AISSMS GROUP OF COLLEGES – KENNEDY ROAD CAMPUS, PUNE

ENERGY AUDIT REPORT

AUDITED BY

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Date- 22nd Decemer,2022

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i. Acknowledgement

We, Upendra Deuskar & Associates are grateful to Mr. Malojiraje Chhatrapati Hon. Secretary of AISSMS Group, Shivajinagar Pune for giving us an opportunity to contribute in their efforts towards efficient energy management by undertaking this Energy Audit exercise.

We acknowledge with thanks for the co-operation and support extended by management and operating personnel from client side during the audit exercise. Detailed discussions and interaction were held with plant personnel throughout the course of the audit and awareness of energy conservation was noted as exemplary. We would also like to place on record our sincere thanks and appreciation for all plant executives.

We are also thankful to the other staff members who were actively involved while collecting the data and conducting the field studies. We take this opportunity to also thank all the team members at various departments associated with this study of energy audit for extending co-operation during collection of on-site data.

We trust that the findings of this study will help plant management in improving the equipment performance thereby giving optimum energy consumption at the premise.

ii. Energy Audit Team

Upendra Deuskar &	Mr. Upendra G. Deuskar (BEE Certified Energy Auditor)
Associates	Mr. Sunny Pangire
AISSMS Group	Mr. Sachin S. Kulkarni-Chief Executive Officer
	Mr. Shivaji Patil-Project Manager

Date of Measurement 15th Nov, 2022

iii. Instruments

1. Power Quality Analyzer
2. Ultrasonic Flow meter
3. Thermal Imager
4. Temperature – RH logger
5. Lux Meter
6. Power Clamp Meter
7. Measuring Tape

iv. Executive Summary

AISSMS group of colleges (Client) has decided to do detailed energy audit of their premise at Kennedy Road (Near RTO), Pune, Maharashtra. Client has already implemented most of energy efficiency measure into their premises. Client is focusing on energy savings and successful in reducing their energy demand.

Following are some energy saving and sustainability approach driven measures that are taken by college management.

1. Replacement of fluorescent lights with energy efficient LED lights.
2. Selection of Energy Efficient Equipment's (BEE 5 Star Labeled) whenever replacement of any equipment is to be done.
3. College is also maintaining energy consumption records of each section to track energy consumption of the premise.
4. Use of Solar energy for water heating purpose instead of electric geysers.
5. Use of Solar Photovoltaic system to generate own electricity using rooftop area available at the premise.

The action taken for energy conservation measures and use of renewable energy by the college management shows the sustainable approach towards energy use and environment friendly behaviour which is appreciable.

Other energy saving measures & cost saving measures

Although the college management is doing well in energy efficiency area further improvements can be done by the management for additional savings-

1. Use of aerators for water taps.
2. Use of heat pumps wherever possible in college premises for cooling and heating.
3. Fine tuning of Automatic Power Factor Correction system to improve PF to unity & reduce billing units in kVAh billing system.

1 Introduction

1.1 General Description of Facility

AISSMS Group of Colleges (Client) is located at Kennedy Road in Pune city area, Pune District of Maharashtra, India. The institutes are committed towards creating a community which is vibrant and which provides a lifelong learning experience and professional development, corporates, academicians, industrialists and the student community have lauded the efforts made by the All India Shri Shivaji Memorial Society to take the Society to unscaled heights.

At present the campus has multiple colleges in one premise and description of area is provided below.

- College of Engineering having built-up area of about 23888 sq.m.
- College of Polytechnic having buit-up area of about 11340 sq.m.
- College of Pharmacy having built-up area 7178 sq.m
- College of Business Management having built-up area 3626 sq.m.

1.2 Objectives

- To undertake an energy audit so as to identify areas for energy saving, both without and with investment.
- To prioritize distinct areas identified for energy savings depending upon saving potential, skills, and time frame for execution, investment cost, paybacks etc.

1.3 Scope of Work

- To correlate monthly data of production with electricity, fuels & water consumption, for a period of 12 months of normal operation to establish bench mark values for energy consumption.
- To study electrical energy metering, monitoring and control system existing at the plant and to recommend a suitable system for future monitoring.
- To study monthly power factor, maximum demand, working hours, load factor etc. for the reference period along with monthly electricity consumption and establish scope for MD control through possible optimization of load factor and through detailed load management study.
- Based on above, to evaluate the possibility of replacing major motors with energy efficient motors. To provide cost benefit analysis for the replacement policy.
- To study existing requirements of energy provisions at present locations and to identify distinct possibilities of rationalization / savings.
- To study existing maintenance practices for utility systems and recommend areas for improvement in energy efficiency / savings.
- To identify, evaluate and priorities energy saving opportunities into short, mid and long-term time spans depending upon investments, quantum of savings, skills and time required for implementation, etc.
- To prepare draft energy audit report, present to management, undertake necessary modifications based on presentation meeting and submit the final report.

1.4 Energy Source and Breakup

College campus is having diesel generator for emergency power supply and the share of diesel consumption is about 5 % of total energy consumption. Energy consumption breakup & energy breakup on the basis of source of energy are provided below.

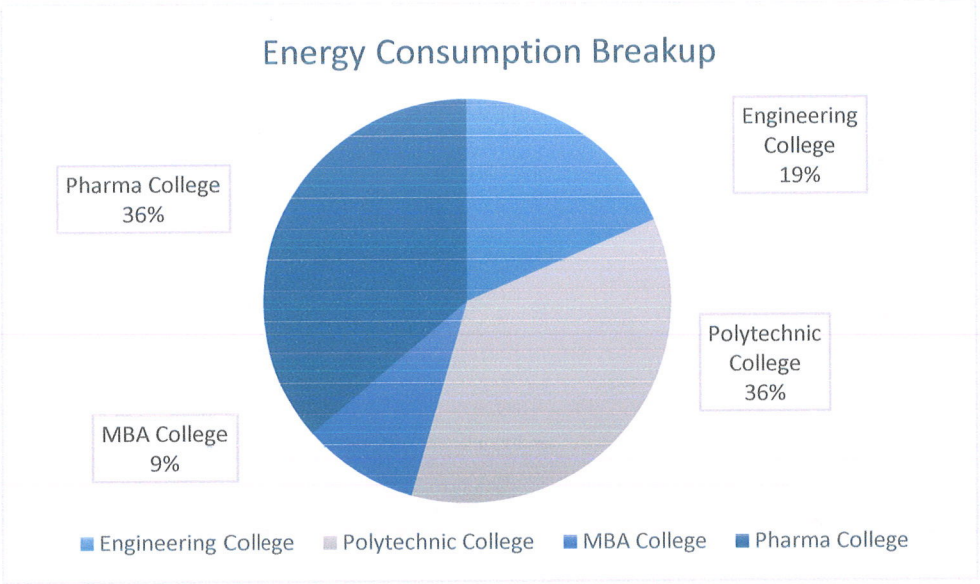

Figure 1 Energy Consumption Breakup

College is having rooftop solar system of 300 kWp and energy generation by the solar PV plant is having major share in the energy supply to the premise. Breakup of the same is represented below.

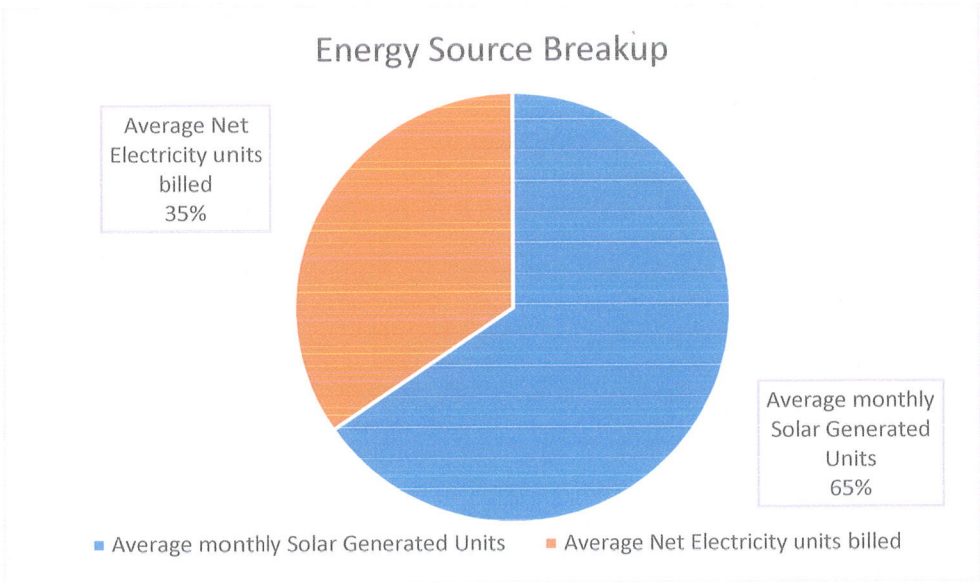

Figure 2 Energy Source Breakup

1.5 Electricity Consumption

Client is receiving electricity supply from Maharashtra State Electricity Distribution Company Limited (MSEDCL) with contract demand of 400 KVA & 11kV/433 V, 630 KVA Transformer .

Following table represents bill analysis for last 12 months energy use of the facility.

Table 1-Bill Analysis – Last 12 months

Month	Billed Demand	Highest Recorded MD	Energy Consumption		Power Factor	Demand Charges	Energy Charges	Total Current Bill	Excess Payment due to higher contract Demand
	kVA	kVA	kWh	kVAh		Rs.	Rs.	Rs.	Rs.
May-21	240	39	11310	11538	0.98	103680	106265	261546	86832
Jun-21	240	49	13458	13678	0.98	103680	125974	288491	82512
Jul-21	NA	NA	NA	16328	NA	NA	NA	NA	NA
Aug-21	NA	NA	NA	13828	NA	NA	NA	NA	NA
Sep-21	240	83	16025	17495	0.91	103680	161129	333788	67824
Oct-21	NA	NA	NA	20260	NA	NA	NA	NA	NA
Nov-21	NA	NA	NA	16420	NA	NA	NA	NA	NA
Dec-21	NA	NA	NA	16898	NA	NA	NA	NA	NA
Jan-22	NA	NA	NA	14470	NA	NA	NA	NA	NA
Feb-22	240	81	18683	18860	0.99	103680	173700	350979	68688
Mar-22	NA	NA	NA	30550	NA	NA	NA	NA	NA
Apr-22	NA	NA	NA	28565	NA	NA	NA	NA	NA
Total	-	-	**59,476**	**218,890**	-	**414,720**	**567,068**	**1,234,804**	**3,05,856**
Average	**240**	**63**	**14,869**	**18,241**	**0.96**	**103,680**	**141,767**	**308,701**	**76,464**

Average monthly MSEDCL unit's consumption is 18,241 units and avg. monthly bill is Rs. 3.08 Lakh.

