

# ENERGY AUDIT REPORT

2020-21

in compliance with the statutory requirements under the NAAC accreditation procedures

**KLE Society's  
Shri Kadasiddheshwar Arts College  
and  
H S Kotambri Science Institute  
Hubballi.**



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THOUGHT FOR EVERY MOMENT

There are about 19,00,00,000 students in INDIA. If every student saves one sheet per day, 19,00,00,000 sheets of paper meaning 988 ton of paper will be saved every day. This is equivalent to saving 2748.54 ton of wood a day. This will lead to saving about 33,00,678 trees per year.

**ABOUT SUNSHUBH TECHNOVATIONS PRIVATE LIMITED**

Sunshubh Technovations Private Limited is registered in the year 2020 and has evolved from initial proprietary concern, Sunshubh Renewables & Research Centre. Sunshubh has been in operation since 2008. Sunshubh today is led by a team of well experienced Certified Energy Auditors and tech- savvy young engineers.

We believe in Identifying opportunities and executing solutions based on need with highest priority to Energy conservation over efficiency.

Since beginning, Sunshubh has been growing and today, we have wide range of clientele In the field of Industry : Tool room, Chemicals and refinery, Mining, Health, Hospitality, Food processing, Infrastructure and Educational institutions under NAAC compliance. Our approach has been very aggressive in equipping ourselves with the latest instruments.

After decade of professional experience, we restructured ourselves and thus the formation of a Private Limited company on 22<sup>nd</sup> July 2020.

Today we have with us the technical team comprising three Certified Energy Auditors, One Certified Energy Manager and support team of young and enthusiastic engineers to comply to the client requirements.

**POLICY MATTERS**

Learning from our training in Germany and their policies, SUNSHUBH does not supply any energy saving equipment's or systems. However, we do stand up to support and execute the measures to prove our findings right. This is mandatory to assure the client that we do not market any self-centred product or orient the Audit assignment to sell any third party product. Meaning to say **we stand neutral to all methodologies in the interest of adopting best technologies.**

We strongly believe in sharing our knowledge and training inhouse manpower for continual improvement in energy flow.

We have set a policy not to hire the instruments from third party but to procure every small or big ones to do justice to our clients.

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## EXECUTIVE SUMMARY

Sr No	Observation*	Problems*	Resulting losses*	Remedial measures*	Capital*	Projected savings*	Category 7
1	Power Consumption	PF Penalty	Energy & revenue loss	Install Capacitor bank.	Rs.50,000/- approximately	Avoided revenue penalty	
2	Solar Power	Suggest to install Solar Power to minimise use of energy during Offgrid times.					7.1.2
3	Occupancy sensor	Wastage of power	High	Occupancy sensor based switching	₹1500 per room	Resulted ROI of one year.	7.1.2
4	Battery placement	Concealed enclosure. Battery shell in conductor loop	Low performance & self-discharge.	Design the stacking arrangements.	In house resources	25% of the cost of the batteries.	7.1.2, 7.1.6
5	Battery regeneration.	Short life span	300% of the cost of the battery.	Subject all batteries to regeneration made.	Rs.20.00 Lacs or as per user agreement	300 %	7.1.2, 7.1.6

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Sr No	Observation*	Problems*	Resulting losses*	Remedial measures*	Capital*	Projected savings*	Category 7
6	Electrical	Old tube lights	High energy consumers	LED lights of appropriate ratings.	Rs.80/- to Rs.250/- per unit	Rs.175/- per tube per annum. ROI of 1 years.	7.1.6
7	Natural Lighting	Un cleaned windows and ventilators, forced switching on of tube lights	High energy bills	Clean the windowpanes and allow maximum natural light penetration.	Nil, part of routine, In house manpower	Substantial cost of energy bills on lighting.	7.1.2, 7.1.6
8	Natural Ventilation	Permanently closed ventilators.	Creation of hot air pockets below the ceiling.	Open the Ventilators for easy exit of hot/warm air from the rooms.	Nil, In house manpower	Eliminates use of Electrical Fans and Substantial cost of energy bills	7.1.2, 7.1.6

\* For details, please follow the discussions in the report.

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## CRITERION VII – INSTITUTIONAL VALUES AND BEST PRACTICES

### Key Indicator - 7.1 Institutional Values and Social Responsibilities

Metric No.	Description	Compliance	Initiatives required
7.1.1  QIM	<p>Measures initiated by the Institution for the promotion of gender equity during the last five years.</p> <p>Annual gender sensitization action plan</p> <p>Specific facilities provided for women in terms of:</p> <p>Safety and security - Energy</p>	Partly Complied	Our The concept of home energy management may be initiated for the women. The typical illustration is reproduced.

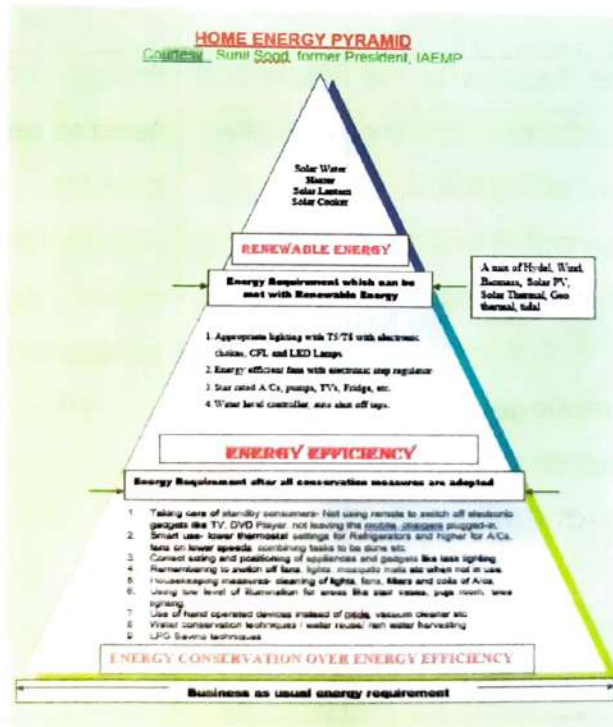


Figure 1 - Home energy pyramid

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	Environmental Consciousness and Sustainability		Discuss on why the recent calamities keep occurring more often than before.
7.1.2 Q <sub>n</sub> M	<p>The Institution has facilities for alternate sources of energy and energy conservation measures</p> <ul style="list-style-type: none"> <li>• Solar energy</li> <li>• Biogas plant</li> <li>• Wheeling to the Grid</li> <li>• Sensor-based energy conservation</li> <li>• Use of LED bulbs/ power efficient equipment</li> </ul>	Complied through parent society.	<p>Considering the cost of energy use, serious consideration may be taken up for,</p> <p>Solar</p> <p>Biogas plant in Hostel mess.</p> <p>If solar is installed the power can be exported to grid on non-working hours.</p> <p>Sensor based control is a must for energy use optimization.</p> <p>Complete the ongoing work at faster pace.</p>
7.1.3 Q <sub>i</sub> M	<p>Describe the facilities in the Institution for the management of the following types of degradable and non-degradable waste (within 500 words)</p> <p>Solid waste management</p> <p>Liquid waste management</p> <p>Biomedical waste management</p> <p>E-waste management</p> <p>Waste recycling system</p>	Complied partially wrt minimising .	Energy consumption details need to be monitored and the benefits of avoided accumulated energy use and power demand should be established.

