Energy Audit Report

(2022-23)

Panchakshari Shivacharya Trust's

CHANNABASWESHWAR PHARMACY COLLEGE (DEGREE)

Basweshwar Chowk, Latur 413512 (Maharashtra)

Energy Audit Conducted by

Kedar Khamitkar & Associates

Energy Auditor (Empanelled Mahaurja, Govt. of Maharashtra)

M: 9850244701 Email. : urjabachat@gmail.com

Requirements for the NAAC

CEA Team has been Conducted Detailed Energy Audit of Channabasweshwar Pharmacy College (Degree), Latur Building Located at Latur- District Maharashtra During Energy Audit We have found Environmental Consciousness and Sustainability initiatives in their Campus.

1. Percentage of Annual Lighting power requirement met through LED Bulbs

(Current Year Data) = 74 %

2. Percentage of Annual Power requirements met through Renewable Energy

Sources Current year data is 55%

KEDAR KHAMITKAR
Govt. Certified
Energy Auditor
Reg.No.EA-8287
LATUR-Maharashtra

Kedar Khamitkar
Energy Auditor
(Certified by Bureau of Energy Efficiency, Ministry of Power, Gov. of India)
Empanelled Energy Auditor MAHAURJA , Govt. of Maharashtra Institution

INDEX

Executive Summary

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

Sr	Recommendations	Savings / year	Investment	Payback
1.	**Replace** Existing Inefficient Ceiling Fans with Efficient BLDC fans	7560 KWH	Rs. 2.55/- Lakhs	3.37 Yrs.
2.	**Improve Power Quality :** Install Voltage Servo Stabilizer of 25 KVA Capacity	2000 KWH	75000/-	3.75 yrs.
3.	**Install occupancy Sensors** in Campus Energy Consumption Monitoring & Security purpose (100 Sensors)	1000 KWH	50000/-	5 Yrs.
4.	**Conduct Awareness Training Program** (Install Sign Boards)	-	NA	Immediate

Preface

An energy audit is a study of a plant or facility to determine how and where energy is used and to identify methods for energy savings. There is now a universal recognition of the fact that new technologies and much greater use of some that already exist provide the most hopeful prospects for the future.

Data collection for energy audit of the Channabasweshwar Pharmacy College (Degree), Latur was conceded by EA Team on 24th March 2023. This audit was over sighted to inquire about convenience to progress the energy competence of the campus.

All data collected from each classroom, Laboratory, Library & every room. The work is completed by considering how many Tubes, Fan, A.Cs, Electronic instruments, etc. in each room. How much was participation of each component in total electricity consumption.

Acknowledgement

We express our sincere gratitude to the Principal Sir & authorities of Channabasweshwar Pharmacy College for entrusting and offering the opportunity of energy performance assessment assignment. We are thankful to Institute for their positive support in undertaking the task of system mapping and energy efficiency assessment of all electrical system, utilities and other workshop equipment. The field studies would not have been completed on time without their interaction and guidance. We are grateful to their cooperation during field studies and providing necessary data for the study.

With Best Wishes,

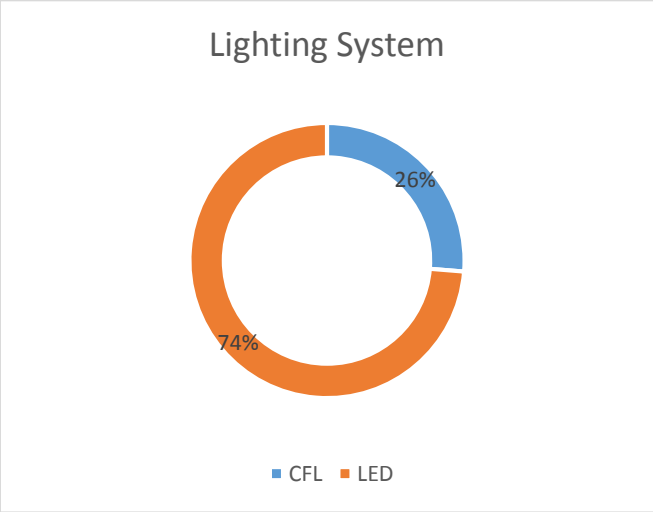
Kedar Khamitkar

- Energy Auditor, Certified by Bureau of Energy Efficiency, Ministry of Power, Govt. of India
- Empanelled Consultant MAHAURJA , Govt. of Maharashtra

Requirements for NAAC

1. Percentage of use LED Lighting

Type	Total
LED Lights Connected Load	4863
CFL Bulb Connected Load	1723
Total Lighting Load	6586

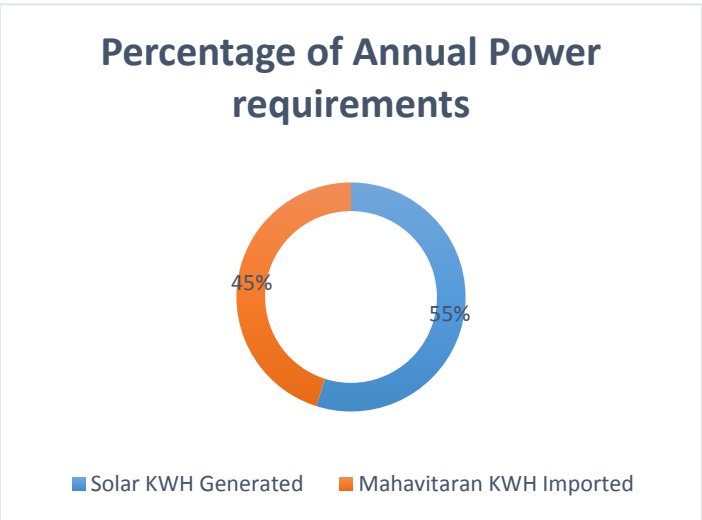


Observations: Percentage of Annual Power requirements met through LED Bulb/Tube Current year data is 74%