Average of last 12 months unit cost is Rs. 16.92 / kVAh.

Average PF is at 0.96 & shall be improved to 0.995 for reduced kVAh billed.

No leakage currents were observed in the facility in the various feeders.

Energy consumption trend represented in graphical format as below-

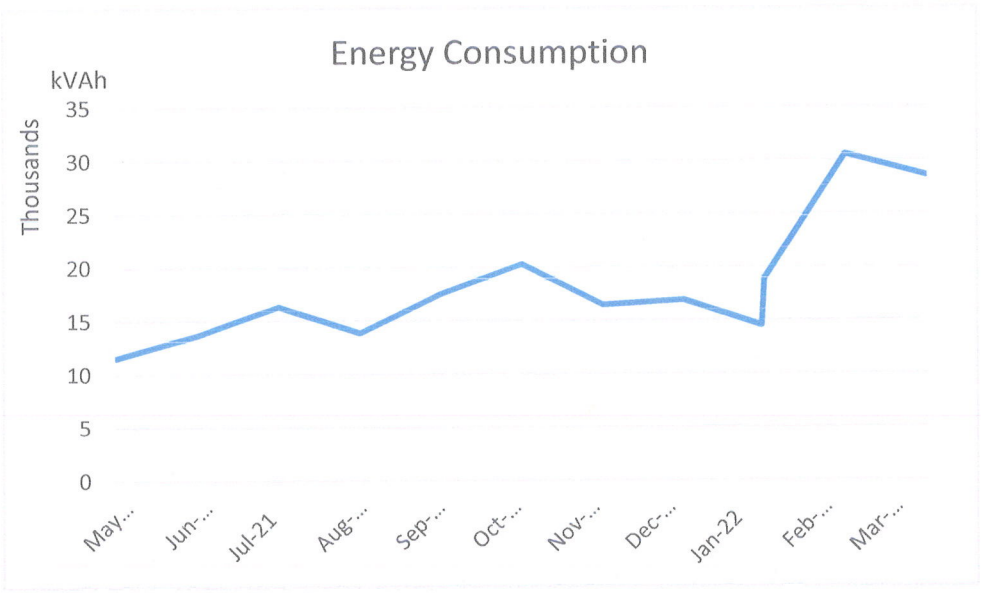

Figure 3- Energy Consumption Trend

- **The Electricity bill consist of following parts:-**

Demand charges – Maximum Peak Demand (in terms of KVA) is recorded in the bill for the complete month and a fixed charge of Rs. 432/- per KVA

Unit charges – As per the units consumed Industrial tariff are applicable.

Time of Day Charges – Depending on the time of day of usage, the Time of Day charges adjustment is made.

Other charges, which cannot be controlled

- **The following are the conclusions of Electrical Bill Analysis:**

1. Considering data available, average cost of electricity is Rs. 16.92 / kVAh.

2. Average billed Power factor is 0.96 (Based on available data). The power factor is maintained but can be improved to near unity value.

3. As contract demand is 400 kVA, minimum billed Demand is 240 kVA (60% of contract demand). Even though the actual maximum demand is lower (due to higher contract demand) extra Maximum Demand charges are being paid. It is recommended to reduce the contract demand so as to reduce the Maximum Demand charges. Average monthly loss of Rs. 76,464*/- is being incurred due to higher contract demand.

*Value based on available data

1.6 Water Consumption

College campus is having 5 water connections and average water consumption per billing cycle for the premise is represented below.

Table 2- Average Water consumption

Month	connection no.				
	ST005483	SE025101	SE025102	ST005483	SE025620
	kL	kL	kL	kL	kL
Average Water Consumption	882	91	241	244	237

1.7 Harmonics Study

Harmonic of a wave is the wave which has frequency as the positive integer multiple of the frequency of the original wave, known as the fundamental frequency.

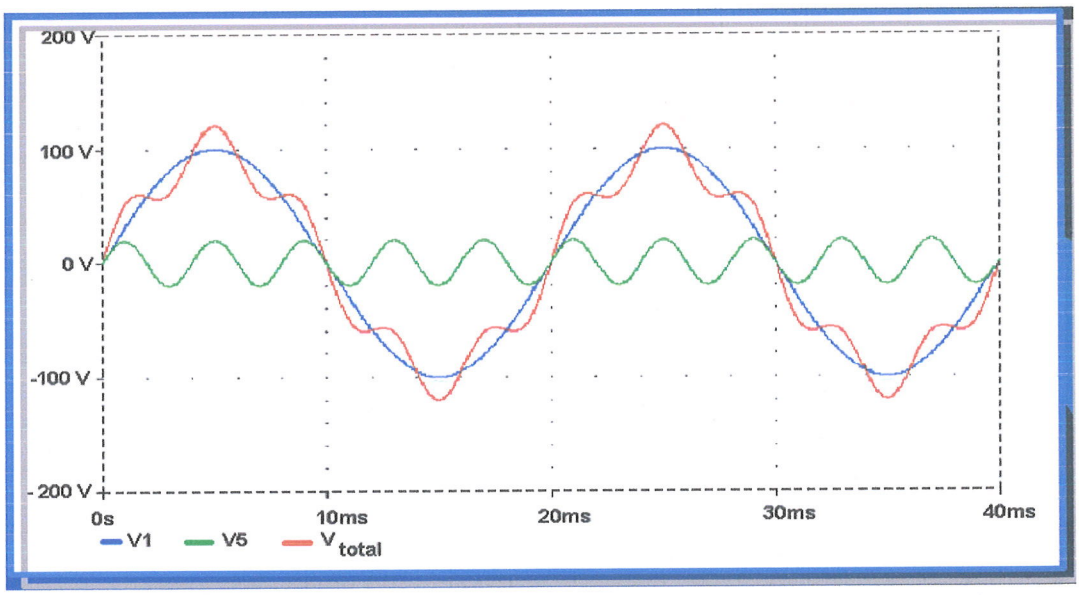

Figure 4- Harmonics

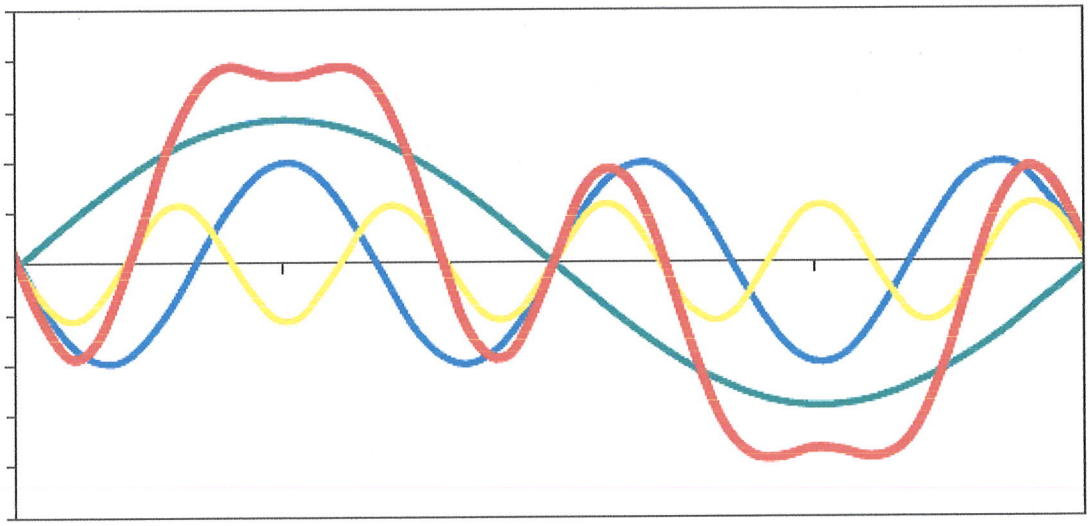

Figure 5-. Harmonics Generation

Electrical loads can be classified as linear and non-linear loads. A linear load is one, which draws a sinusoidal current when subjected to sinusoidal voltage. The current wave may or may not have a phase difference with respect to the voltage. A pure resistance, inductance or capacitance or any combination of these forms a linear load. On the contrary, a non-linear load is one, which draws non-sinusoidal or pulsating current when subjected to sinusoidal voltage.

Any non-sinusoidal current can be mathematically resolved into a series of sinusoidal components (Fourier series). The first component is called as fundamental and the remaining components whose frequencies are integral multiples of the fundamental frequency are known as harmonics. If the fundamental frequency is 50 Hz, then 2nd harmonic will have a frequency of 100Hz and the 3rd will have 150Hz and so on.

Non-linear loads that draw current in abrupt pulses rather than a smooth sinusoidal manner create harmonics. The pulses of current cause distorted current wave shape, which in turn cause harmonic currents to flow back into other parts of the power system.

1.7.1 Voltage Harmonics

Main reason for voltage harmonics is current harmonics. The voltage wave form from voltage source is distorted by the current harmonics due to source impedance. Larger the source impedance, higher will be the voltage harmonics caused by current harmonics. It is typically the case that voltage harmonics are indeed small compared to current harmonics. Thus, harmonic voltage can be defined as the product of harmonic current and source impedance at the harmonic frequency.
The source impedance includes the Impedance of the power source (Transformer, Generator, and Grid etc.), Impedance of the Bus bars, Cables, Switchgears and other loads in the network.
Following are some of the non-linear loads, which generate harmonics:

- Static power converters and rectification circuits, which are used in ups, battery chargers, etc.
- Arc furnaces
- Power electronics drivers for motor controls (AC/DC) drives.