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	Hazardous chemicals and radioactive waste management		
7.1.4 QnM	<p>Water conservation facilities available in the Institution:</p> <p>Rain water harvesting Borewell /Open well recharge Construction of tanks and bunds. Waste water recycling Maintenance of water bodies and distribution system in the campus</p>	<p>Complied</p> <p>Open ground percolation, Open well restoration. Percolation pond near to open well</p>	<p>The institution should consider in measuring the energy and power demand at various ground water table to demonstrate the impact of increased water table by rainwater harvesting methods. Kindly refer to the article listed at the end of the table.</p>
7.1.5 QnM	<p>Green campus initiatives include (4)</p> <p>7.1.5.1. The institutional initiatives for greening the campus are as follows: Restricted entry of automobiles Use of Bicycles/ Battery powered vehicles Pedestrian Friendly pathways Ban on use of Plastic landscaping with trees and plants.</p>	<p>Partially complied.</p>	<p>With disciplined vehicle parking the reduction in fuel consumption can be demonstrated in the college campus. The students can be given a task of conducting such practical on field and a competition should educate the society.</p>

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7.1.6 QnM	<p>Quality audits on environment and energy are regularly undertaken by the institution (5)</p> <p>7.1.6.1. The institutional environment and energy initiatives are confirmed through the following</p> <ol style="list-style-type: none"> <li>1.Green audit</li> <li>2. Energy audit</li> <li>3.Environment audit</li> <li>4.Clean and green campus recognitions/awards</li> <li>5. Beyond the campus environmental promotional activities</li> </ol>	Complied	The audit findings should be predominantly projected by action from all stake holders of the institution.
7.1.7 QnM	<p>The Institution has disabled-friendly, barrier free environment</p> <p>Built environment with ramps/lifts for easy access to classrooms.</p> <p>Disabled-friendly washrooms</p> <p>Signage including tactile path, lights, display boards and signposts</p> <p>Assistive technology and facilities for persons with disabilities (Divyangjan)</p> <p>accessible website, screen-</p>	The initiatives have been considered.	The demand for muscle power to climb the ramp may be considered as one such case and ideally establish the gradient of the ramp.

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	reading software, mechanized equipment Provision for enquiry and information: Human assistance, reader, scribe, soft copies of reading material, screen reading		
7.1.9 Q <sub>1</sub> M	<i>Sensitization of students and employees of the Institution to the constitutional obligations: values, rights, duties and responsibilities of citizens</i> Describe the various activities in the Institution for inculcating values for being responsible citizens as reflected in the Constitution of India within 500 words.	Need to explore.	The sensitization of switching off the non-required electrical appliances and devices should be encouraged. Like organizing the inhouse competition. Every student to table their energy bills in the previous year. The savings in the forth coming year should be recorded and an energy ambassador award be shouldered on the top students. This activity brings in the sense of responsibility, accountability and importantly knowing their energy use and abuse.
7.1.10 Q <sub>n</sub> M	<i>The Institution has a prescribed code of conduct for students, teachers, administrators and other staff</i>	Complied	A range of activities can be brought in just as discussed in 7.1.9 above.

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	<p>and conducts periodic programs in this regard.</p> <p>The Code of Conduct is displayed on the website</p> <p>There is a committee to monitor adherence to the Code of Conduct</p> <p>Institution organizes professional ethics programs for students, teachers, administrators and other staff</p> <p>Annual awareness programs on Code of Conduct are organized</p>		
7.1.11 Q1M	<p>Institution celebrates / organizes national and international commemorative days, events and festivals</p> <p>Describe the efforts of the Institution in celebrating /organizing national and international commemorative days, events and festivals during the last five years within 500 words</p>	Complied	<p>In today's practices, the celebration has been formal.</p> <p>The actual celebration has to be yearlong. The theme for the year has to be laid and the activities should be conducted and on the day of celebration the selective activities be carried out. Just to illustrate, Consider the Republic Day.</p> <p>We celebrate the flag hoisting and with cultural activities. Consider the week-long program where in, students</p>

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			<p>can discuss what is the Republic Day. How the final draft got to be written and who all are the members of the draft committee.</p> <p><a href="https://en.wikipedia.org/wiki/Constitution_of_India">https://en.wikipedia.org/wiki/Constitution_of_India</a></p>
7.2.1 QIM	Describe two best practices successfully implemented by the Institution as per NAAC format provided in the Manual.	Complied	<p>When the listed activities from 7.1.1 to 7.1.11 are complied, the institute can have many creative best practices and the achievements can really bring in the name, fame and the recognition and appreciation not just on records but on monetary contributions as well.</p>

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इन लेखों में प्रकट विचार मूलतः लेखकों के हैं तथा यह आवश्यक नहीं है कि इन्फो या विनटैक भी इन विचारों से सहमत हो।

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FROM THE EDITOR-IN-CHIEF

## The simple economics of water and energy security



It is estimated that the global annual use of commercial energy is about 400 Quads (quadrillion BTUs). The sun pours an additional 6 million Quads of radiant energy into the Earth's atmosphere each year. Thus in absolute terms, energy available is several orders of magnitude higher than demand. Yet, the world continues to struggle against an acute energy crisis. This leads one to believe that the problem is not merely of energy availability but rather a problem of affordability. Energy is a matter of pure economics, of demand and supply – at a cost.

A similar principle applies to water. Though roughly 80 percent of the Earth's surface is water, cheap potable and clean water is simply beyond the reach of millions across the world. Potable water sourcing, treatment, and distribution require considerable amounts of energy. Access to water is therefore closely linked to energy availability and affordability.

This close interdependence between energy and water needs to be clearly recognized and the nexus addressed suitably at the policy level. The first and foremost priority of any energy policy should be the wise, efficient use of whatever energy supplies are available. Similarly, priority should be given to the efficient use of whatever water supplies exist. Once the issue of efficient use has been tackled, focus can then be shifted on creating new energy and water supplies that meet sustainability and environmental requirements. And this may not be as difficult to achieve as it appears.

As in the case of energy use, the difficult part is reducing the quantum of water use while maintaining the level of benefits both for the customer and the utility. If this can be addressed, water utilities can save money as the reduced demand effectively creates more system capacity. With decreasing demand, the water utility effectively avoids additional investments in new facilities and equipment. Reduced volume of water flowing through the system has the attendant advantage of reduced frictional energy losses, thereby reducing the cost of pumping. This leads to a win-win situation for both the consumer and the utility, with the consumer benefiting through the reduced cost of delivery, diminished chances of water shortfalls, and the utility benefiting from decreased likelihood of major investment expenditures.

Needless to say that all this also saves energy. In rural areas, a large number of irrigation pump sets are either operated at highly subsidized electricity tariff from the power utilities or at no cost at all, encouraging the use of poorly designed inefficient pump sets which are over-rated and over-used. Replacing these pump sets with energy-efficient ones is one option, but who bears the cost? Another option is rainwater harvesting. For every one foot increase of the water table one achieves an approximate savings of 1 percent power.

Which means one gets more for the same energy use. That's simple economics.