Suggestions: Replace 26% Inefficient CFL lighting with Efficient LED Lighting

2. Percentage of Renewable Energy use

Average Renewable Energy units generated	35800	KWH
Nonrenewable Energy (Mahavitaran) imported	19972	KWH
Annual Total Power Requirement	24320	KWH



Observations:
Percentage of Annual Power requirements met through Renewable Energy Sources Current year data is 55%

Suggestions: Install Motion sensors.

Energy Performance Index (EPI)

Channabasweshwar Pharmacy College (Degree), Latur Uses Electrical Energy from MSEDCL Maharashtra State Electricity Distribution Company Limited.

The Specific Energy Consumption (SEC) is the ratio of energy required per square meter.

Total Electricity Consumption 19972 KWH /Year

Total Built-up Area 6438.76 Sq. Meter

In this case the SEC is evaluated as electrical units consumed per square meter of area.

Observations:

EPI calculated as under (for Electricity): 3.10 KWH/Sq. Meter

As per BEE Star Rating Guidelines Existing Channabasweshwar Pharmacy College, Building may be considered as 5 Star.

EPI KWH/Sq. Meter/Year	Star Label
80-70	1 Star
70-60	2 Star
60-50	3 Star
50-40	4 Star
Below 40	5 Star

Chapter: I Introduction

"Panchakshari Shivacharya Trust" is a charitable trust registered under Bombay act 1950. It undertakes educational and social activities. This trust started Channabasweshwar Pharmacy (polytechnic), Latur in 1980. After realizing the prospects and potential of the course in the emerging scenario of global pharmaceutical industry and education, Channabasweshwar Pharmacy College (Degree) was started Bachelor of Pharmacy course in 2010. Thereafter, postgraduate course M. Pharmacy (Pharmaceutics and Pharmaceutical Quality Assurance) in 2012. Since 2019 the College has been recognized as Approved Ph. D Research Centre. Thereafter the Pharm D. course in 2020 and other PG branches like Pharmaceutical Chemistry and Pharmacology in 2021. The college is affiliated to Swami Ramanand Teerth Marathwada University, Nanded. It is approved by Pharmacy Council of India, New Delhi and Directorate of Technical Education, Mumbai. Further it is recognized by University Grant Commission under section 2[f] and ISO 9001:2015 certified. College has its own well-structured building, well equipped laboratories, and library with a number of reference books, international journals with e-library, good computing facility and research laboratory.

Chapter 2: Energy Audit Objectives

Channabasweshwar Pharmacy College (Degree), Latur entrusted the work of conducting a detailed Energy Audit of campus with the main objectives given bellow:

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

Scope of Work, Methodology and Approach:

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

Approach to Energy Audit:

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

Energy Audit:

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

Chapter: 3 Energy Audit Methodology

Energy Audit Study is divided into following steps

1. Historical data analysis:

The historical data analysis involves establishment of energy consumption pattern to the established base line data on energy consumption and its variation with change in production volumes.

2. Actual measurement and data analysis:

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

3. Identification and evaluation of Energy Conservation Opportunities:

This step involves evaluation of energy conservation opportunities identified during the energy audit. It gives potential of energy saving and investment required to implement the Proposed modifications with payback period.

4. Energy Audit Instruments used

a) Power Quality Analyser HIOKI – 3197

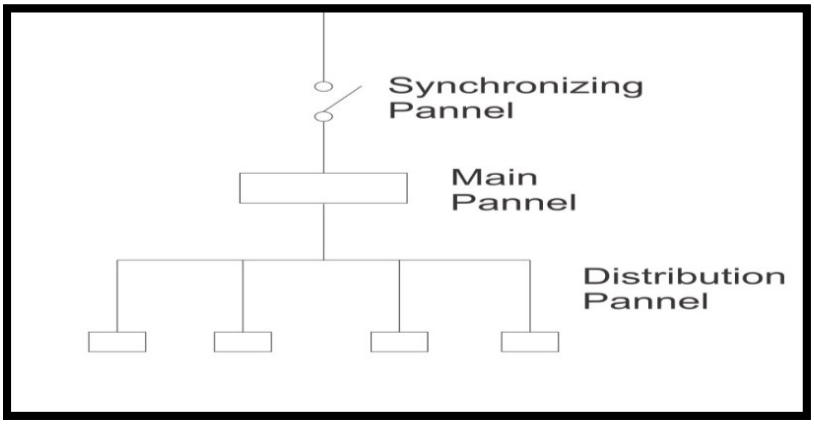
b) Thermal Imager Fluke – PTI 120

c) Earth Tester MECO

Chapter: 4. Study of Electrical Systems

Electrical Energy Sources:

1. The electrical supply to the Institute comes from MSEDCL LT supply.
2. Solar Power Plant Capacity19 KW



MSEDCL LT supply: Mahavitaran has been installed three meters in Campus.

