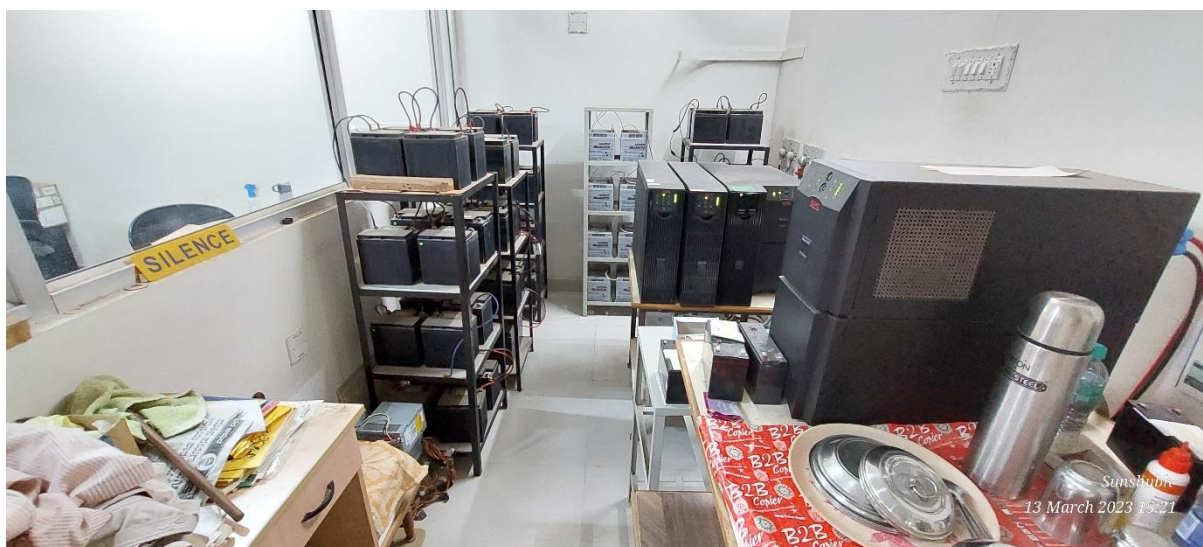
WE suggest to regenerate the batteries once every 3 years, so that the sulfur lining is minimized. If the regeneration is executed once every three years, we can regain the working performance to 95 to 98% of its original status.

However, this needs to be backed up with necessary periodical check with the density of the battery solution.

ELECTRICAL AUDIT REPORT 2021



## BATTERY PLACEMENT:



The batteries breath acid fumes. It is good practice to make room for cross ventilation for the batteries to be placed in cool place.

The benefits include –

Prolonged life of the Batteries.

Avoids acid fumes accumulation on the Batteries.

Increased life of all electronic gadgets around the Battery bank.

Delayed discarding of the Batteries avoids environment pollution and Revenue outflow for the organization.

All batteries should be placed in well ventilated area. As battery disposal is turning out to be a serious issue, ways to prolong the life of the batteries is very important from the environmental point and also from the Financial implications.

We will discuss the regenerative system of used and week batteries to enhance the life. It is important to know few points on handling of batteries. BU-703: Health Concerns with Batteries

**Become familiar with the dos and don'ts when handling batteries.**

Batteries are safe, but caution is necessary when touching damaged cells and when handling lead acid systems that have access to lead and sulfuric acid. Several countries label lead acid as hazardous material, and rightly so. Lead can be a health hazard if not properly handled.

## LEAD

Lead is a toxic metal that can enter the body by inhalation of lead dust or ingestion when touching the mouth with lead-contaminated hands. If leaked onto the ground, acid and lead particles contaminate the soil and become airborne when dry. Children and foetuses of pregnant women are most vulnerable to lead exposure because their bodies are developing. Excessive levels of lead can affect a child's growth, cause brain damage, harm kidneys, impair hearing and induce behavioural problems. In adults, lead can cause memory loss and lower the ability to concentrate, as well as harm the reproductive system. Lead is also known to cause high blood pressure, nerve disorders, and muscle and joint pain. Researchers speculate that Ludwig van Beethoven became ill and died because of lead poisoning.

By 2017, members of the International Lead Association (ILA) want to keep the lead blood level of workers in mining, smelting, refining and recycling below 30 micrograms per decilitre (30µg/dl). In 2014, the average participating employee checked in at 15.6µg/dl, but 4.8 percent were above 30µg/dl. (Source Batteries & Energy Storage Technology, Summer 2015.)