Debashish Majumdar  
Managing Director, IREDA

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## INSIGHT

# Water-Energy: two faces of a coin

*There is a direct relationship between water and power. A reduced water table is directly proportional to the square of the increased electrical power consumption, says the author*

**W**e all presume that if the dams and reservoirs are full then electrical power could be available in plenty. However, we tend to ignore that the demand for electrical power has been growing at a much faster rate than what we can produce and, hence, any amount of rain and/or electrical power generated is insufficient to meet our demand. Most thermal power plants are running low owing to a short supply of coal. So where are we?

The recent changes in temperature and erratic rainfall has a direct relationship with urbanization. With increased urbanization and industrialization, we have only created a greater need for energy. This energy is sourced primarily from fossil fuels such as coal and nuclear power plants. In the absence of rains, the only means of generating electrical power is by burning fossil fuels. The burning releases emissions into the atmosphere, resulting in increased CO<sub>2</sub> concentration in the troposphere, and subsequently the greenhouse effect. The disturbed rainfall pattern is a result of this global warming.

The demand for power can be classified into four areas: agricultural need-based; industrial need-based; commercial need-based; and domestic need-based.

Today, a number of agencies such as the Bureau of Energy Efficiency (BEE), Petroleum Conservation Research Association (PCRA), the National Productivity Council (NPC) and a host of voluntary organizations, are working at ensuring energy efficiency in industries. But while the commercial and domestic need-based sectors have the potential, little is being done in this area. These sectors need a lot of education, motivation and awareness.

The agricultural industry needs the greatest attention, mainly in irrigation pump-sets (IPs). Most IPs are being operated free or on highly subsidized electricity supply. But eventually they consume a lot of power.

For instance, there are 16,000 irrigation pumps reportedly being operated under the HESCOM (Hubli Electric Supply Company), a division in North Karnataka. If, on an average each 5 HP pump consumes 3.73 kW of power per hour (there are actually a greater number of 10 HP pumps), the total consumption is as below:

For 10 hours per day = 37.30 kWh  
For 200 days of watering = 7,460 kWh (7.46 MWh/pumpset)  
For 16,000 sets, it is 119,360 MWh which means, 358,080 MWh of power generation at the power plant.

To reduce this consumption, should the IP users be asked to change over to energy-efficient sets? The question is:

- can the users afford the change?
- are they willing to accept the new brands of sets imposed on them?
- can the sale of inefficient IP sets be controlled?

Or should measures be adopted where the users may not use the IPs at all? Or can power consumption be reduced?

One good method is to reduce power consumed by IP sets by increasing the water table. If the water table can be increased by, say, 13 ft, then for the same 150 LPM delivery we will need a 4 HP (2.984 kW), and the savings for 16,000 IP sets would be 23,872 MWh, which is 20 percent – approximately 1.5 percent power saving for every feet of increase in the water table. This increase in water table can be achieved by adopting rainwater harvesting – through either bunds or by natural

filtration tanks or by preventing pumping of water by making use of rainwater.

Now who meets the cost of these programs is one big question. Let us see how the electrical supply company benefits: If the organization spends around Rs 5,000 per IP set, we have Rs 800 crore as the capital investment on rainwater harvesting. For an annual savings of 23,872 MWh of electrical power, a savings of Rs 9.55 crore at the rate of Rs 4 per kWh for every feet increase in the water table.

It is always better not to use energy than try and save energy.

When a process industry utilizes water for its operations, then this water has to be demineralized or softened. To do this, it will need electrical power. Also due to dissolved solids and increased concentration, repeated breakdowns may happen, demanding periodic maintenance and scraping of industrial components, which means more energy consumption.

Now, greater the amount of rainwater harvested, lesser will be the dissolved solids, which means less breakdowns and increased fuel savings. Once the fuel consumption comes down, the release of CO<sub>2</sub> into the atmosphere is also reduced. Reduced CO<sub>2</sub> means lesser effect on global warming. This will then lead to stable weather conditions and predictable monsoons. Once the ecological cycle is renewed, achieving a balance between industrial, agricultural and environmental growth is easy.

Water is a renewable source of energy and must be conserved.

**Courtesy: Mallikarjun A. Kambaljal,**  
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## PART 1 – GENERAL

### CARBON FOOTPRINT - GREEN 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 in front, backyard and all other non-approachable areas of all primary and secondary pollutions.

We seek to compile 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 Green 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.)*

#### THOUGHT FOR EVERY MOMENT

There are about 19,00,00,000 students in INDIA. If every student saves one sheet per day, 19,00,00,000 sheets of paper meaning 988 ton of paper will be saved every day. This is equivalent to saving 2748.54 ton of wood a day. This will lead to saving about 33,00,678 trees per year.

**ACKNOWLEDGEMENT:**

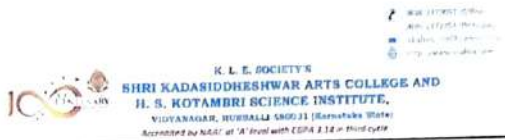
SUNSHUBH TECHNOVATIONS PVT LTD., is pleased to express its sincere gratitude to the management of KLE Society's Shri Kadasiddheshwar Arts College and H. S. Kotambri Science Institute, Hubballi, Karnataka, for entrusting SUNSHUBH TECHNOVATIONS PVT LTD., with the assignment on Green Earth practices based 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 7<sup>th</sup> Criteria Team lead by the able and motivating Principal Dr. Uma V. Nerle 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.



Ref. No. skahsh/CA/EA/En. A /2020-21/73

Date: 06-07-2023

To,  
Mr. Mithankar Sambhal  
Sundubh Technovations Pvt Ltd,  
Hubballi

Respected Sir,

Sub: Reg. conduct of Green Audit, Energy Audit and Environment Audit

With Reference to the subject cited above, I request you to conduct Green Audit, Energy Audit and Environment Audit of our College and issue certificates and reports of the same for the year 2020-21.

I also request you to provide the details of charges for the same.  
Please do the needful and oblige.

Thanking you,



SHRI KADASIDDHESHWAR ARTS COLLEGE &  
H. S. KOTAMBRI SCIENCE INSTITUTE, HUBBALLI-11

**THOUGHT FOR EVERY MOMENT**

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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 ENERGY STATUS.

We acknowledge the involvement of HODs & Coordinator

Name	Designation
Dr. Uma V Nerle	Principal
Shri S N Emmi	IQAC Coordinator
Dr Siddesh M B	Co-Coordinator IQAC
Smt S S Patted	Convener Criteria 7
Dr. K S Betageri	Convener Green Audit
Smt Devadatta Y	Convener

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

Certified Energy Auditors (EA-3485)

SUNSHUBH TECHNOVATIONS PVT LTD.,



**Criteria 7.1.6****ENERGY AUDIT COMPLETION CERTIFICATE**

I, Mallikarjun A Kambalyal, endorse and confirm that the Energy Audit has been carried out on 6<sup>th</sup> Aug 2020 under the instructions of Principal, Dr. Uma V. Nerle for KLE Society's Shri Kadasiddheshwar Arts College and H. S. Kotambri Science Institute, Hubballi, Karnataka. This report is generated based on the site visits and evidence collected from the site.

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.

I also confirm and sign this certificate, in case the institution needs demonstration, my team of professionals shall be happy to do so.

We present this report to much more than the legal or mandatory compliances. This report is tabled in two parts. The first forms the core discussions which are general in nature. The second section is subject specific under the statutory requirements of the NAAC accreditation norms. They are Audit reports on, Green aspects, Energy aspects, Environment aspects, Health aspects and the discussions on net CARBON FOOTPRINT & the CARBON HANDPRINT initiatives.