- Computers
- Television receivers
- Saturated transformers
- Fluorescent lighting
- Telecommunication equipment's

Table 3- Voltage Harmonics level at Engineering College

Voltage Harmonics	R	Y	B
THD	1.60	1.88	1.64
3rd Level Harmonics	0.15	0.32	0.13
5th Level Harmonics	0.46	0.59	0.38
7th Level harmonics	1.25	1.60	1.30
9th Level harmonics	0.50	0.19	0.48
11th Level harmonics	0.62	0.61	0.70
13th Level harmonics	0.21	0.22	0.26

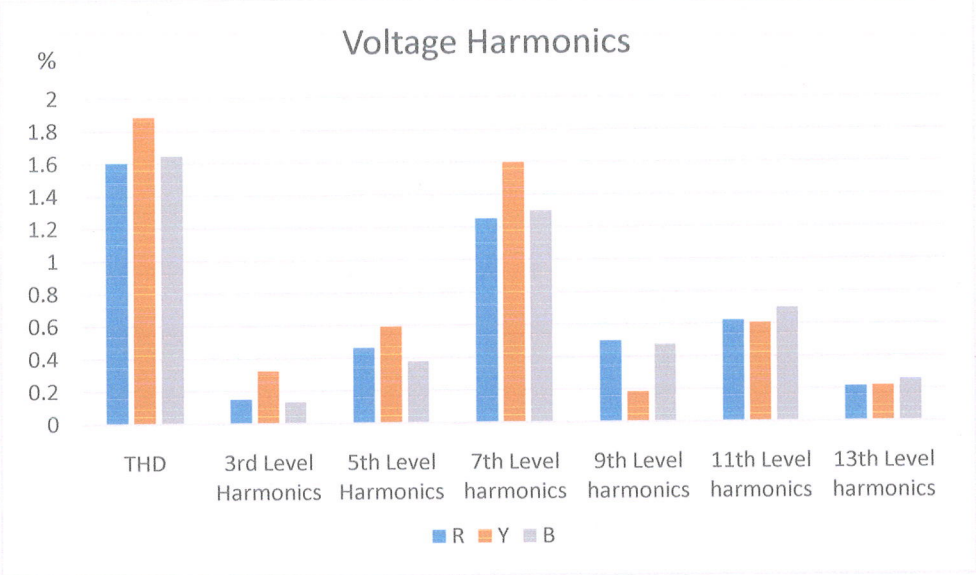

Figure -6. Voltage Harmonics Profile – Engineering College

Observations:

- It is observed that the voltage harmonics for engineering college is within limit which 1.88 % which is acceptable as standard value of 5% (voltage harmonics (V_{THD} %) limit as per IEEE 519:2014 standards).

Table 4-. Voltage Harmonics level at Management College

Voltage Harmonics	R	Y	B
THD	1.68	1.77	1.60
3rd Level Harmonics	0.18	0.29	0.16
5th Level Harmonics	0.33	0.34	0.29
7th Level harmonics	1.43	1.58	1.23
9th Level harmonics	0.36	0.11	0.62
11th Level harmonics	0.67	0.56	0.69
13th Level harmonics	0.19	0.22	0.19

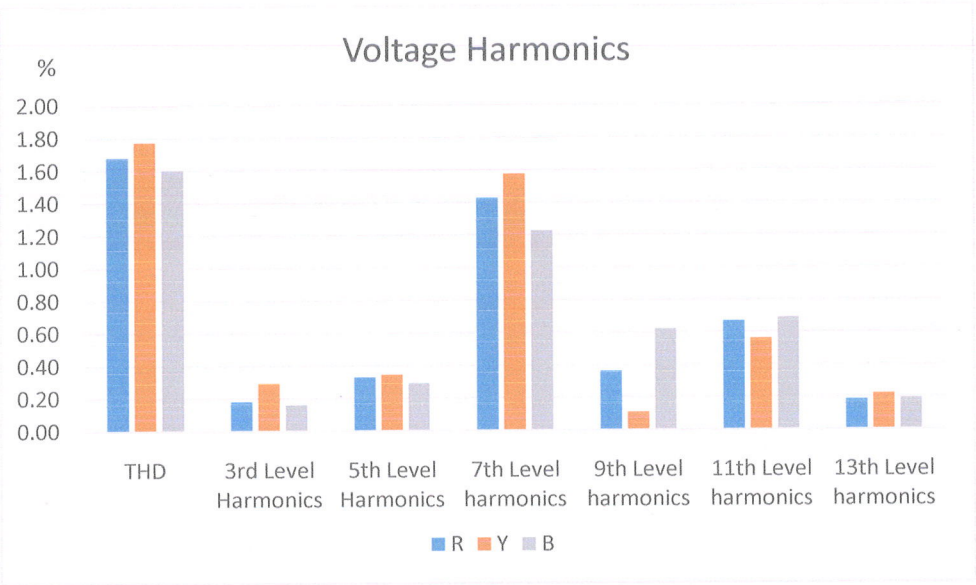

Figure7. Voltage Harmonics Profile – Management College

Observations:

- It is observed that the voltage harmonics for engineering college is within limit which 1.77 % which is acceptable as standard value of 5% (voltage harmonics (V_{THD} %) limit as per IEEE 519:2014 standards).

Table 5. Voltage Harmonics level at College of Pharmacy

Voltage Harmonics	R	Y	B
THD	1.63	1.78	1.62
3rd Level Harmonics	0.18	0.31	0.15
5th Level Harmonics	0.28	0.27	0.23
7th Level harmonics	1.37	1.58	1.30
9th Level harmonics	0.36	0.17	0.50
11th Level harmonics	0.66	0.58	0.71
13th Level harmonics	0.18	0.26	0.23

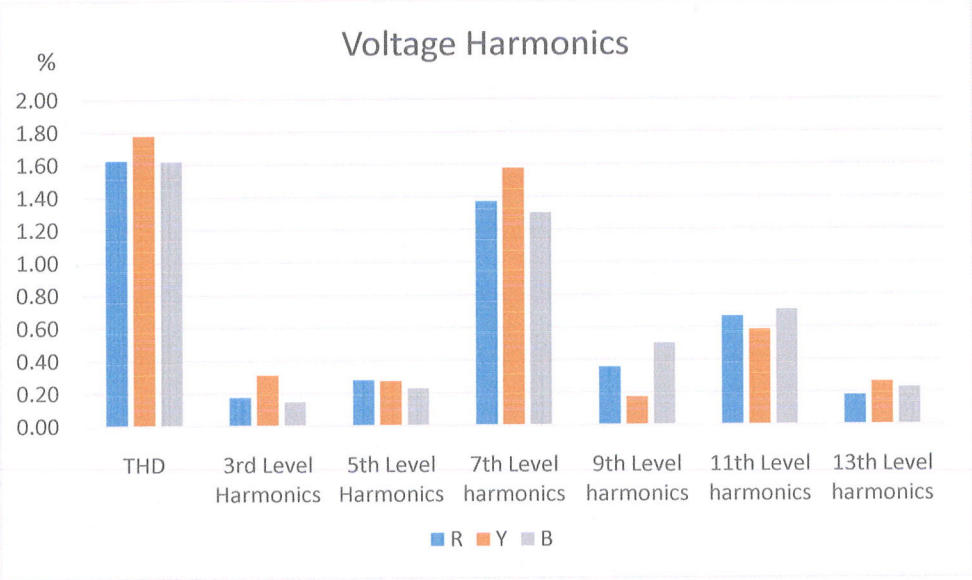

Figure 8-. Voltage Harmonics Profile – College of Pharmacy

Observations:

- It is observed that the voltage harmonics for engineering college is within limit which 1.78 % which is acceptable as standard value of 5% (voltage harmonics (V_{THD} %) limit as per IEEE 519:2014 standards).

Table 6. Voltage Harmonics level at Polytechnic College

Voltage Harmonics	R	Y	B
THD	1.49	1.61	1.49
3rd Level Harmonics	0.24	0.22	0.06
5th Level Harmonics	0.52	0.43	0.44
7th Level harmonics	1.31	1.28	1.04
9th Level harmonics	0.31	0.35	0.27
11th Level harmonics	0.44	0.62	0.67
13th Level harmonics	0.21	0.20	0.14

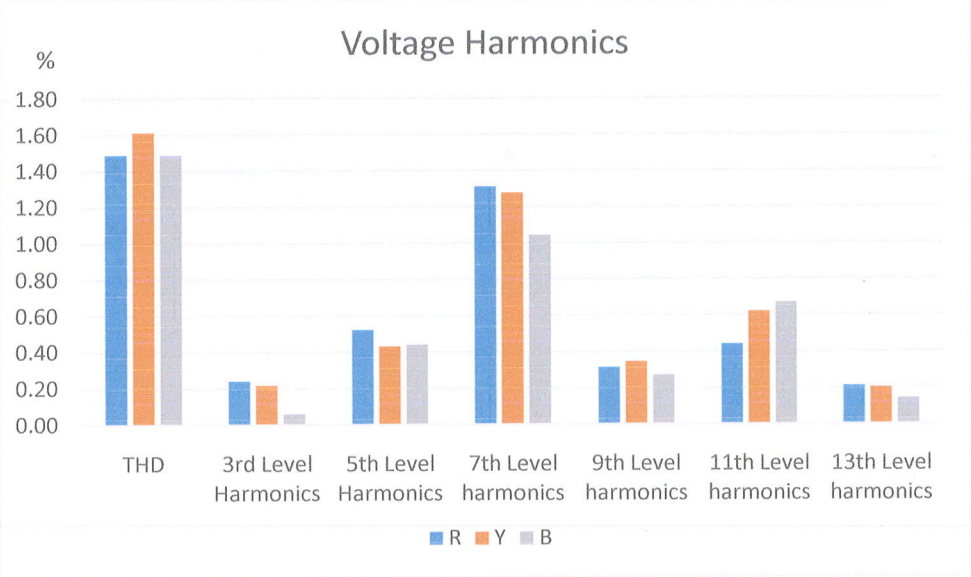

Figure 9- Voltage Harmonics Profile – Polytechnic College

Observations:

- It is observed that the voltage harmonics for engineering college is within limit which 1.49 % which is acceptable as standard value of 5% (voltage harmonics (V_{THD} %) limit as per IEEE 519:2014 standards).

1.7.2 Current Harmonics

In a normal alternating current power system, the current drawn by a linear load will be sinusoidal at the specified frequency. The current wave may or may not have a phase difference with respect to the voltage. Current harmonics are caused by non-linear loads which draw current that is not necessarily sinusoidal. The current wave form can be distorted and complex depending on the load and the interaction between other components of the system. Using Fourier series, the complex wave form can be resolved into simple sinusoidal waves of multiple frequency for analysis purpose.

Any non-sinusoidal current can be mathematically resolved into a series of sinusoidal components (Fourier series). The first component is called as fundamental and the remaining components whose frequencies are integral multiples of the fundamental frequency are known as harmonics. If the fundamental frequency is 50 Hz, then 2nd harmonic will have a frequency of 100Hz and the 3rdwill have 150Hz and so on.