In 2019, the University of Southern California published the detection of lead in teeth of children living near the Exide Technologies battery recycling plant in Vernon, California.

Lead occurs naturally in soil at 15–40mg/kg level. This level can increase multi-fold near lead battery manufacturing and recycling plants. Soil levels in developing countries, including on the continent of Africa, recorded lead contamination levels of 40–140,000mg/kg. (See BU-705: How to Recycle Batteries.)

## SULFURIC ACID

The sulfuric acid in a lead acid battery is highly corrosive and is more harmful than acids used in most other battery systems. Contact with eye can cause permanent blindness; swallowing damages internal organs that can lead to death. First aid treatment calls for flushing the skin for 10–15 minutes with large amounts of water to cool the affected tissue and to prevent secondary damage. Immediately remove contaminated clothing and thoroughly wash the underlying skin. Always wear protective equipment when handling sulfuric acid.



## CADMIUM

Cadmium used in nickel-cadmium batteries is considered more harmful than lead if ingested. Workers at NiCad manufacturing plants in Japan have been experiencing health problems from prolonged exposure to the metal, and governments have banned disposal of nickel-cadmium batteries in landfills. The soft, whitish metal that occurs naturally in the soil can damage kidneys. Cadmium can be absorbed through the skin by touching a spilled battery. Since most NiCad batteries are sealed, there are no health risks in handling intact cells; caution is required when working with an open battery.

Nickel-metal-hydride is considered non-toxic and the only concern is the electrolyte. Although toxic to plants, nickel is not harmful to humans. Lithium-ion is also benign – the battery contains little toxic material. Nevertheless, caution is required when working with a damaged battery. When handling a spilled battery, do not touch your mouth, nose or eyes. Wash your hands thoroughly. Keep small batteries out of children's reach. Children younger than four are the most likely to swallow batteries, and the most common types that are ingested are button cells. Each year in the United States alone, more than 2,800 children are treated in emergency rooms for swallowing button batteries. According to a 2015 report, serious injuries and deaths from swallowing batteries have increased nine-fold in the last decade

.The battery often gets stuck in the oesophagus (the tube that passes food). Water or saliva creates an electrical current that can trigger a chemical reaction producing hydroxide, a caustic ion that causes serious

burns to the surrounding tissue. Doctors often misdiagnose the symptoms, which can reveal themselves as fever, vomiting, poor appetite and weariness. Batteries that make it through the oesophagus often move through the digestive tract with little or no lasting damage. The advice to a parent is to choose safe toys and to keep small batteries away from young children.

## VENTILATION

Charging batteries in living quarters should be safe, and this also applies to lead acid. Ventilate the area regularly as you would a kitchen when cooking. Lead acid produces some hydrogen gas but the amount is minimal when charged correctly. Hydrogen gas becomes explosive at a concentration of 4 percent. This would only be achieved if large lead acid batteries were charged in a sealed room.

Over-charging a lead acid battery can produce hydrogen sulphide. The gas is colourless, very poisonous, flammable and has the odour of rotten eggs. Hydrogen sulphide also occurs naturally during the breakdown of organic matter in swamps and sewers; it is present in volcanic gases, natural gas and some well waters. Being heavier than air, the gas accumulates at the bottom of poorly ventilated spaces. Although noticeable at first, the sense of smell deadens the sensation with time and potential victims may be unaware of its presence.

As a simple guideline, hydrogen sulphide becomes harmful to human life if the odour is noticeable. Turn off the charger, vent the facility and stay outside until the odour disappears. Other gases that can develop during charging and the operations of lead acid batteries are arsine (arsenic hydride,  $\text{AsH}_3$ ) and (antimony hydride,  $\text{SbH}_3$ ). Although the levels of these metal hydrides stay well below the occupational exposure limits, they are a reminder to provide adequate ventilation.

Regeneration of week batteries for the Second/Third lease of life.

Significance...

The early regeneration results into second tenure of the batteries i.e., another term of 3 to 5 years as per Battery specifications.

Optimised energy consumption. Thus, reduced cost of operation.

Delayed disposal results into elimination of environment pollution.

Reduced impact on CARBON FOOTPRINT.