The details of meter are as under

Meter - A Consumer No. 610557505868
Meter - B Consumer No. 610550188492
Meter - C Consumer No. 610550207241

MSEDCL Supply

The electrical bills from MSEDCL for 12 months from April 2022 to March 2023 have been studied.

Meter 'A' Details:

		Consumer No.	610557505868
SN	Details of Electricity Demand	Tariff	073 /LT-X B I 0-20KW Pub Ser oth
I	Sanctioned Load	6.91	KW

Meter 'B' Details:

		Consumer No.	610550188492
SN	Details of Electricity Demand	Tariff	73 LT-VII B I
I	Sanctioned Load	3.73	KW
2	Contract Demand	4	kVA
3	Recorded Maximum Demand	5	kVA

Meter 'C' Details:

		Consumer No.	610550207241
SN	Details of Electricity Demand	Tariff	052 / LT II Comm 3Ph < 20KW
I	Sanctioned Load	4	KW

Solar Power Plant :

Institute has been taken good initiative for energy conservation.

Installed 19KW Capacity Off-grid solar power plant.

Observations :

1. Percentage of Annual Power requirements met through renewable energy Sources is 55%
2. Electricity Generation from Solar Power Plant 24320 Units/Year
3. Electricity Imported from Mahavitran 19772 Units / Year

Suggestions :

1. Install Occupancy Sensors to minimize electricity unknown losses.
2. Install Solar Street Lights to Minimize Electricity Import during Night.

Connected Load Details

Major Energy use and Areas: In the College Campus Electrical energy is used for various applications like: Computers, Printers, Xerox machines, LCD Projector, Router System, Lighting, Fans, Flood light, Pumping Motor, Air-Conditioning & Other Laboratory Equipment etc.

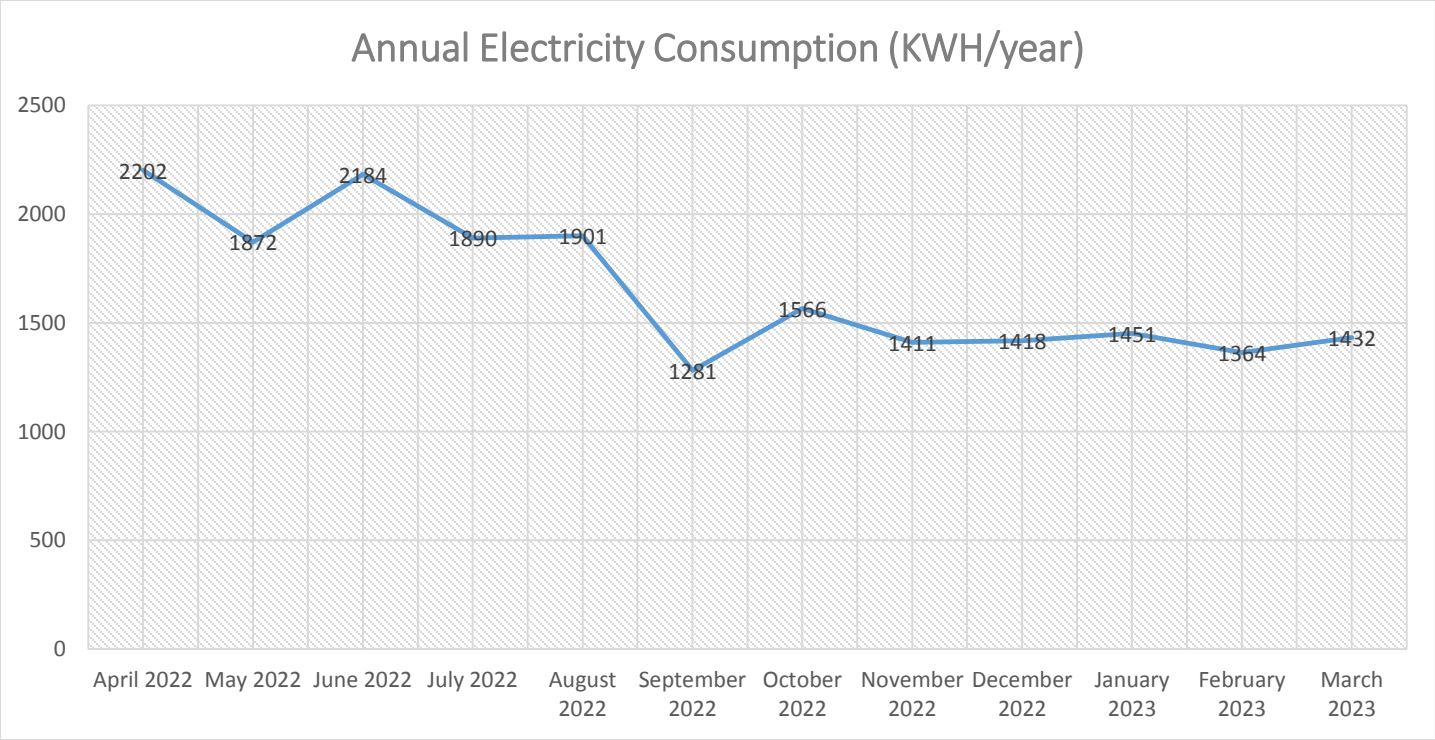
Sr.	Building	Type	Quantity	Watt	Total
1	Ground Floor	LED Panel	121	15W	1815
		LED Panel	24	12W	288
		LED Panel	12	9W	108
		CFL lamp	6	18W	108
		CFL lamp	9	23W	207
		LED Tube	38	20W	760
		LED Tube	1	20W	20
		Ceiling Fan	29	70W	2030
		Wall Fan	2	55W	110
		AC	5	975W	4875
		Florescent Tube light	7	52W	364
		Exhaust Fan	7	40W	280
		Refrigerator	3	130W	390
2	First Floor	LED Tube	15	20W	300
		CFL lamp	12	23W	276
		Ceiling Fan	42	70W	2940
		Wall Fan	1	55W	55
		Florescent Tube light	33	20W	660
		Exhaust Fan	1	40W	40
		AC	1	975W	975
		Focus	2	50W	100
		Freeze	2	130W	260
3	Second Floor	LED Tube	60	20W	1200
		LED Panel	31	12W	372
		CFL lamp	2	23W	46
		CFL lamp	1	22W	22
		Ceiling Fan	44	70W	3080
		Florescent Tube light	1	40W	40
		Exhaust Fan	3	40W	120
		AC	12	975W	11700
		Refrigerator	2	130W	260
		Deep Freezer	1	290W	290
4	Miscellaneous Load				34091