Table 7- Current Harmonics Level – Engineering College

Current Harmonics	R	Y	B
THD	80.36	119.70	142.25
3rd Level Harmonics	30.97	17.53	23.12
5th Level Harmonics	50.91	76.89	81.06
7th Level harmonics	39.24	74.16	80.22
9th Level harmonics	30.01	33.44	63.80
11th Level harmonics	15.36	29.58	39.06
13th Level harmonics	10.30	19.33	22.74

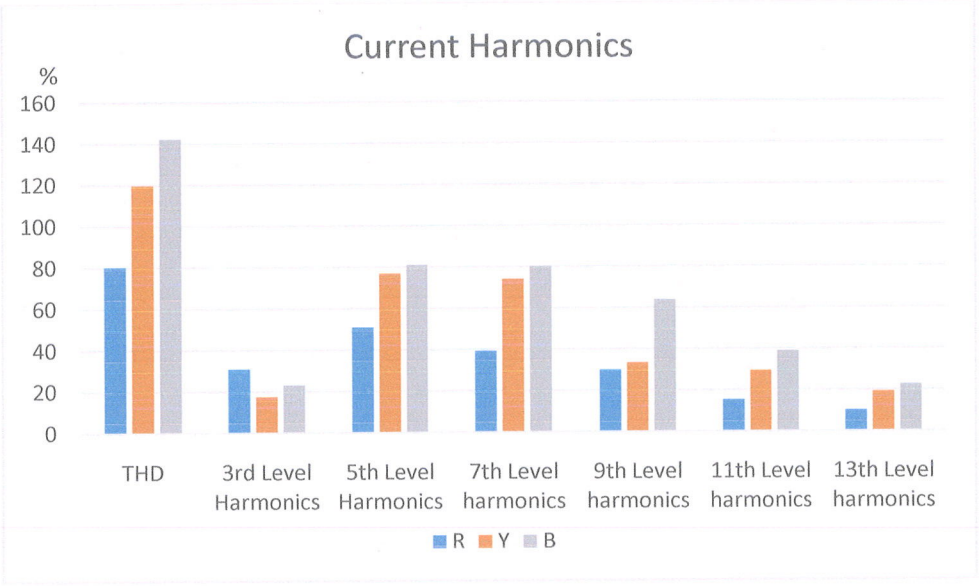

Figure 10- Current Harmonics– Engineering College

Observations:

- It is observed that THD is 142 % which is on higher side than standard value of 8% (Current harmonics (I_{THD} %) limit as per IEEE 519:2014 standards).

Table 8- Current Harmonics Level – Management College

Current Harmonics	R	Y	B
THD	12.91	21.55	14.61
3rd Level Harmonics	10.73	4.29	13.16
5th Level Harmonics	3.49	9.60	3.05
7th Level harmonics	3.37	13.69	3.00
9th Level harmonics	3.19	9.98	3.42
11th Level harmonics	1.89	4.77	1.09
13th Level harmonics	1.39	1.82	1.47

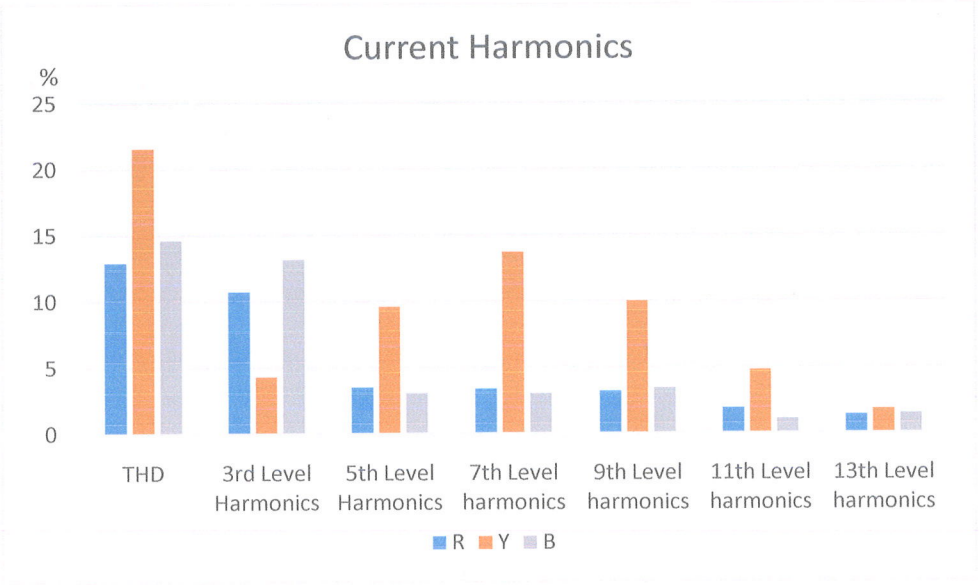

Figure 11- Current Harmonics – Management College

Observations:

It is observed that THD is 21 % which is on higher side than standard value of 8% (Current harmonics (I_{THD} %) limit as per IEEE 519:2014 standards).

Table 9- Current Harmonics Level – College of Pharmacy

Current Harmonics	R	Y	B
THD	13.65	11.80	12.71
3rd Level Harmonics	7.50	2.65	4.47
5th Level Harmonics	8.43	5.81	8.38
7th Level harmonics	4.40	7.04	4.11
9th Level harmonics	4.24	3.92	5.41
11th Level harmonics	2.92	4.18	3.76
13th Level harmonics	1.81	2.86	1.42

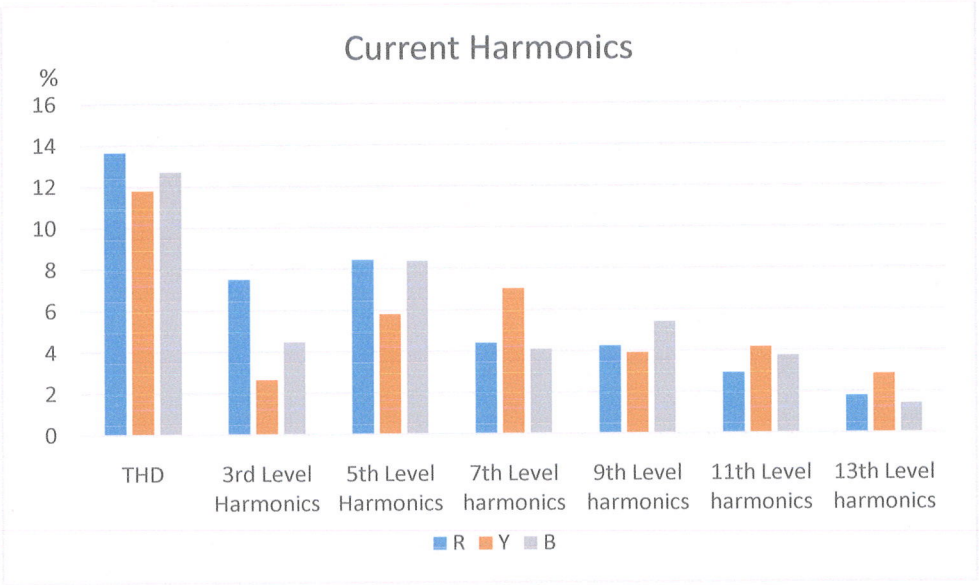

Figure 12- Current Harmonics – College of Pharmacy

Observations:

It is observed that THD is 13 % which is on higher side than standard value of 8% (Current harmonics (I_{THD} %) limit as per IEEE 519:2014 standards).

Table 10- Current Harmonics Level – Polytechnic College

Current Harmonics	R	Y	B
THD	13.65	12.97	22.79
3rd Level Harmonics	5.78	3.05	9.30
5th Level Harmonics	9.12	9.71	14.16
7th Level harmonics	6.99	5.71	9.56
9th Level harmonics	3.91	4.96	9.96
11th Level harmonics	0.81	0.49	3.47
13th Level harmonics	1.12	1.22	1.64

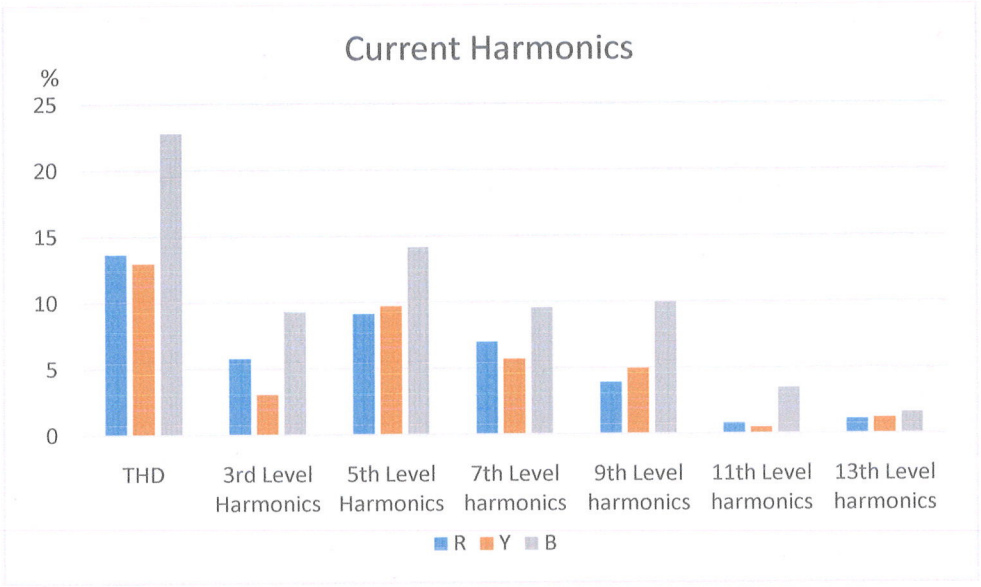

Figure 13- Current Harmonics – Polytechnic College

Observations:

It is observed that THD is 13.6 % which is on higher side than standard value of 8% (Current harmonics (I_{THD} %) limit as per IEEE 519:2014 standards).

1.7.3 Limits of Harmonics

IEEE recommended practices and requirements for harmonic control in electrical power system: It represents a standard level of acceptable harmonic distortion in a power system.

Table 11-Harmonics Distortion Limits: – IEEE – 519C:2014

I_{sc}	Short Circuit current at the point of common coupling (PCC), under normal operating conditions
I_L	Fundamental full load current in Amps
H	Harmonic number
11<h<17	Limits of individual current at PCC
THD	Total harmonic distortions

Table 12- Current distortion limits for systems rated 120 V to 69 kV – User's responsibility

Maximum harmonic current distortion in percent of I_L						
	Individual harmonic order (odd harmonics)					
I_{sc}/I_L	**3≤h<11**	**11≤h<17**	**17≤h<23**	**23≤h<35**	**35≤h<50**	**TDD**

Maximum harmonic current distortion in percent of I_L						
	Individual harmonic order (odd harmonics)					
I_{sc}/I_L	3≤h<11	11≤h<17	17≤h<23	23≤h<35	35≤h<50	TDD
<20*	4.0	2.0	1.5	0.6	0.3	5.0
20<50	7.0	3.5	2.5	1.0	0.5	8.0
50<100	10.0	4.5	4.0	1.5	0.7	12
100<1000	12.0	5.5	5.0	2.0	1.0	15
>1000	15.0	7.0	6.0	2.5	1.4	20

*All power generation equipment is limited those values regardless their I_{sc}/I_L.