## SOLUTION

All batteries should be placed in well ventilated area. As battery disposal is turning out to be a serious issue, ways to prolong the life of the batteries is very important from the environmental point and also from the Financial implications.

The placement of batteries needs to be at the place very close to cross ventilation, if possible, in open but shaded place. The following clippings are explained.

## SENSORS

Occupancy and lux activated switch.:

Occupancy sensors is key part of energy savings. The sensors play a vital part in all commercial and public buildings.

The engineering students of the institute can explore in initiating the project and building the occupancy sensor based switching device.

One such device can be explored for building a device to suit the needs at the lowest cost.

Wall Switch PIR Occupancy Sensor.

APPLICATION : Leviton's Cat. Nos. PR150-1L and PR180-1L fit in standard wall boxes and are equipped with passive infrared (PIR) sensing technology. These versatile, top-quality devices turn lights ON when a person enters a room and OFF when they leave – automatically. They can be used in a variety of residential applications,

What need to be explored is in regulating partially occupied conference hall or the auditorium.



Installing occupancy sensor will help achieve energy conservation.



## TYPICAL ILLUSTRATIONS

### WINDOWS:



Present visibility.

The lower part of the windows need to be opaque. While we need to use natural lighting, we also need to prevent the distraction of the attention. In view of this, it is advised to have the lower part of the glass covered with opaque film or replace the glass where possible,



Projected visibility.



Similar condition is required in all class rooms where the students can see the outside events while sitting.



### ELECTRICAL SAFETY

The images shown under safety discussions are for illustration only and are not actual situations in the institution.

No safety gloves in use while operating on Electrical contacts

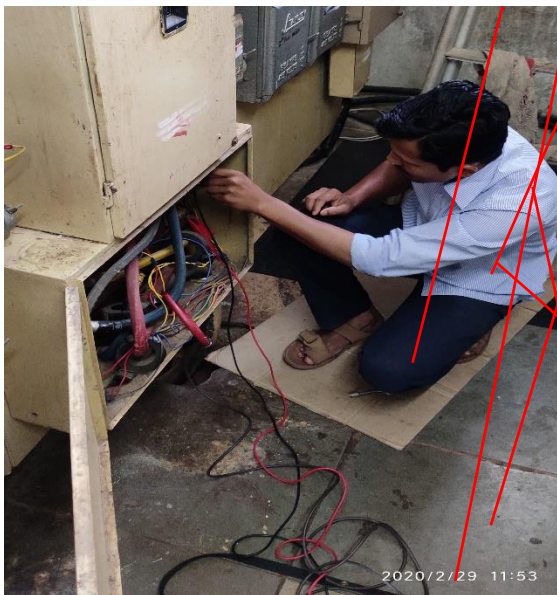
Not wearing electrical shoes while operating on Electrical contacts

Not wearing safety eye wear while operating on Electrical contacts

No proper insulation mat in front of the electrical panels

Not wearing electrically insulated dress while operating on Electrical

Face protection mask not being used while operating on Electrical



The detailed discussion on the above safety aspects is made for the information of the management and necessary compliance.

Human safety is the topmost priority in all our aspirations. Electrical infrastructure drives all our aspirations. When quality work is to be delivered all the support mechanism should be in good operating condition. For the system to be in good operating condition, we need to follow certain the regulatory bodies.

We have also given solutions where necessary. Before we proceed, it is important for all the stake holders to understand few key aspects and why these standards have been specified.

#### ACCESSIBILITY:

Electrical hazards are among the most common safety hazards found during compliance, occupational



safety and health inspections. Electrical systems in the workplace should have mechanisms in place to protect employees from injury. However, these systems must be maintained properly in order to be effective. Electrical panels are the primary units that control the flow of electricity to different parts of an office or building equipment. Each connection on the panel has a switch that can stop the flow of current to specific electrical circuits and appliances.

If an employee receives an electrical shock, shutting down the source of power may be the only safe method to stop the electrical current. OSHA requires enough access and working spaces around all electrical equipment, or panels, serving 600 volts or less. 29 CFR 1910.303(g). For equipment operating at 600 volts, nominal or less to ground, electrical panels must have a minimum of three feet of clearance in front of the panel and a minimum clearance width of 2.5 feet or the width of the equipment, whichever is greater. This assures that in case of an electrical emergency, there is a clear working space in front of the panel for quick access to the circuit breakers. Electrical panels should also have secure covers to ensure no wires are exposed that could cause electrical shock. This also prevents the internal mechanisms from being exposed to dust, dirt, and moisture. Electrical panel boxes in commercial buildings should be secured and accessible by trained personnel only.