Observations: Ceiling Fan (70Watt) contributes @8136 Watts Load

Suggestion: Minimize Connected load Install BEE Star rated Energy efficient BLDC Fans.

Annual Electricity Consumption Historical Electricity Bill:

Month	Consumer No. 610557505868	Consumer No. 610550188492	Consumer No. 610550207241	Total
April 2022	1189	919	94	2202
May 2022	1070	601	201	1872
June 2022	1168	774	242	2184
July 2022	1142	611	137	1890
August 2022	1143	526	232	1901
September 2022	550	479	252	1281
October 2022	752	573	241	1566
November 2022	644	502	265	1411
December 2022	630	583	205	1418
January 2023	736	487	228	1451
February 2023	675	533	156	1364
March 2023	712	597	123	1432
			Total KWH	**19972**



General Observations based on Electricity Bill:

Total Annual Electricity Imported from Mahavitran 19972 KWH/year

Max KWH consumption found in the month of April 2022 and Minimum Consumption found in the month of September 2022

Chapter: 5 Performance Evaluation

5.1 Fan System:

Total number of fans used in the campus = 115 No's

Consider @200 days Working 6 Hrs.

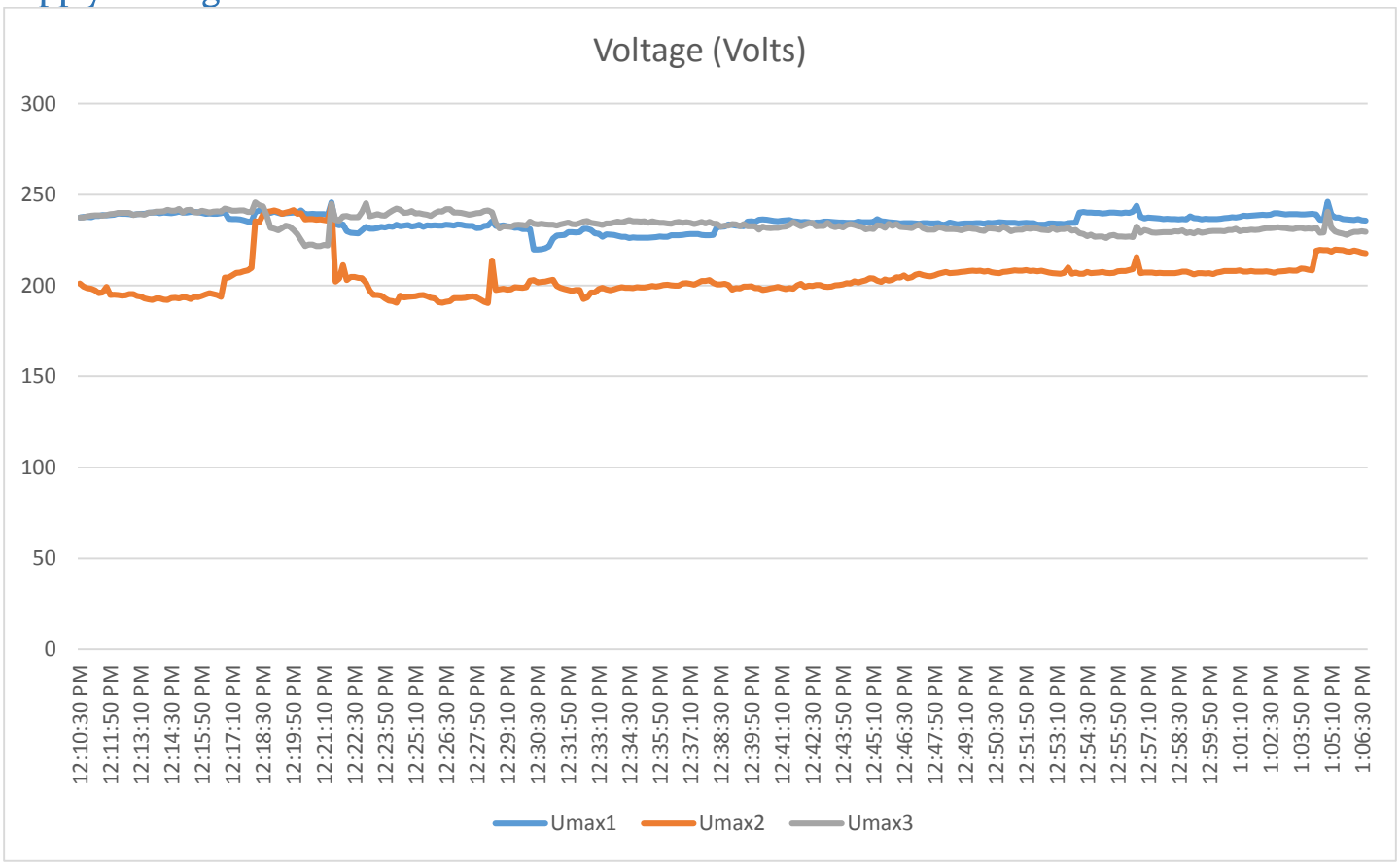
- Number of fans to be replace = 115 Nos.
- The Total Current Consumption =9660 kWh
- The Expected fan Consumption =3864 kWh
- Expected Saving per year = 5790 kWh/year