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.**

Original certificate is sent separately.

THOUGHT FOR EVERY MOMENT

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## 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
<u>28.01.2020</u>			

Figure 2 - Bureau of energy Efficiency Regd No: EA3485

#### THOUGHT FOR EVERY MOMENT

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## *Certificate of Successful Completion*



*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:* 

*Course Dates:* 14<sup>th</sup> - 16<sup>th</sup> July, 2019

*Certificate Number:* 47730

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



Figure 3 - ISO Certified Lead Auditor. Certificate No: 47730

### THOUGHT FOR EVERY MOMENT

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## 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)**

Premchand 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 A17563 certified by IRCA

The British Standards Institution is incorporated by Royal Charter  
BSI India, The Maharashtra Sahasra (A-2), Plot 1 & 2, Silver Nagar, Mehra Road, New Delhi 110005, India Tel: +91 11 2602 9000

...making excellence a habit.

Figure 4 - ISO Certified Lead Auditor. Certificate No: ENR-00253448

### THOUGHT FOR EVERY MOMENT

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## Teilnahmebescheinigung

**Mr. Mallikarjun Andanappa Kambalyal**

has successfully completed the

### **Manager Training Programme of the Federal Ministry of Economics and Technology**

Germany, September 02 – 28, 2013

### *Energy Efficiency in Industrial Enterprises*

Cologne, September 28<sup>th</sup>, 2013

Dr. Steffi Auri  
(Geschäftsführerin)

Hubert Smarowos  
(Geschäftsführer)

TÜV Rheinland Akademie GmbH • Alboinstr. 56 • 12103 Berlin

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Figure 5 - Manager training programme, Germany

#### THOUGHT FOR EVERY MOMENT

There are about 19,00,00,000 students in INDIA. If every student saves one sheet per day, 19,00,00,000 sheets of paper meaning 988 ton of paper will be saved every day. This is equivalent to saving 2748.54 ton of wood a day. This will lead to saving about 33,00,678 trees per year.

Manager Training Programme



Federal Ministry  
of Economics  
and Technology



Deutsche Gesellschaft  
für Internationale  
Zusammenarbeit (GIZ) GmbH

Certificate  
Fit for Partnership with Germany

Mr Mallikarjun Kambalyal

has successfully participated in the

**Manager Training Programme of the  
Federal Ministry of Economics and Technology  
with India**

from September 2 to September 28, 2013 in Germany.

The programme was carried out by the TÜV Rheinland Akademie,  
Cologne.

The Manager Training Programme is funded by the Federal Ministry of  
Economics and Technology of the Federal Republic of Germany.  
GIZ is the general manager and coordinator of the programme.

Bonn, September 2013

  
Reimut Düring

Head of Manager Training Programme  
GIZ – Deutsche Gesellschaft für  
Internationale Zusammenarbeit GmbH



  
Christina Otto  
Senior Project Manager  
GIZ – Deutsche Gesellschaft für  
Internationale Zusammenarbeit GmbH

Figure 6 - Fit for partnership with Germany

THOUGHT FOR EVERY MOMENT

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**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.

**NO WASTE – NO POLLUTION – NO HEALTH HAZARD.****WHY IS THIS AUDIT BEING CARRIED OUT?**

Whether you own or manage a small business, a large commercial facility, or a manufacturing operation, it's important to take advantage of any tips, programs and incentives that will help you save money on your energy bills. There are measures that will generate savings to positively impact your bottom line immediately, as well as longer-term strategic initiatives to assess your needs and stabilize your energy spend in the longer term – which is great news for your budget!

One such initiative is an energy audit. Energy audits reveal your usage patterns, identify waste, over-expenditure and, generally, make you fully cognizant of where your energy dollars are going. This knowledge will enable you to be more efficient with your energy use and be able to track and accelerate savings. Energy Audits may sound expensive or complicated, but they can be free and are easier than you think.

**WHAT IS AN ENERGY AUDIT?**

An energy audit is an analysis of a facility, indicating how and where that facility can reduce energy consumption and save energy costs. Its insight to energy efficiency and conservation can lead to significant savings on the company's utility bill.

**THOUGHT FOR EVERY MOMENT**

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## WHY SHOULD YOU GET AN ENERGY AUDIT?

Energy costs are soaring and your business can be at considerable risk if you do not take the guesswork out of your energy usage and the budget you need to cover it. Energy audits identify where your business is wasting energy. Residential and commercial properties account for around 10% of carbon emissions in the US, according to the EPA, which means they are very inefficient and waste huge amounts of energy and... revenue. An energy audit helps by revealing just how and where energy is being wasted. With thousands of commercial energy customers nationwide, we are well-qualified to advise you on which methods are best used for reducing energy waste and overall energy consumption. Let's start with a simple free evaluation of your bills and show you how we have been found to save between 5% and 35% for many of our customers.

In the case of energy, less is more. Lower energy consumption equals lower energy costs. And, of course, less energy consumption is obviously good for the environment.

As you can see, to be truly effective, energy management requires a strategy just like the other aspect of your operation and measures to curb costs can be simple and in some cases free. Gaining more control over your energy costs will improve the general health of your budget. Not only that but reducing your CARBON FOOTPRINT is great for the environment too!

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### THOUGHT FOR EVERY MOMENT

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## 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 Energy 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 Energy 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 Energy 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, Energy 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++", "A+", "A", Grade "B", .... according to the scores assigned at the time of accreditation.

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The other intention of organising Energy 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 in 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 ENERGY AUDIT

- The purpose of carrying out Energy 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 Energy 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

#### THOUGHT FOR EVERY MOMENT

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## 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 Energy 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.
- 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.
- 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.
- 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.

### THOUGHT FOR EVERY MOMENT

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- 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.
- To make in organisation net zero net zero carbon emission use of renewable resources including energy such as solar wind biogas geothermal energies are put into ooh utilisation.
- The net impact All the above energy audits should be to make an organisation contribute zero emissions which are called bye bhai use of water generation of waste use of energy e environmental damage health damage and finally to explore if the campus or direction can go in in contributing to third-party emissions minimising
- 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 proposed)
- Indicative templet for display at all prominent areas, classrooms, waiting rooms, canteen, library, relaxing areas in the campus.