It is important that these trained electrical staff be provided with appropriate PPE i.e., Personal Protective Equipment's for safe handling of these devices. We have shown few of the PPE's which need to be provided in all sizes so that every staff is well protected.

The floor of the electrical room housing the panel boards are not covered with Insulated rubber mat. It is important to have them in place to avoid accidental electrocution.

## FIRE SAFETY

The fire extinguishers should be placed at the entrance of the room housing dangerous devices. So that, they are handy when need to be used.

# PORTABLE FIRE EXTINGUISHERS

**IN CASE OF FIRE:**

- Call the fire department immediately.
- Do not use an extinguisher without proper training.
- Know which extinguisher is correct for what type of fire.
- Only use portable extinguishers when the fire is contained to a small area.

**FIRE CLASSIFICATION:**

**A**  
Use for ordinary combustibles.  
Contains water.

**C**  
Use for electrical fires. Do not use water on these fires! Contains dry chemicals, carbon dioxide or halogenated agents to smother the fire with foam.

**B**  
Use for flammable liquids. Contains dry chemicals or halogenated agents to smother the fire with foam.

**D**  
Use for combustible metals. Contains special liquids or dry powder agent.

## P. A. S. S. OPERATING PROCEDURE

**P**  
**PULL** the pin. Hold the extinguisher with the nozzle pointing away from you, and release the locking mechanism.

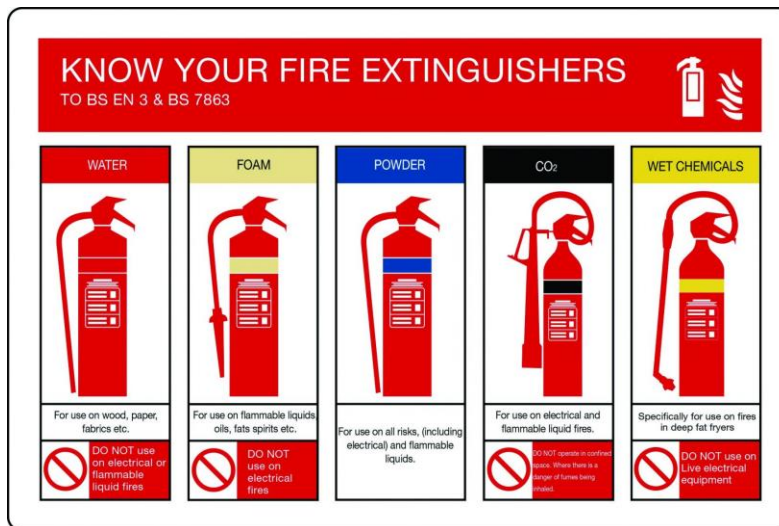
**A**  
**AIM** the nozzle at the base of the fire.

**S**  
**SQUEEZE** the lever slowly and evenly.

**S**  
**SWEEP** from side-to-side at the base of the flame.

It is also important that the handling instructions are Predominantly displayed. The sample poster is reproduced for replication.

Type Extinguisher	CLASS A	CLASS B	CLASS C	CLASS D	Electrical	CLASS F	Comments
	Combustible materials (e.g. paper & wood)	Flammable liquids (e.g. paint & petrol)	Flammable gases (e.g. butane and methane)	Flammable metals (e.g. lithium & potassium)	Electrical equipment (e.g. computers & generators)	Deep fat fryers (e.g. chip pans)	
Water	✓	✗	✗	✗	✗	✗	Do not use on liquid or electric fires
Foam	✓	✓	✗	✗	✗	✗	Not suited to domestic use
Dry Powder	✓	✓	✓	✓	✓	✗	Can be used safely up to 1000 volts
CO <sub>2</sub>	✗	✓	✗	✗	✓	✗	Safe on both high and low voltage
Wet Chemical	✓	✗	✗	✗	✗	✓	Use on extremely high temperatures



In case of fire, the appropriate Fire extinguishers should be placed at the entrance but outside the room. The details of such classified Extinguishers is indicated for reference.