Suggestions: Replace existing Inefficient Fan System (75W) with Five Star BLDC (28W)

5.2 Power Quality Analysis (PQA)

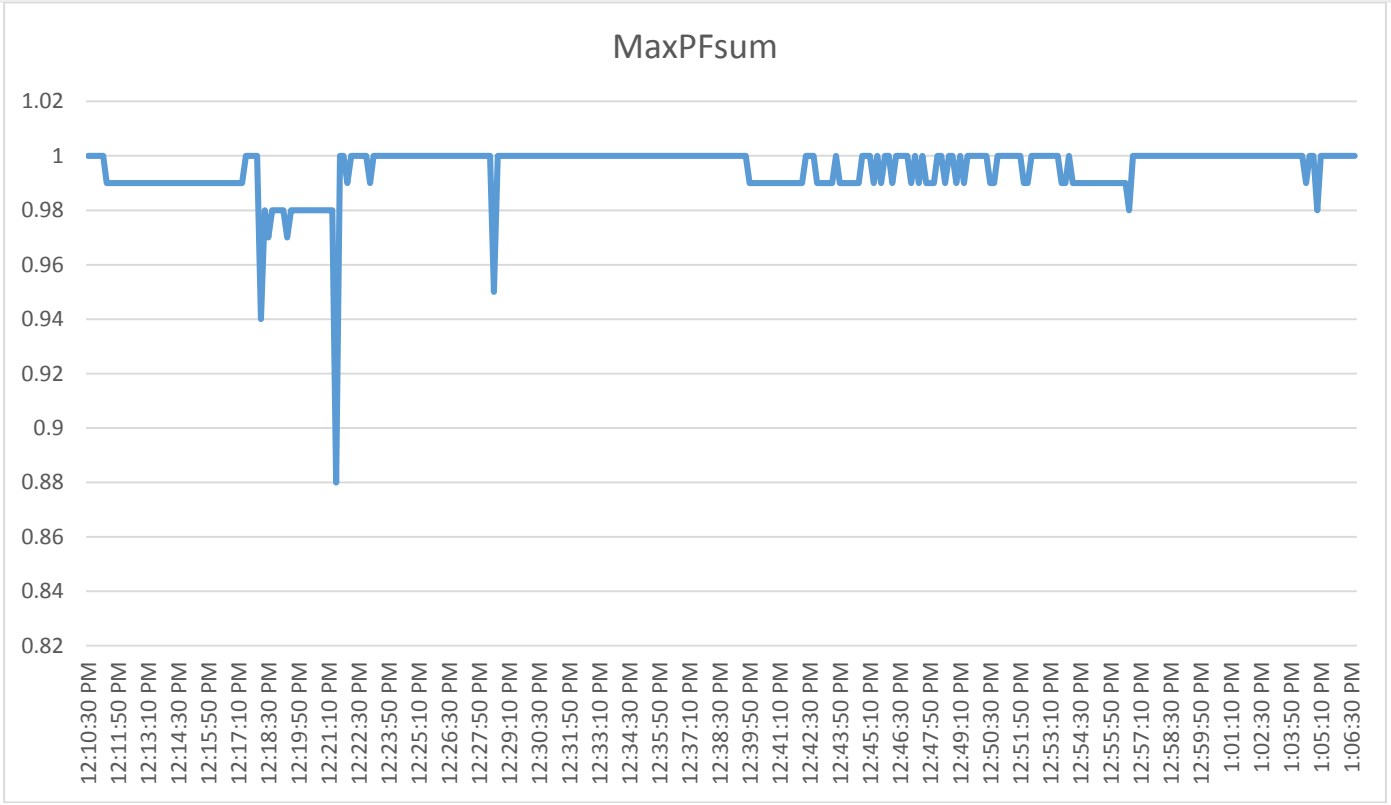
Power quality issues can affect the operation of critical loads and can have the negative impact on operation. This power quality analyser can monitor the cost of energy wasted due to poor power quality. The wider range of measurement function and measurement method in this analyser is the ideal tool and for the calculation of errors.

Supply Voltage level Overview



Observations: Found Poor Power Quality supply from Mahavitran Electricity Distribution Company to the Institute.
Suggestions: Install Three Phase 25 kVA Air Cooled Servo Stabilizer.