- Odd harmonics are represented as % of fundamental at PCC
- Even harmonics are limited to 25% of odd harmonic's limits.

2 Power Parameter Profiles

2.1 Power Parameter Profiles

All electrical parameters for individual feeders were logged using 3 phase electrical data logger. The logging was conducted at all feeders from main panel for evaluation of load in each section.Voltage, Current, Power and power factor profile with other electrical measurements were carried out at the main incomer coming of installed Transformer using a Power Quality Analyser. The profiles for the each section/feeders are given below.

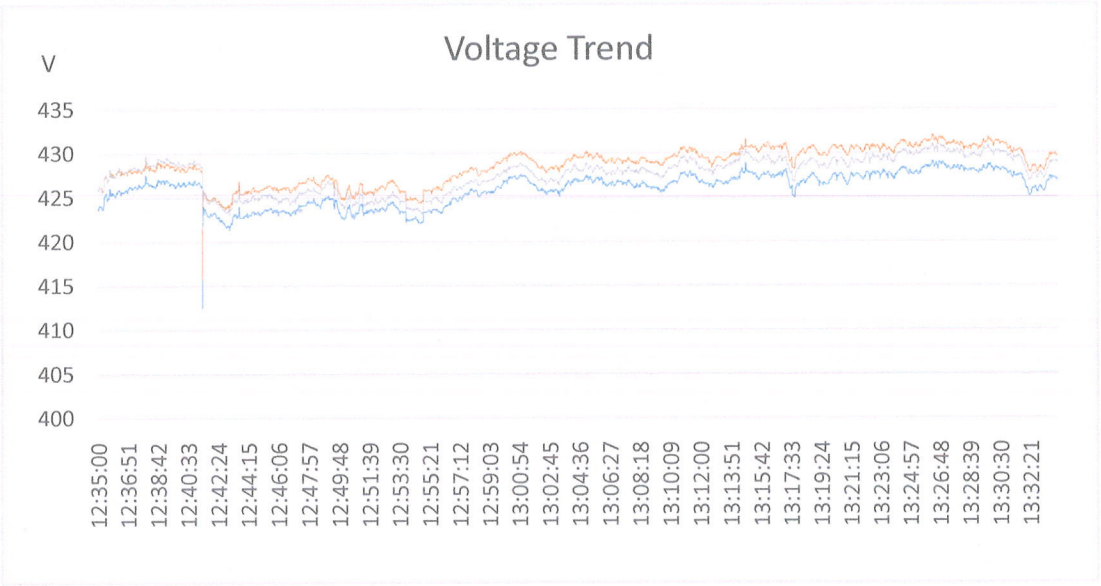

Figure 14- Engineering College Voltage Profile

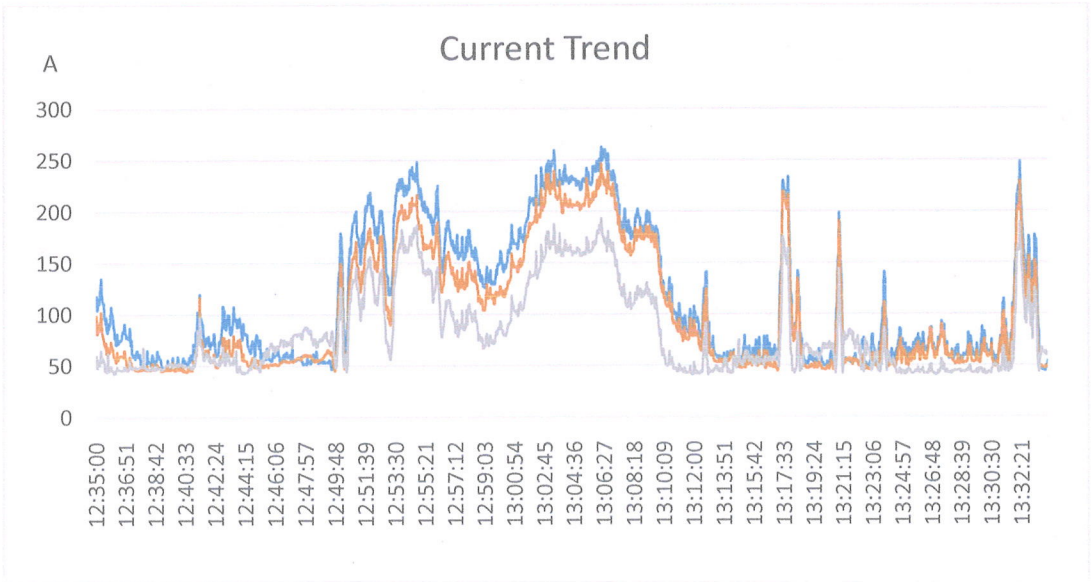

Figure 15- Engineering College Current Profile

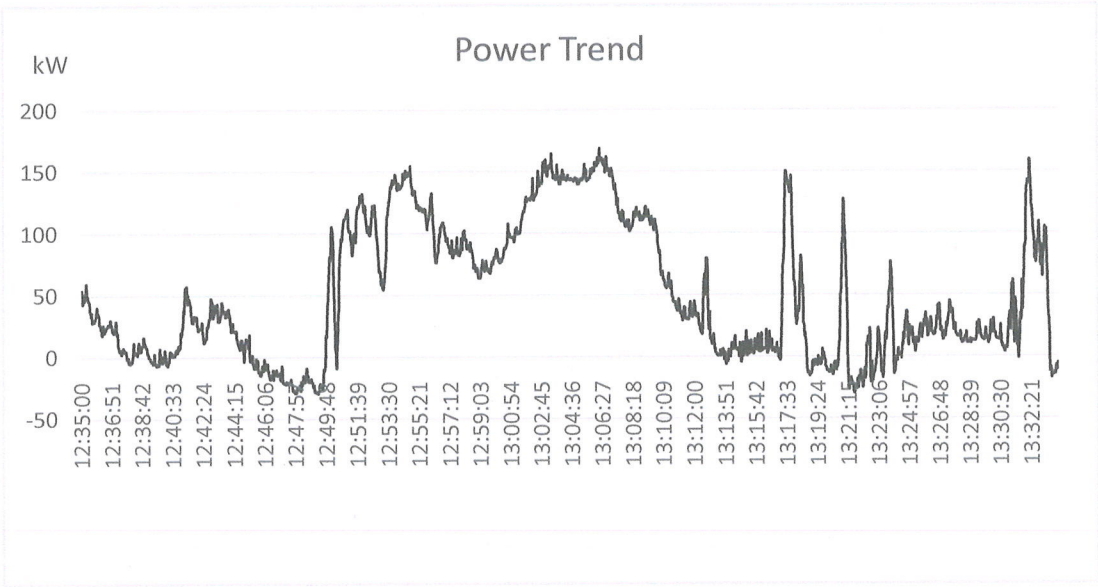

Figure 16- Engineering College Power Consumption Profile – kW

Whenever there was net export of electricity due to solar power generation exceeding the actual consumption negative power consumption was observed in graph.

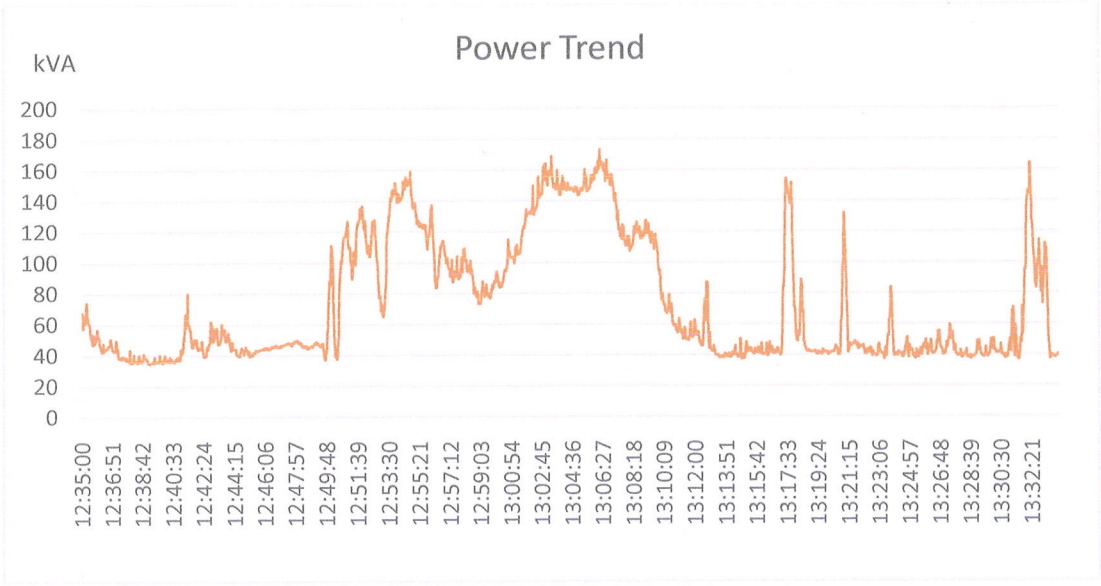

Figure 17- Engineering College Power Consumption Profile – kVA

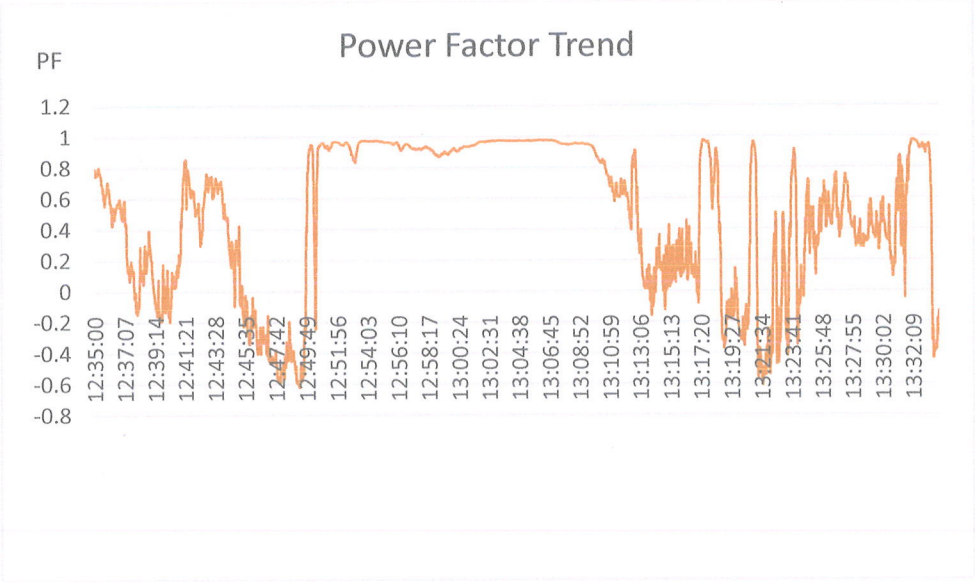

Figure 18- Engineering College Power Factor Profile

As it can be clearly seen in above graph that Power factor variation is due to additional capacitance being generated in the electrical system causing leading PF. However when these loads are less the power factor is varying both on inductive and capacitive side due to switching of capacitors. Fine tuning of the capacitor banks is recommended in this case.