#### THOUGHT FOR EVERY MOMENT

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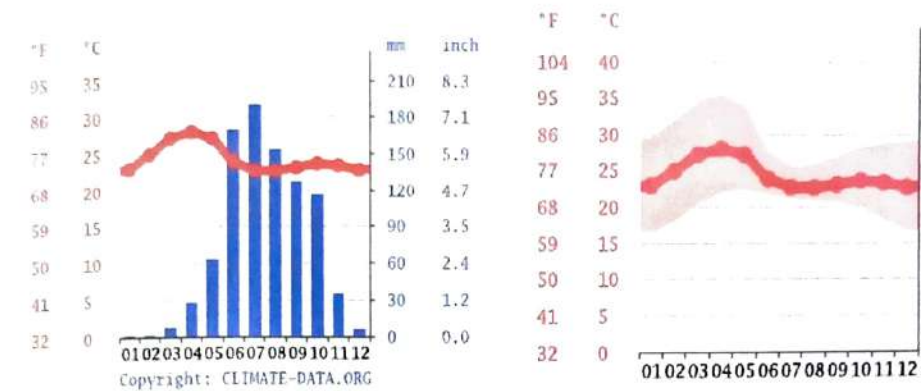


GEOGRAPHICAL CONSIDERATIONS:

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

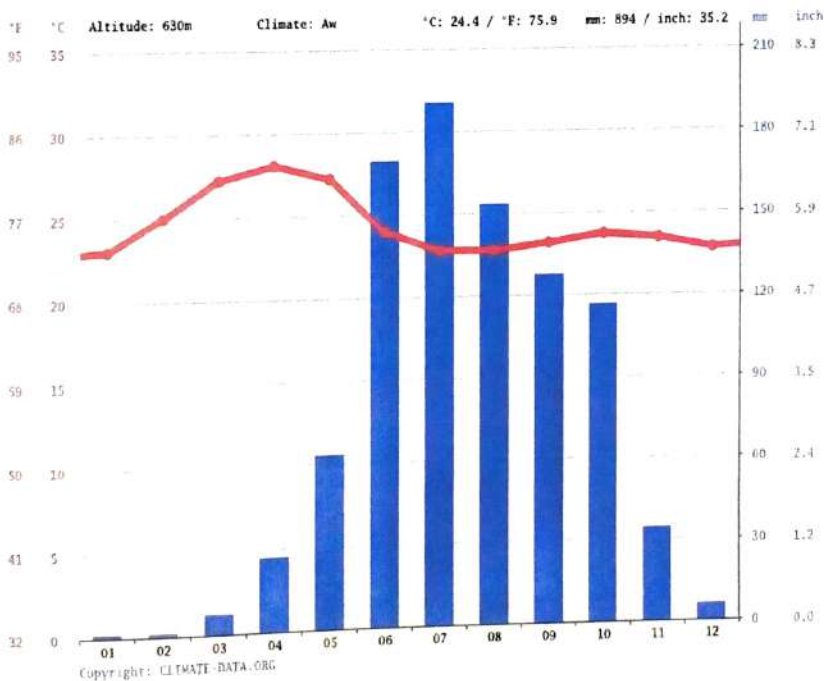
CLIMATIC CONDITIONS

CLIMATE HUBBALLI (INDIA)



This city has a tropical climate. In winter, there is much less rainfall than in summer. This location is classified as Aw by Köppen and Geiger. The temperature here averages 24.4 °C | 75.9 °F. In a year, the rainfall is 894 mm | 35.2 inch.

CLIMATE GRAPH // WEATHER BY MONTH HUBBALLI.

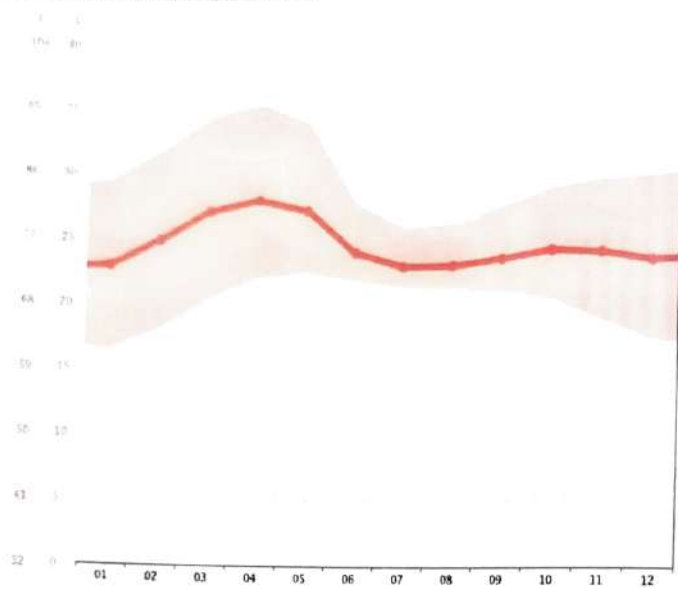


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The least amount of rainfall occurs in January. The average in this month is 1 mm | 0.0 inch. Most precipitation falls in July, with an average of 190 mm | 7.5 inch.

### AVERAGE TEMPERATURE HUBBALLI



The temperatures are highest on average in April, at around 28.0 °C | 82.5 °F. In August, the average temperature is 22.7 °C | 72.9 °F. It is the lowest average temperature of the whole year.

### WEATHER BY MONTH // WEATHER AVERAGES HUBBALLI

	January	February	March	April	May	June	July	August	September	October	November	December
Avg Temperature °C (°F)	23 °C (73.4) °F	25 °C (77) °F	27.2 °C (81) °F	28 °C (82.5) °F	27.2 °C (81) °F	23.9 °C (75.1) °F	22.7 °C (72.9) °F	22.7 °C (72.9) °F	23.1 °C (73.7) °F	23.7 °C (74.6) °F	23.4 °C (74.1) °F	22.8 °C (73) °F
Min. Temperature °C (°F)	16.5 °C (61.6) °F	18 °C (64.5) °F	20.3 °C (68.6) °F	22 °C (71.7) °F	22.4 °C (72.4) °F	21.7 °C (71.1) °F	21.1 °C (70) °F	20.9 °C (69.6) °F	20.6 °C (69.1) °F	20 °C (68) °F	18.3 °C (64.9) °F	16.8 °C (62.3) °F
Max. Temperature °C (°F)	29.6 °C (85.3) °F	32 °C (89.5) °F	34.5 °C (94.1) °F	35.5 °C (95.9) °F	34 °C (93.1) °F	27.7 °C (81.9) °F	25.7 °C (78.2) °F	25.9 °C (78.6) °F	27.1 °C (80.7) °F	28.3 °C (82.9) °F	28.8 °C (83.9) °F	29 °C (84.2) °F
Precipitation / Rainfall mm (in)	1 (0)	1 (0)	7 (0.3)	27 (1.1)	63 (2.5)	169 (6.7)	190 (7.5)	153 (6)	127 (5)	116 (4.6)	34 (1.3)	6 (0.2)
Humidity(%)	44%	40%	41%	53%	63%	83%	67%	86%	83%	74%	59%	48%
Rainy days (d)	1	0	1	5	8	18	21	20	14	11	3	1
avg. Sun hours (hours)	9.8	10.2	10.4	10.3	9.3	5.6	5.0	5.0	5.7	7.5	8.7	9.2

### THOUGHT FOR EVERY MOMENT

There are about 19,00,00,000 students in INDIA. If every student saves one sheet per day, 19,00,00,000 sheets of paper meaning 988 ton of paper will be saved every day. This is equivalent to saving 2748.54 ton of wood a day. This will lead to saving about 33,00,678 trees per year.

The variation in the precipitation between the driest and wettest months is 189 mm | 7 inch. The average temperatures vary during the year by 5.3 °C | 9.6 °F.

The month with the highest relative humidity is July (86.70 %). The month with the lowest relative humidity is February (39.67 %).

The month with the highest number of rainy days is July (27.47 days). The month with the lowest number of rainy days is February (0.40 days).

### 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.

---

### THOUGHT FOR EVERY MOMENT

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## PART 2 -TECHNICAL

### DISCUSSIONS ON EXECUTIVE SUMMARY:

We will discuss the factors that influence the use of energy resources so as to bring in sustainable remedial measures.

Aerial View of the College Campus.