5.3 Power Factor:

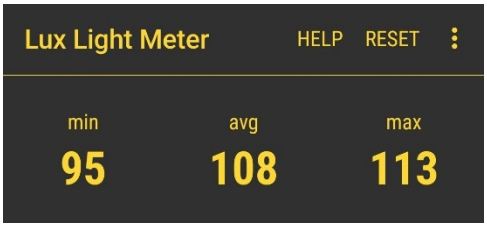


Suggestions: Install APFC Automatic Power Factor Controller.

5.4 Lighting System:

Observations: Measured Lux Level Max 113 Min 95 & Average 108

Existing LED Tube are installed without reflectors.



Suggestions: Improve effectiveness of Lighting System Increase Lighting Efficiency by using reflectors.

Light globes generally disperse light in all directions from the source. If a ceiling mounted light does not direct the light back down to the working plane, more fittings will be required to achieve the required lux levels. So the effectiveness of the reflectors (or minimizing losses due to poor reflectors) is important. Reflectors should be both reflective as well as carefully designed to disperse light effectively on the working plane at the design height of the fitting (e.g., light should not be concentrated in one area, providing too much light, whilst falling short of required levels in another area).

Silver Reflectors. This is the reflector that reflects the most light.

White Reflectors. More flexible between indoor and outdoor use.

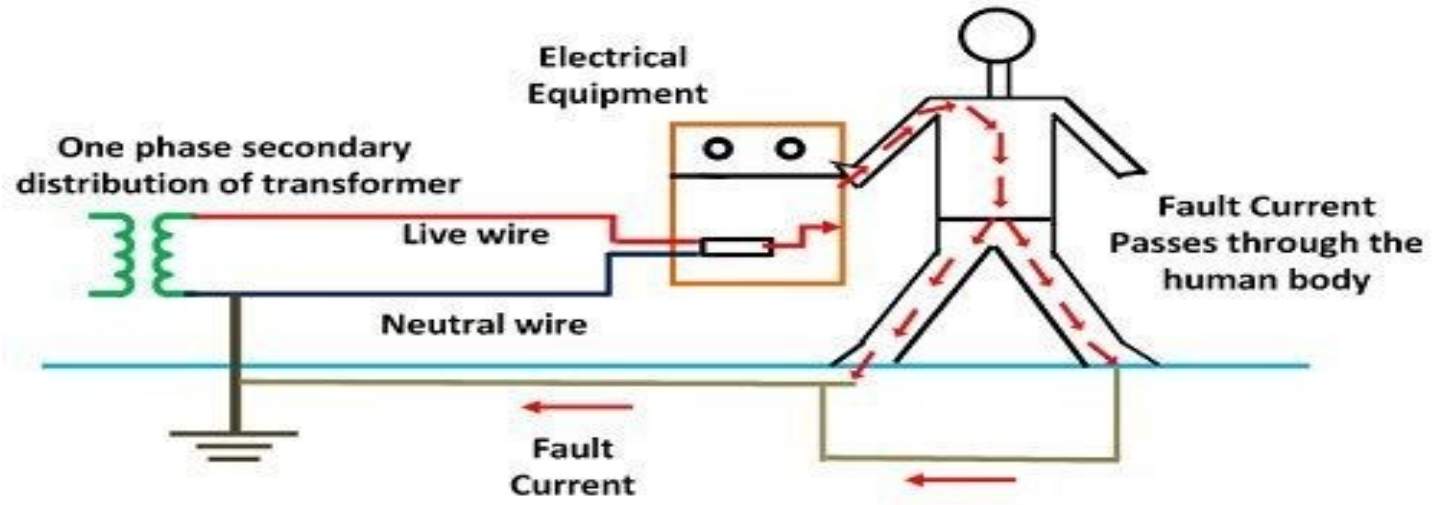
1. Gold Reflectors 2. Black Reflectors 3. White Reflectors

Proposed:-

Chapter: 6 Electrical Safety:

I. Earth Resistance Measurement

Ideally a ground should be of zero ohms resistance. There is not one standard ground resistance threshold that is recognized by all agencies. However, the NFPA and IEEE have recommended a ground resistance value of 5.0 ohms or less. The use of chemical elements around the electrode of earthing systems reduces the earth resistance which improves the efficiency of these systems.



Electrical System Without Earthing

Circuit Globe

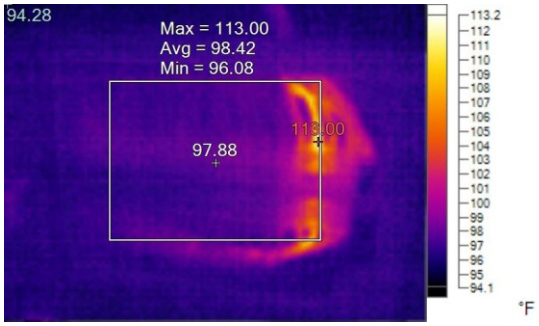
Observations: Earth Resistance Testing done by digital earth resistance tester.
Earth resistance found 0.42 Ohm & its o.k.

Thermography:

Thermography or thermal imaging detects heating concentrations or heat leak sources in electrical equipment. Thus, thermography detects infrared energy emitted by an electrical circuit or an electrical part through which an electrical current passes (wire, cable, transformer, contactor, electrical motor, breaker, etc.)