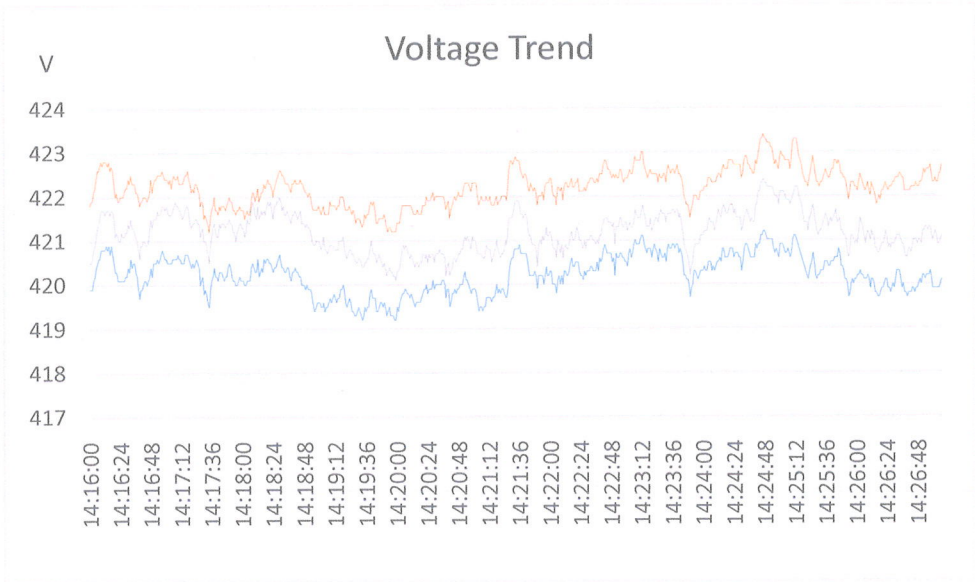

Figure 19-College of Management Voltage Profile

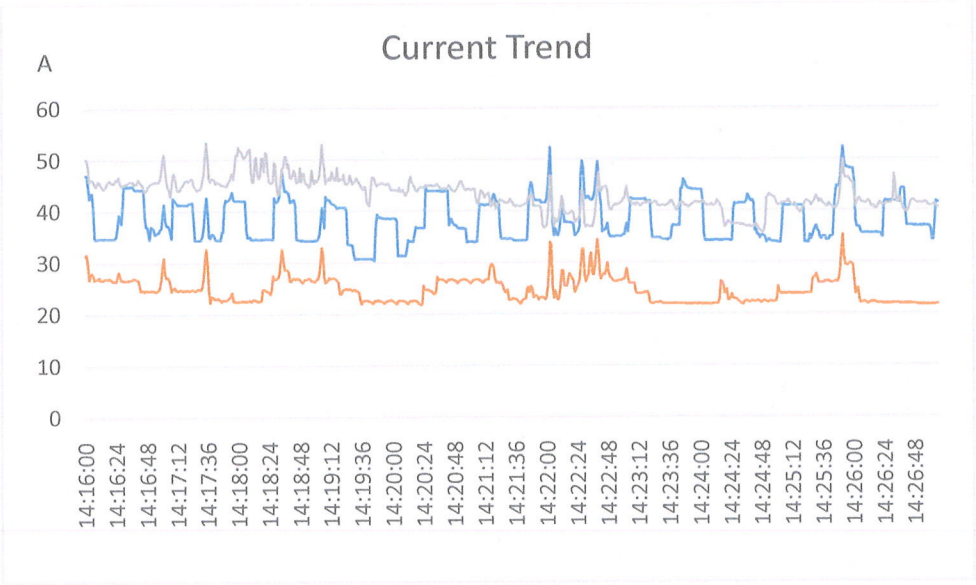

Figure 20- College of Management Current Profile

Current Unbalance of value ~ 31% was observed in the feeder & need to be resolved immediately.