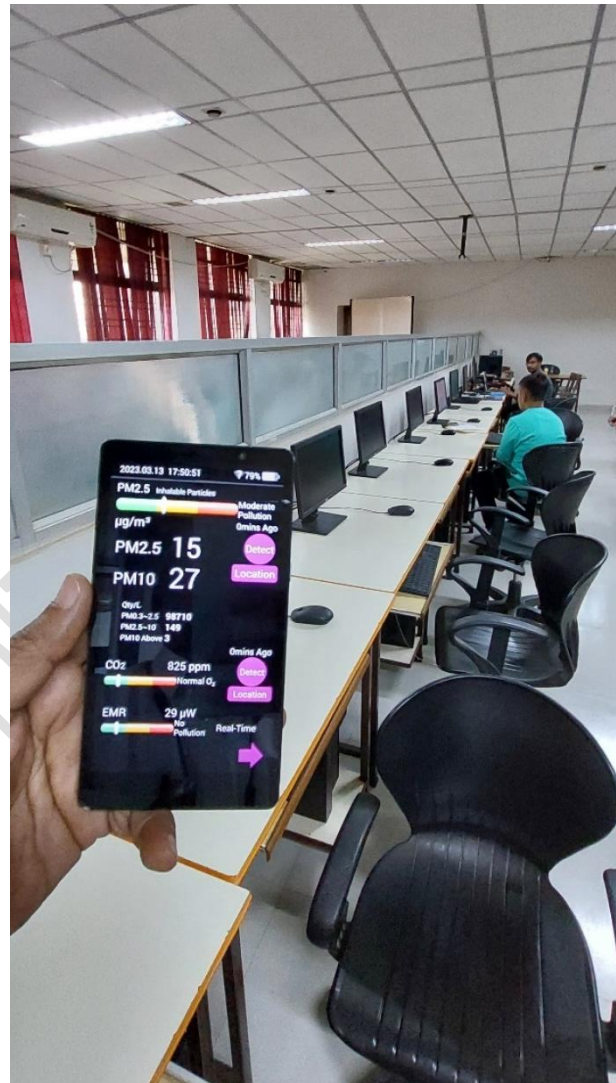


## VENTILATION

In absence of cross ventilation, the indoor air quality suffers from increased CO<sub>2</sub> PPM/ The rooms should be provided with cross ventilation.

Indoor air quality (IAQ) is the air quality within and around buildings and structures. IAQ is known to affect the health, comfort and well-being of building occupants. Poor indoor air quality has been linked to sick building syndrome, reduced productivity and impaired learning in schools.

Ventilators to be used to vent out the air and foul smell to minimise the use of energy and to make room for fresh air intake.



## NATURAL LIGHTING



It is suggested to reorient the book rack in the library as it has blocked the natural lighting and is forced to switch on light. The racks can be placed perpendicular to make way for natural light and fresh air intake as well.

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## EARTHING, BONDING AND SHIELDING SYSTEM



The transformer and the distribution system Earthing should be properly tagged and Earth parameters ie Resistance of earthing , System Resistance, System leakage current should be properly displayed. As below.

Earth pit No: .....	Tagged to : .....
Date of commission of the earthing:	<b>dd/mm/yyyy</b>
Resistance when earthing was commissioned :	<b>xx Ohms</b>
Leakage current when earthing was connected to system :	<b>XX Amps</b>
Resistance of earthing on the date of test:	<b>xx Ohms</b>
System Resistance on the date of test:	<b>xx Ohms</b>
System leakage current on the date of test:	<b>XX Amps</b>
Date of Testing :	<b>dd/mm/yyyy</b>
Next date of Testing :	<b>dd/mm/yyyy</b>



## REFERENCES

IEEE standard 1100-2005: Recommended practice for power and grounding sensitive electronic equipment.

IEEE standard 518-1982: Guide for installation of electrical equipment to minimize noise inputs to controllers from external sources.

Note: IEEE now has withdrawn this standard.

IEEE standard 142-1991: Recommended practices for grounding of industrial and commercial power systems.

IEEE standard 81-1983 and 81.2-1991: Guide for measuring earth resistivity, ground impedance, and earth surface potentials of a ground system.

NFPA-78 Lightning Protection Code 1986, Quincy, Massachusetts: National Fire Protection Association, 1986.

Glossary of additional areas that need to be corrected.

Battery placement system and also the ventilation for Quality Indoor Air.

Lighting illustrations. :

NOTES:

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