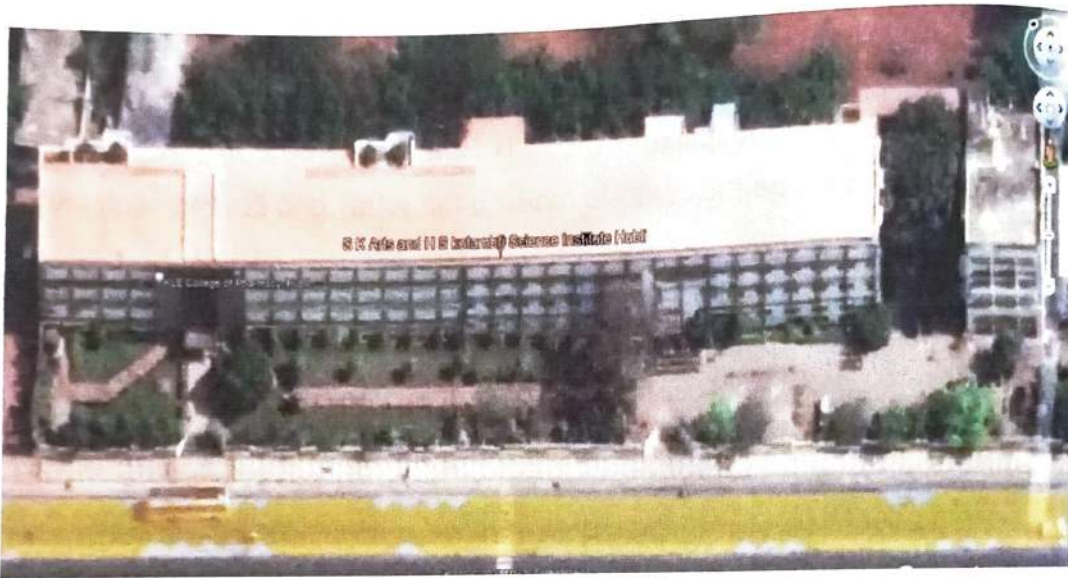


Figure 7 - Aerial view of campus

It is also prominently exhibited in all prominent places. Aerial view indicates that the building is facing South.

the management has shown keen interest in providing the amenities and is focusing on keeping the campus green there by the cool environment within the boundaries of the college.

Image : courtesy, Google Earth Pro.

#### THOUGHT FOR EVERY MOMENT

There are about 19,00,00,000 students in INDIA. If every student saves one sheet per day, 19,00,00,000 sheets of paper meaning 988 ton of paper will be saved every day. This is equivalent to saving 2748.54 ton of wood a day. This will lead to saving about 33,00,678 trees per year.

## POWER CONSUMPTION

Sl. No.	Observation*	Problems*	Resulting losses*	Remedial measures*	Capital*	Projected savings*	Category*
1	Energy Consumption	Variable	The institute has to monitor the energy consumption and list the days when the energy consumption is high and the events that cause the demand.			Avoided Peak demand	

## Energy demand.

Electrical energy utilisation during the academic year

Year	Month	Meter 1		Meter 2		Meter 3		Meter 4		Meter 5		Total Units	Total Amount
		1 Unit	Amount	2 Unit	Amount	3 Unit	Amount	4 Unit	Amount	5 Unit	Amount		
2019	August	0	53	1912	18429	414	3852	521	4117	114	1102	2961	27553
2019	September	31	737	1890	17382	321	3013	320	2729	67	741	2629	24602
2019	October	0	199	4554	24356	674	3298	1038	6316	222	1424	6488	35593
2019	November	0	660	495	29852	314	6258	133	7471	22	1826	964	46067
2019	December	0	461	1703	16077	237	2252	118	1019	47	589	2105	20398
2020	January	0	461	1676	15675	295	2738	309	2588	63	702	2343	22164
2020	February	0	461	1263	11536	276	2568	183	1485	43	551	1765	16601
2020	March	0	461	3625	22403	685	3756	858	5835	161	1118	5329	33573
2020	April	0	461	1748	21231	323	3962	385	3918	74	782	2530	30354
2020	May	0	924	1748	37091	323	6949	385	7182	74	1567	2530	53713
2020	June	0	489	3058	2243	365	-1067	448	-2159	171	35	4042	-459
2020	July	0	461	826	9920	149	438	81	-1445	41	536	1097	9910

The energy consumption in the campus is highly variable and no fixed pattern is seen. This is mainly due to the educational curriculum and conduct of classes.

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## RENEWABLE ENERGY

Sr No	Observation*	Problems*	Resulting losses*	Remedial measures*	Capital*	Projected savings*	Category 7
2	Solar Power	Suggest to install Solar Power to minimise use of energy during Off grid times.					7.1.2

The institute has good space to explore rooftop Solar power to meet the energy requirement of the institute. The initiative can take the institute to net zero energy.

## SENSOR TECHNOLOGY

Sr No	Observation*	Problems*	Resulting losses*	Remedial measures*	Capital*	Projected savings*	Category 7
3	Occupancy sensor	Wastage of power	High	Occupancy sensor based switching	₹1500 per room	Resulted ROI of one year.	7.1.2
	Placem ent of control switches	Operation al problems.	Unregul ated operati on of room lights.	Master switch at a specified location and specified height.	₹ 4000/- per room. This could vary based on local sourcing.	Wel controlled operation.	7.1.2

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It is also observed that the lights are left switched ON at majority of places during daylight, thus calling for wastage of electrical power. Thus, causing financial losses to the management and energy loss to the country.



Figure 8 - Lighting need for sensor



It is also seen that the children have no easy access to operating the control gear (Switches). Hence the lights remain on even when not needed.

**Solution:** It is therefore required to install Light Intensity Sensors in all the rooms. Lighting improvements should be carried out by using T5/LED or The Induction Light systems in lieu of normal tube lights. If the finance department permits, it is advised to install 40W Induction lamps in all classrooms.

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**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.

We suggest to allocate this to the Physics stream of students to understand the science and application of technology.

Need based light energy utilisation should be imparted to the children so as to take it forward to the society.

The other aspect to the light energy is the task based lighting.

ie., Task – normal or critical.

General lighting ie open area or living room lighting.

External lighting ie yard lighting for security reasons.

We find use of T8 & T12 tube lights. It is wise to replace the same with LED tube lights on immediate basis. Considering the energy savings, the wait for there failure may not be justified.



Figure 9- Need for occupancy sensor

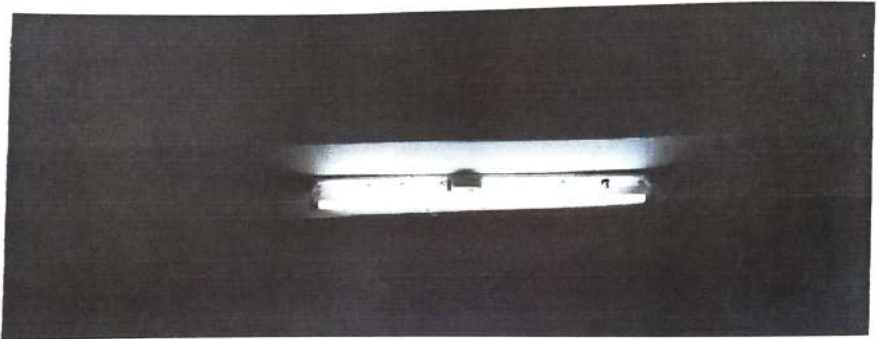


Figure 10 -T5 & T8 tube lights with Electromagnetic choke

We also suggest to make best use of natural lighting

In the above roof, it may be considered to replace couple of the Galvalume sheets with green tinted Translucent (frp) sheets as below.