Inspected By: Energy Auditor Kedar Khamitkar

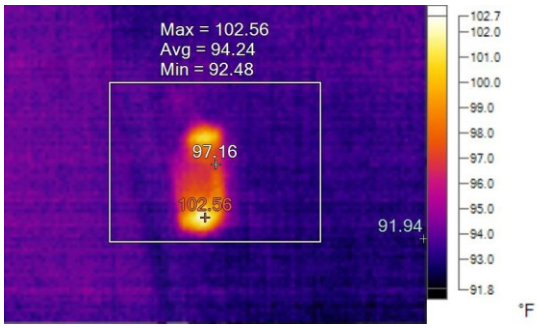
Inspection Date:	24-March-23 12:24:30 PM	Location	Main Supply Board
Equipment		Equipment Name:	Circuit Panel
Emissivity:	0.98	Reflected Temperature:	93.20 °F
Camera Manufacturer	Fluke	Camera:	PTi120HT-21120397



IR_00434.IS2

Visible Light Image

Inspection Date:	24-March-23 12:27:48 PM	Location	Main Supply Board
Equipment		Equipment Name:	Circuit Panel
Emissivity:	0.98	Reflected Temperature:	93.20 °F
Camera Manufacturer	Fluke	Camera:	PTi120HT-21120397



IR_00438.IS2

Visible Light Image

Observations: Overloaded Circuits. Hot Spots found -

Suggestions:

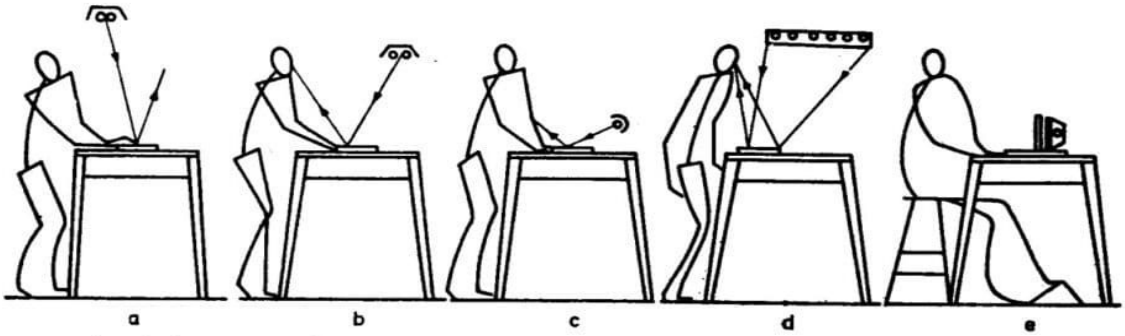
1. Use the correct wire suitable for the operation and the electrical load to work on. Use the correct extension cord designed for heavy-duty use. Also, do not overload an outlet and use proper circuit breakers.
2. Install Smoke Detector.
3. Perform regular fire risk assessments to identify areas at risk of bad wiring and circuits.

INSTALL ELECTRICAL SAFETY SIGN BOARD

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 College buildings should be secured and accessible by trained personnel only.

Chapter: 7 Guidelines for Identified Energy Saving Opportunities

• Use as much natural day light as possible by use of translucent roofing sheets.
• Use day lighting effectively by locating work stations requiring good illuminance near the windows.
• Minimise illuminance in non- task areas by reducing the wattage of lamps or number of fittings
• Avoid use of incandescent/tungsten filament lamps. The power consumed by these lamps is 80% more than the fluorescent lamps (discharge) for same lumen output.
• Use electronic ballasts in place of conventional ballast for fluorescent lamps.
• Task lighting saves energy, utilize it whenever possible.
• All surfaces absorb light to some degree and lower their reflectance. Light colored surfaces are more efficient and need to be regularly painted or washed in order to ensure economical use of light.
• Maintenance is very important factor. Evaluate present lighting maintenance program and revise it as necessary to provide the most efficient use of lighting system.
• Clean luminaries, ceilings, walls, lamps etc. on a regular basis.
• Controls are very effective for reducing lighting cost. Provide separate controls for large ratings.
• Install switching or dimmer controls to provide flexibility when spaces are used for multiple purpose and require different amounts of illumination for various activities.
• Switching arrangements should permit luminaries or rows of luminaires near natural light sources like windows or roof lights to be controlled separately.
• Separate lighting feeder and maintain the feeder at permissible voltages by using transformers.
• Install occupancy sensors for indoor cabin light controls



a — Luminaire located to prevent reflected glare; reflected light does not coincide with angle of view.
b — Reflected light coincides with angle of view.
c — Low-angle lighting to emphasize surface irregularities.
d — Large-area surface source and pattern are reflected toward the eye.
e — Transillumination from diffuse source.

FIG. 2 EXAMPLES OF PLACEMENT OF SUPPLEMENTED LUMINAIRES

Measures to improve ILER:

1. Provide mirror optics luminaires for lamps. Many lamps do not have reflectors
2. Replace existing 36 W lamps and electromagnetic ballast by more efficient T5 tube lights having electronic ballasts.
3. Reduce mounting height of lamps to 1.5 meters from the working plane. This can increase illuminance on work place without spending more power. This helps in improving ILER.
4. Improve reflectance of walls & ceiling by providing light colored, preferably white, painted surface Lighting is provided in commercial buildings, indoor and outdoor for providing comfortable working environment.

The primary objective is to provide the required lighting effect for the lowest installed load i.e highest lighting at lowest power consumption.