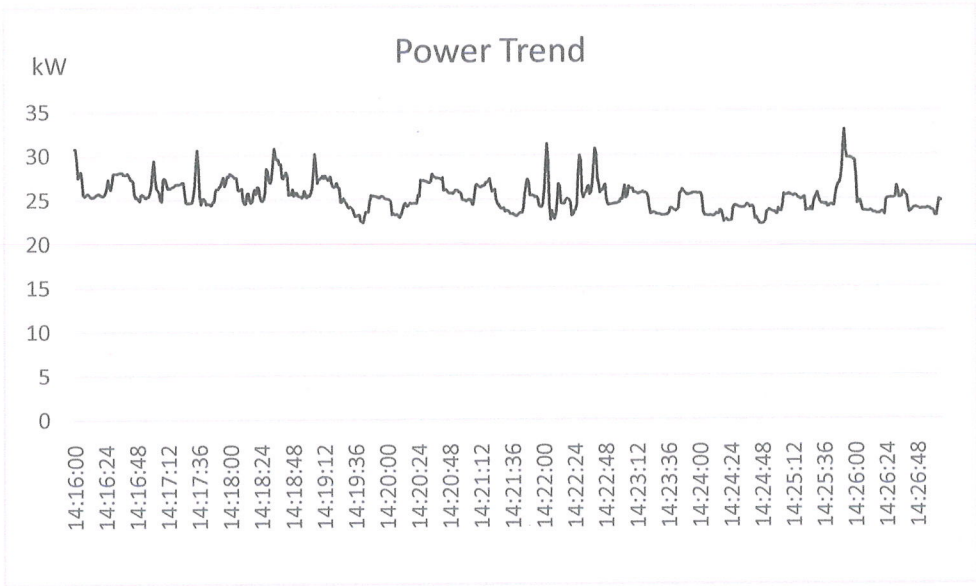

Figure 21- College of Management Power Consumption Profile – kW

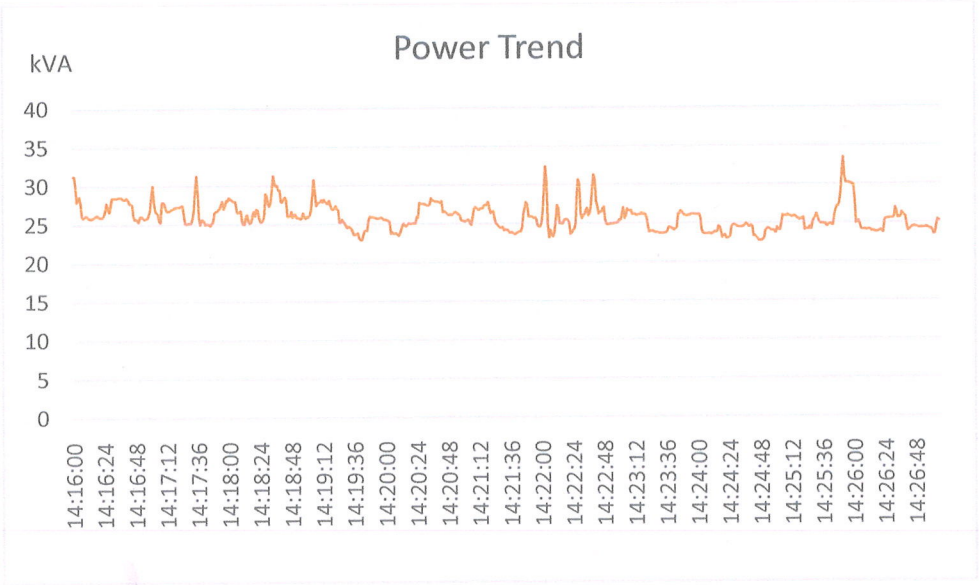

Figure 22-College of Management Power Consumption Profile – KVA

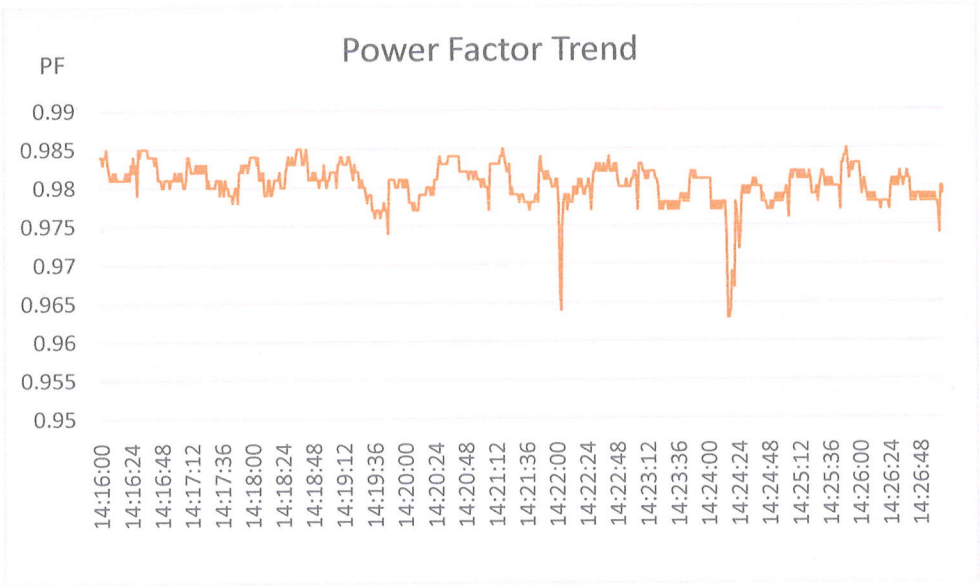

Figure 23-College of Management Power Factor Profile

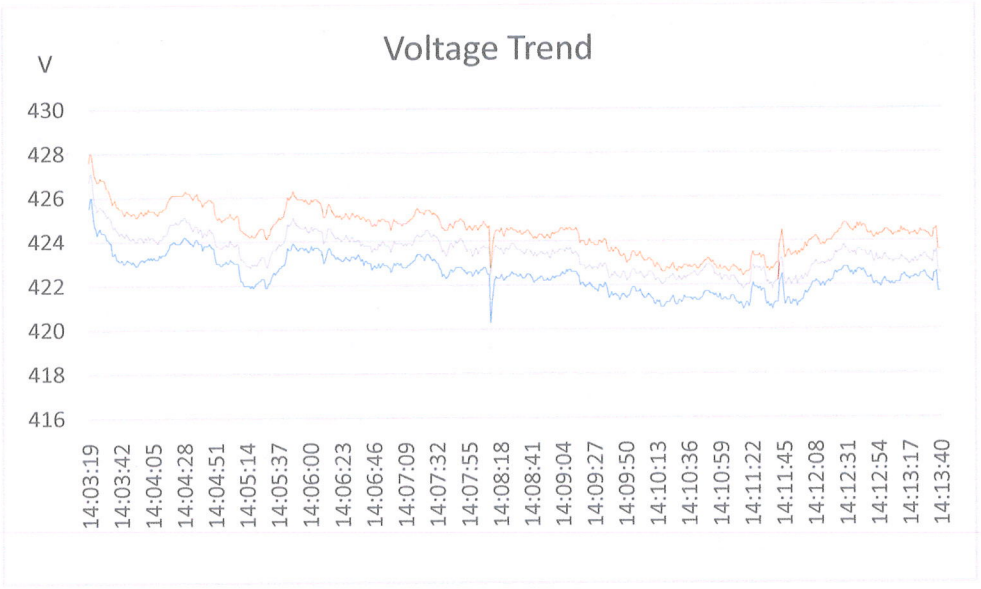

Figure 24- College of Pharmacy Voltage Profile

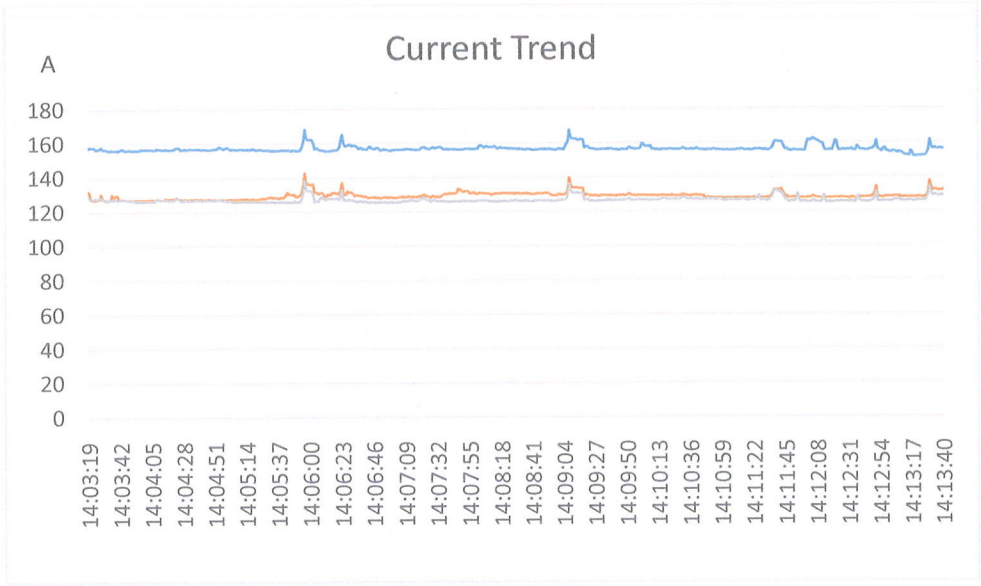

Figure 25- College of Pharmacy Current Profile

Current unbalance observed is 13% and need immediate attention.