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## LIGHT INTENSITY SENSOR REQUIREMENT.

It may be seen that the Light is illuminated. However, the brightness on the students is seen to be coming from the sides. The shadow indicates natural light coming from the windows is brighter. Natural light is more predominant than the tube light. Hence tube light being switched off has no adverse effect. However, it would save on the energy consumption and contribute to green practices.



Overhead water tang regulator should be considered for excess use of energy and wastage of water.

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NATURAL LIGHTING: Category 7.1.1, 7.1.2, 7.1.3 and 7.1.5

## NATURAL LIGHTING

	Observation*	Problems*	Resulting losses*	Remedial measures*	Capital*	Projected savings*	Category 7
5	Electric al	Old tube lights	High energy consumers	LED lights of appropriate ratings.	Rs.80/- to Rs.250/- per unit	Rs.175/- per tube per annum. ROI of 1 years.	7.1.6
6	Natural Lighting	Un cleaned windows and ventilators	High energy bills	Clean the windowpanes and allow maximum natural light penetration.	Nil, part of routine , In house manpower.	Substantial cost of energy bills on lighting.	7.1.2, 7.1.6



Figure 11 - Lighting, use of natural lighting with anti-glare roofing sheets

The open hall when taken up for renovation, we suggest to use natural lighting using opaque roofing sheets.

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## BATTERY MANAGEMENT.

Sr No	Observation*	Problems*	Resulting losses*	Remedial measures*	Capital*	Projected savings*	Category 7
3	Battery placement	Battery shell in conductor loop	Low performance & self-discharge	Design the stacking arrangements.	In house resources	25% of the cost of the batteries.	7.1.3

Criteria 7.1.1, 7.1.2, 7.1.3 and 7.1.5

## BATTERY PLACEMENT:

The batteries should be placed on an

Batteries should be placed on an insulated platform not touching any of the metal frames with top clearance of 6" for ease of handling and breathing.

Need cross ventilation for favourable breathing.

Provision for periodical checking and maintenance should be made possible without major obstacles.

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Figure 12 - Galvanic reaction causing damage to battery life.



Figure 13 - Battery placement, Need cross ventilation.

In absence of the above placement conditions,

The batteries will discharge faster. Loss of energy

The charging time and current will increase as there is the return path for self-discharge. Increased Energy Demand.

A well-maintained battery is known to serve for more than 7 years.

The presence of oxidation marks at the point of contact should not develop over the time.

We strongly advice for regenerating the batteries once every 3 to 4 years so that they serve over 15 years in lieu of 5 years under present conditions.

A well-maintained battery will draw less charging power, i.e., saves on energy consumption, delivers more energy per charge thus resulting in better serviced life.

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Batteries should be placed well ventilated and avoid dumping of any material on the breathers provided.

For more information on battery regeneration, Contact  
Sunshubh Technovations Pvt Ltd, Hubli [ceo@sunshubhrenewables.com](mailto:ceo@sunshubhrenewables.com).

## BATTERY REGENERATION

Battery regeneration is very popular. 80% of the batteries breaking down and losing capacity are sulphated, but can be restored with the right equipment. Battery regenerator successfully replaces sulphation by active material thanks to an electrical high-frequency pulsation process. This process restores the battery capacity, giving you the ability to reuse old and sulphated batteries. You can also use the battery regenerator for annual maintenance to considerably prolong the lifespan of your batteries. The battery regenerator can be used in every lead-acid-based battery: starter batteries, stationary batteries, traction & semi-traction batteries, Ni-Cad batteries ... Since the college uses BATTERIES in large numbers, the management can consider to procure one unit at the centralised station in the college campus.

Sr No	Observation*	Problems*	Resulting losses*	Remedial measures*	Capital*	Projected savings*	Category 7
4	Battery regeneration.	Short life span	300% of the cost of the battery.	Subject all batteries to regeneration made.	Rs.20.00 Lacs or as per user agreement	300 %	7.1.2, 7.1.6

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## NECESSITY AND ISSUES

It is customary in the present energy scenario to use Batteries either in our office or working environment. In continuation, The old week batteries are a nuisance as they need to be discarded in to the environment for further process. Which is a costly option both in terms of Health and pollution issues. Let us review our use of applications and consider if we can improve our battery use methods. A brief note, before we consider to take corrective step.

Lead-acid batteries are widely used as important power supply devices that include automotive, uninterruptible power supply (UPS), telecommunication systems and various traction duties.

Lead-acid batteries are the workhorse of the rechargeable battery systems for their reliability, low cost, and good operational life. Predictably, approximately million tons of waste batteries are generated every year and the production of lead-acid batteries will continue to rise even more sharply with sustained and rapid development of economy. The lead-acid battery is a complex industrial product, constituted by several different materials, the consequence was very serious which often caused much property loss, casualties and environment pollution once accidents happen. Based on "Technical Guidelines for Environmental Risk Assessment on Projects" and in consideration of the characteristics of the chemical compositions and contents, a framework of environmental risk assessment framework on lead-acid batteries was established. The work procedure included risk identification, sources analysis, pollution forecast, and defensive measures. By analysing the environmental risk assessment of lead-acid batteries, the study opined for directions both for the preventive measures and safe use, according to the forecast results of lead-acid batteries.

## RISK IDENTIFICATION OF LEAD-ACID BATTERIES.

Lead-acid batteries generally consist of four parts, which are electrolyte, lead and lead alloy grid, lead paste, and organics and plastics, which included lots of toxic.

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hazardous, flammable, explosive substances that can easily create potential risk sources. The materials contained in lead-acid batteries may bring about lots of pollution accidents such as fires, explosions, poisoning and leaks, contaminating environment and damaging ecosystem. The main chemical compositions and contents of spent lead-acid batteries are listed below.

The main chemical compositions and contents of spent lead-acid batteries

Compositions	Contents (wt.%)
Electrolyte	11–30%
Lead and lead alloy grid	24–30%
Lead paste	30–40%
Organics and plastics	22–30%

**Environmental effects of lead** can end up in water and soils through corrosion of leaded pipelines in a water transporting system and through corrosion of leaded paints. ... **Lead** accumulates in the bodies of water organisms and soil

The recognition & scope of lead-acid batteries, mainly focused on the pollutants involved in the process of centralized recovery, Storage areas and transport. Based on "Technical Guidelines for Environmental Risk Assessment on Projects" and "Identification of hazard installations for dangerous chemicals

With change in times, new solutions keep coming up.

One such option is to Regenerate the dead or non-usable batteries. Energic Plus battery regenerator successfully removes sulphating due to an electrical high-frequency pulsation process.

This process restores the battery capacity, giving you the ability to reuse old and sulphated batteries. You can also use the battery preconditioner for annual maintenance to strongly prolong the lifespan of your batteries.