Measures to improve task lighting effectiveness:

1. Proper relocation of light sources to improve task lighting and increase diversity ratio to 3:1.
2. Reduce the mounting height up to 1.5 meter

Activity	Illumination *(lux, lumen/m^2)*
Public areas with dark surroundings	20 - 50
Simple orientation for short visits	50 - 100
Working areas where visual tasks are only occasionally performed	100 - 150
Warehouses, Homes, Theaters, Archives	150
Easy Office Work, Classes	250
Normal Office Work, PC Work, Study Library, Groceries, Show Rooms, Laboratories	500
Supermarkets, Mechanical Workshops, Office Landscapes	750
Normal Drawing Work, Detailed Mechanical Workshops, Operation Theatres	1,000
Detailed Drawing Work, Very Detailed Mechanical Works	1500 - 2000
Performance of visual tasks of low contrast and very small size for prolonged periods of time	2000 - 5000
Performance of very prolonged and exacting visual tasks	5000 - 10000
Performance of very special visual tasks of extremely low contrast and small size	10000 - 20000

Conduct Institutional Training / Awareness Program 14th December 'National Energy Conservation day'

The National Energy Conservation Day is organised on 14th December every year by the Bureau of Energy Efficiency (BEE) with an aim to showcase India's achievements in energy efficiency and conservation. BEE - Ministry of Power celebrate every year Energy Conservation Week from 14th December – 20th December.

Create Awareness:

All Class Rooms and labs to have Display Messages regarding optimum use of electrical appliances in the room like, lights, fans, computers and projectors. Save electricity.

1. There has to be Institute level student community that keeps track of the energy consumption Parameters of the various departments, class rooms, halls, areas, meters, etc
2. Energy auditing inside the campus has to be done on a regular basis and report should be made public to generate awareness.
3. Need to create energy efficiency/ renewable energy awareness among the college campus i.e. solar, wind, Biogas energy. College should take initiative to arrange seminars, lectures, paper presentation competition among students and staff for general awareness.

Display the stickers of save electricity

Save nature everywhere in the campus. So that all stakeholders encouraged to save the electricity.

- Most of the time, all the tube lights in a class room are kept ON, even though, there is sufficient light level near the window opening. In such cases, the light row near the window may be kept OFF.
- All projectors to be kept OFF or in idle mode if there will be no presentation slides.
- All computers to have power saving settings to turn off monitors and hard discs, say after10 minutes/30 minutes.
- The comfort/Default air conditioning temperature to be set between 24°C to26°C.

USE OF ELECTRICITY DURING PEAK HOUR AND OFF PEAK HOUR

The applicable electricity tariff is not also based on timing of the day but it may not be applicable in case of domestic LT/ HT type connection. This will also helpful in maintaining the demand graph. It is recommended to avoid use of electrical gadget for cleaning, watering etc. during the peak hours. This type of work should be operational during the off peak hour.

Chapter 8: Conclusion

A total Investment of Rs. 3.80/- (Approx. Three Lakhs & Eighty Thousand) amount is estimated for the energy efficiency improvement projects)

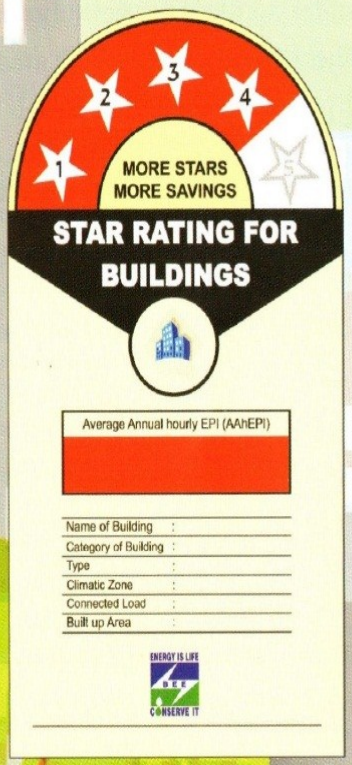
Energy Savings expected around 10560 KWH/year.

Energy Efficiency in Buildings

Checking Energy Efficiency at the Designing Stage by following Energy Conservation Building Code (ECBC)

BEE, Ministry of Power, Govt. of India launched Energy Conservation Building Code (ECBC) in 2007. The main features of ECBC are:

- To provide minimum requirements for the energy efficient design and construction of buildings.
- It considers five climatic zones in India, sets minimum energy performance standards for large commercial buildings or building complexes that have a connected load of 500 kW or greater.
- The code is also applicable to all buildings with a conditioned floor area of 1,000 m^2 (10,000 ft^2) or greater, and is recommended for all other buildings also.
- The provisions of this code apply to:
  - (a) Building envelopes, except for unconditioned storage spaces or warehouses
  - (b) Mechanical systems and equipment, including heating, ventilating, and air conditioning
  - (c) Service hot water heating
  - (d) Interior and exterior lighting
  - (e) Electrical power and motors.



18

प्रतिज्ञा

हम सत्यनिष्ठा से प्रतिज्ञा करते हैं कि अपने सभी कार्यों में पेट्रोलियम उत्पादों के संरक्षण हेतु सतत प्रयासरत रहेंगे, ताकि देश की प्रगति के लिए आवश्यक इन सीमित संसाधनों की आपूर्ति अधिक समय तक सम्भव हो सके। आदर्श नागरिक होने के नाते हम लोगों को पेट्रोलियम पदार्थों के व्यर्थ उपयोग से बचने तथा पर्यावरण संरक्षण हेतु स्वच्छ ईधन का प्रयोग करने के लिए जागरूक करेंगे।