Main Benefits are :

- Removes excessive sulphate
- Prolongs the lifespan of your battery
- Generates detailed reports in Word, Excel or PDF
- Fully automatic, easy to handle
- Free software included with wireless data transfer to computer

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- Combination of charging/discharging
- Works with all types of lead-acid-based batteries:
- Gel batteries,
- Traction(semi-) batteries,
- Starter batteries,
- Stationary Batteries.

Concealed batteries in operation or used batteries should be properly named and placed in proper order. The used batteries should be considered for REGENERATION for the second and subsequent cycles and prolong the disposal as the chemicals cause high level of damage to the environment.

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 do's and don't's 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

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acid and lead particles contaminate the soil and become airborne when dry. Children and fetuses 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 ( $30\mu\text{g}/\text{dl}$ ). In 2014, the average participating employee checked in at  $15.6\mu\text{g}/\text{dl}$ , but 4.8 percent were above  $30\mu\text{g}/\text{dl}$ . (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  $15\text{--}40\text{mg}/\text{kg}$  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  $40\text{--}140,000\text{mg}/\text{kg}$ .

## 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.

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## CADMIUM

Cadmium used in nickel-cadmium batteries is considered more harmful than lead if ingested. Workers at NiCd 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 NiCd 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.

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## SAFETY TIPS

Keep button batteries out of sight and reach of children. Remote controls, singing greeting cards, watches, hearing aids, thermometers, toys and electric keys may contain these batteries.

Similar to pharmaceutical products, keep loose batteries locked away to prevent access by small children.

Communicate the danger of swallowing button batteries with your children, as well as caregivers, friends, family members and babysitters.

If you suspect your child has ingested a battery, go to the hospital immediately. Wait for a medical assessment before allowing the child to eat and drink.

## 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.

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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,  $AsH_3$ ) and (antimony hydride,  $SbH_3$ ). 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 lease of life.

### NATURAL VENTILATION.

Sr No	Observation*	Problems*	Resulting losses*	Remedial measures*	Capital*	Projected savings*	Category 7
7	Natural Ventilation	Permanently closed ventilators.	Creation of hot air pockets below the ceiling.	Open the Ventilators for easy exit of hot/warm air from the rooms.	Nil, In house manpower.	Eliminates use of Electric Fans and Substantial cost of energy bills	7.1 .2 7.1 .6

The natural ventilators are missing in the top floor class rooms. We also see that the roof is of Galvalume sheets. This makes the room hotter and more intolerable during the hot days. In absence of cross ventilation, the room turns out to be a oven. WE strongly suggest that the rooms be provided with cross ventilation just below the roof, making it easy for the hot air to vent out by thermosyphon.

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Illustrative.

We also suggest to use BLDC fans in Liew of normal ceiling fans which are energy intensive.



Figure 14 - Cross ventilation for illustration only.

## WHY SUPER ENERGY EFFICIENT CEILING FANS?

### Regular old ceiling fans

Ceiling fans escape one's mind when thinking about reducing electricity cost. This forgotten appliance contributes significantly to electricity consumption due to its numbers and hours of usage. The following estimation supports this claim. A regular ceiling fan (1200 mm span) consumes about 75 W at the highest speed. There are over 400 million regular ceiling fans in India and each of them creates an electricity demand about 39W\* (consumption at medium speed).

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1. Metal Fan Body
2. Metal Fan Blade
3. Double Bearings
4. External Controller
5. Brushless DC Motor
6. Pure Copper Winding
7. Five Levels Remote Control
8. DC 12V Input Fan
9. DC 6V-24V Operating
10. 36W Power Consumption
11. 380RPM Super High Speed
12. 10+ Years Life Time Motor

### Super energy efficient ceiling fans

At present Brushless Direct Current (BLDC) ceiling fan is the popular choice of super energy efficient ceiling fans in India. There are two premier BLDC ceiling fan brands in India – Superfan (Versa Drives Private Limited) and Gorilla fans (Atomberg Technologies)\*\*. These ceiling fans (1200mm span) consume 35W at the highest speed so they save over 50% of electricity consumption.

The higher efficiency comes with no compromise in air delivery. Now consider replacing all the ceiling fans in India with best energy saving ceiling fan. The reduction in electricity demand created by ceiling fans will be:

Please contact M/s VERSA DRIVES PRIVATE LIMITED  
38 B, Vadakku Thottam Part, Idikarai, Coimbatore. Tamil Nadu, India 641022  
☎ Tel: 0422-2972798 / 2972799 / 2972800

Reference to the audit report may be made to avail educational-additional discount.

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## SAFETY.

Sr No	Observation*	Problems*	Resulting losses*	Remedial measures*	Capital*	Projected savings*	Category 7
8	Electric al safety	Failure of electrica l equipm ent	Loss of valuabl e data and assets.	Proper earthing and periodical maintenance with measurement.	Nil, In house manpo wer.	Eliminates electrical hazards and threat to life. Substantial cost of energy bills	7.1 .2, 7.1 .6



Figure 15 - Safety, electrical earthing compliance

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Name plate : Cumpster room.

Earth pit connected to : xxxx system.

Date of inspection : dd/mm/yyyy

Measured values.

Required values.

Reasistance: xx  $\Omega$

< 5  $\Omega$

Leakage current : xx Amps.

< 3.5mA

Date of next inspection : dd/(mm)/yyyy

THOUGHT FOR EVERY MOMENT

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**LIST OF INSTRUMENTS:**

During the process of the Audit, the following lists of instruments were used.

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	Lap Top Computer	HP	To Interface The Instruments For More Accurate - Sophisticated Readings In Sensitive Equipments.
15	Ultrasonic flow meter		Measure liquid flow.
16	Portable Vibration Meter.	METRAVI	Effect Of Filtration - Sewing System. Structural Stability
17	Live cable detector probe	-	Detect hidden cables for safety audit.
18	Power Analyser – EMM 5	Beluk	For remote communication and detailed audit.
19	Power Analyser – ELITE PRO	Beluk	Power Analyser.
20	ETV meter, KWh & PF meters for site recording.	Secure	
21	PT's for Transformer audits.	KALPA	On field auditing of transformer loading and imbalance evaluation.

Only appropriate instruments will used wherever necessary.

**THOUGHT FOR EVERY MOMENT**

There are about 19,00,00,000 students in INDIA. If every student saves one sheet per day, 19,00,00,000 sheets of paper meaning 988 ton of paper will be saved every day. This is equivalent to saving 2748.54 ton of wood a day. This will lead to saving about 33,00,678 trees per year.

### ACTION PLAN SUMMARY:

Earmark the action plan.

Invite subject experts for Tec talks,

Organize in person panel discussions and interaction to propagate the knowledge and mitigate the problems in practicing the same.

Prioritize the initiatives and execute.

Observe the benefits and shortcomings.

Workout further improvement by involving the staff and students.

### MODE OF ACTION:

The process of GREEN AUDIT & ENERGY CONSERVATION should be carried out in three steps.

Good housekeeping practices using available manpower.

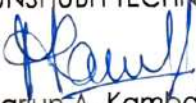
Minor alterations using in house work culture with minimum investments on accessories as discussed.

Capital investments, which may be required for installation of new methodologies may be taken up on phased manner.

We will be happy to assist you for any further advice/consultancy if required either on Rainwater management or on any of the measures discussed in the report.

We hope the measures are implemented in good spirit and to human convenience and comfort.

For SUNSHUBH TECHNOVATIONS PVT LTD.,



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

Certified Energy Auditors EA-3485

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