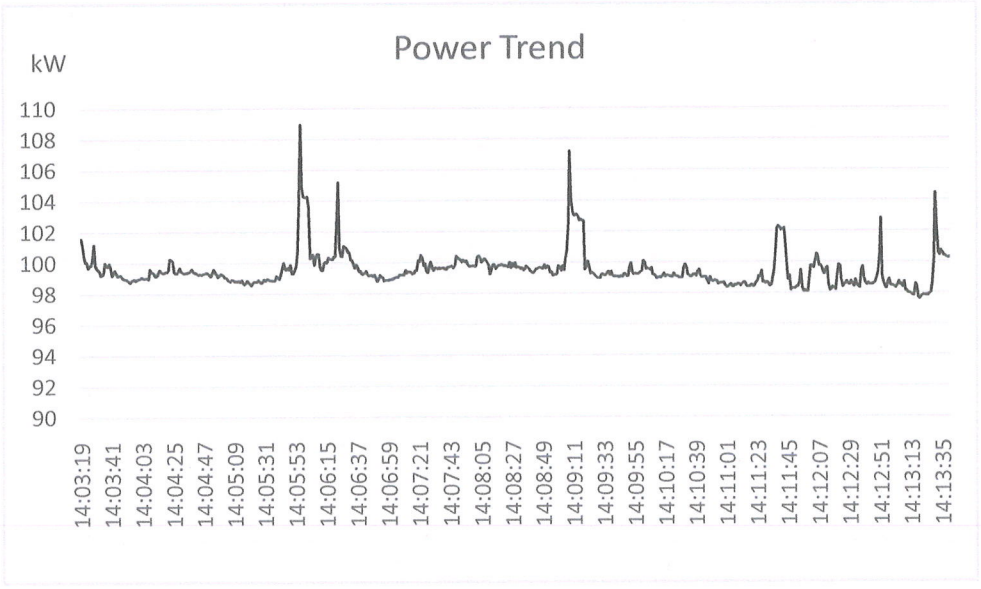

Figure 26- College of Pharmacy Power Consumption Profile – kW

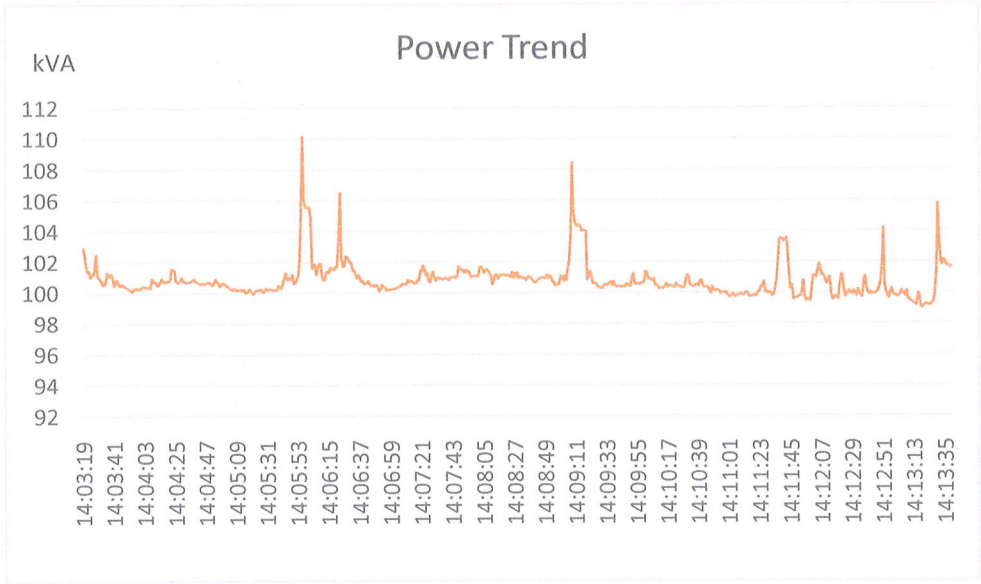

Figure 27-College of Pharmacy Power Consumption Profile – kVA

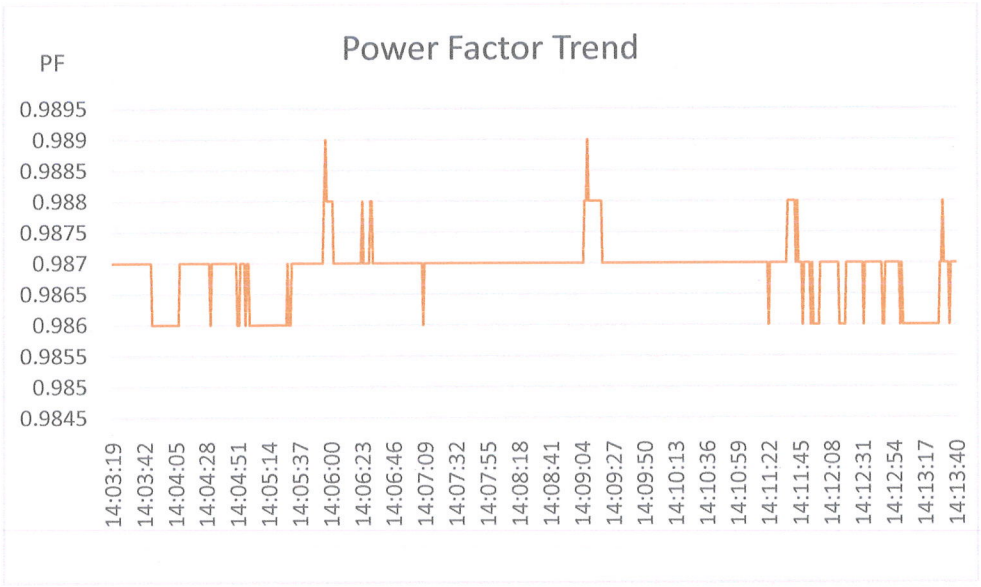

Figure 28- College of Pharmacy Power Factor Profile

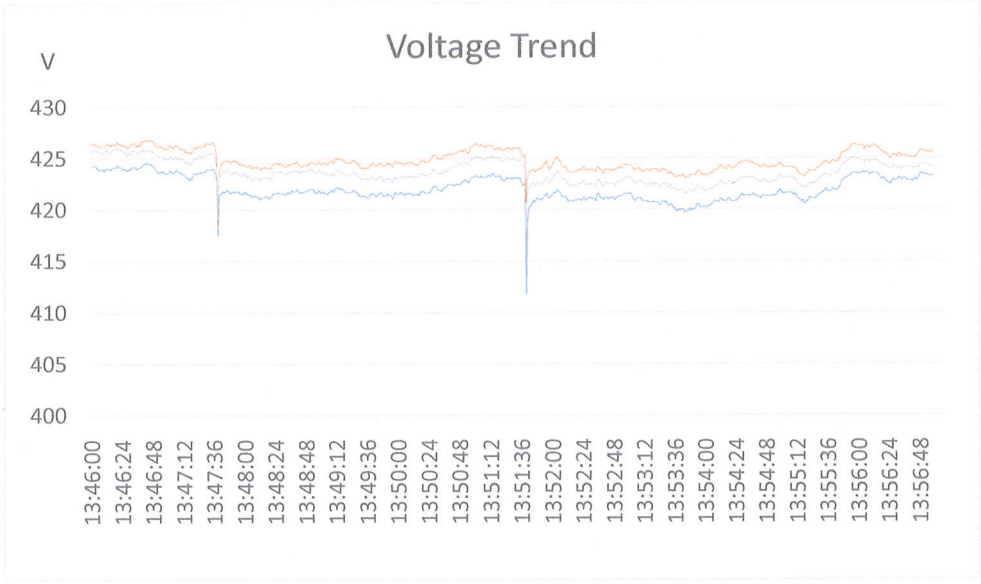

Figure 29- College of Polytechnic Voltage Profile

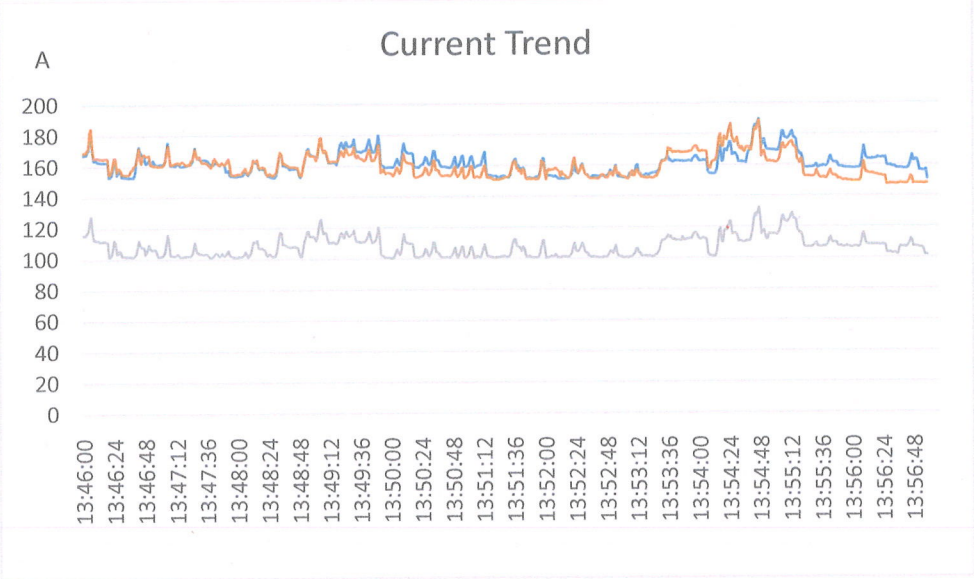

Figure 30- College of Polytechnic Current Profile

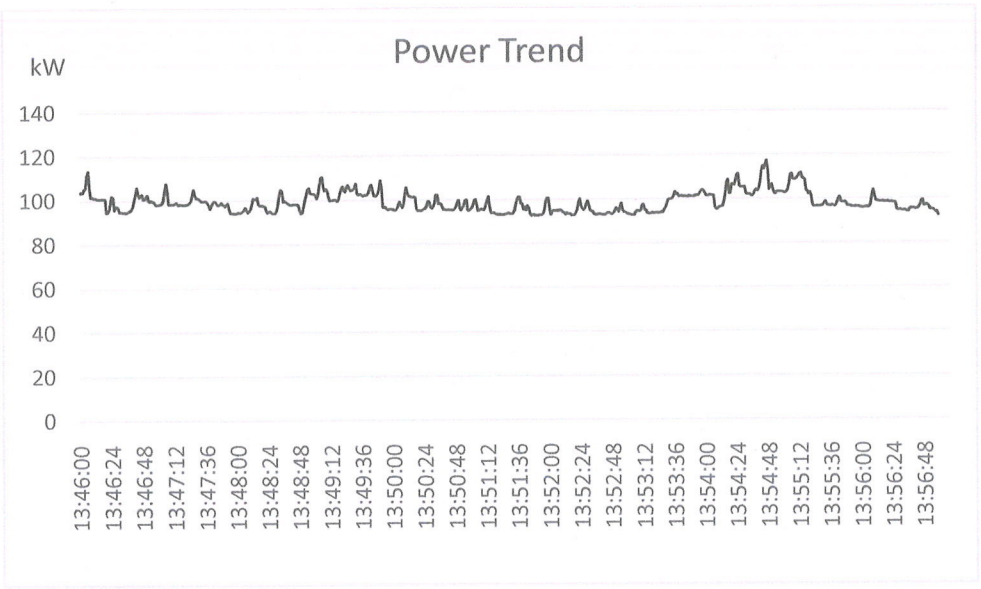

Figure 31-. College of Polytechnic Power Consumption Profile – kW

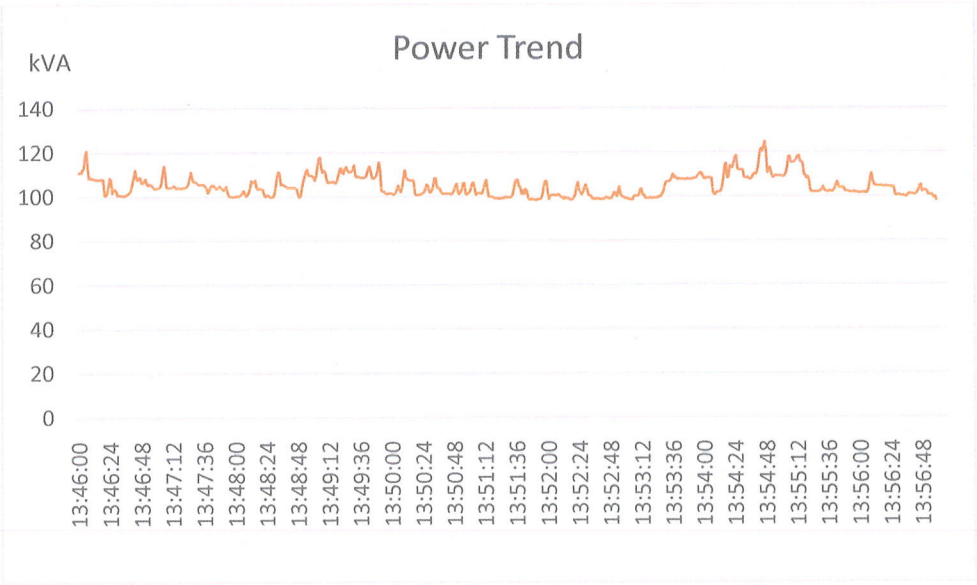

Figure 31-College of Polytechnic Power Consumption Profile – KVA

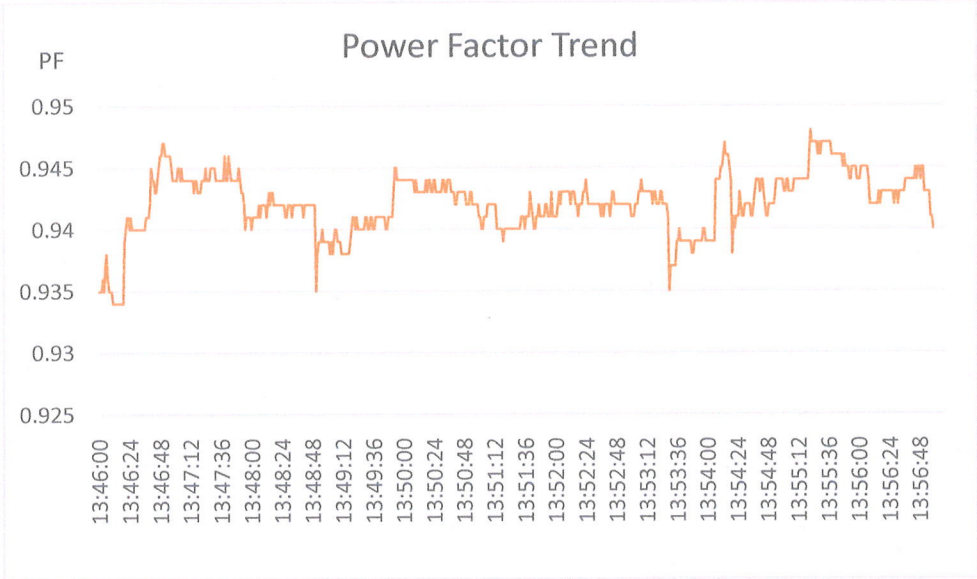

Figure 32- College of Polytechnic Power Factor Profile

Power Factor is in the range of 0.935 to 0.949 & can be improved.

3 Energy Conservation Measures

3.1 Energy conservation measures already undertaken by college

College management is very keen on implementation of energy saving initiatives and have already implemented some energy conservation measures in the premise.

College management is also doing cleaning and maintenance best practices for improved performance of renewable energy systems installed in the premises.

Energy conservation measure which are under implementation stage are as follows.

1. Replacement of fluorescent lights with energy efficient LED lights.
2. Selection of Energy Efficient Equipment's (BEE 5 Star Labeled) whenever replacement of any equipment is to be done.
3. College is also maintaining energy consumption records of each section to track energy consumption of the premise.
4. Use of Solar energy for water heating purpose instead of electric geysers.
5. Use of Solar Photovoltaic system to generate own electricity using rooftop area available at the premise.

The action taken for energy conservation measures and use of renewable energy by the college management shows the sustainable approach towards energy use and environment friendly behaviour which is appreciable.

Other energy saving measures & cost saving measures

Although the college management is doing well in energy efficiency area further improvements can be done by the management for additional savings.

1. Use of heat pumps wherever possible in college premises for cooling and heating.
2. Use of aerators for water taps.
3. Cost saving measure - Fine tuning of Automatic Power Factor Correction system to improve PF to unity & reduce billing units in kVAh billing system.
4. Cost Saving measure - Reduce contract demand to last recorded highest demand to reduce the excess demand charges being paid each moth.

****

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Date-22-12-2022

TO WHOSOEVER IT MAY CONCERN

This is to certify that we had carried out the Energy & Water Audit in the Kennedy Road Campus of All India Shri Shivaji Memoral Society (AISSMS) , Pune.

It was observed that client already have installed energy efficient equipment in their premise. Most of energy efficiency improvement work has been already done by client; which shows their positive approach to energy efficiency and sustainability.

Our Observations & Recommendations are summarized as below-

Energy saving and sustainability improvement measures undertaken by college management are as follows.

1. Replacement of fluorescent lights with energy efficient LED lights.
2. Selection of Energy Efficient Equipment's (BEE 5 Star Labeled) whenever replacement of any equipment is to be done.
3. Active Harmonic Filter is also installed to control Harmonics.
4. Maintaining energy consumption records of each section to track energy consumption of the premise.
5. Use of Solar energy for water heating purpose instead of electric geysers.
6. Use of Solar Photovoltaic system to generate own electricity using rooftop area available at the premise.

Recommendations for further energy savings are as follows-

1. **Use of heat pumps wherever possible in college premises for cooling and heating.**
2. **Use of aerators for water taps.**
3. **Cost saving measure - Fine tuning of Automatic Power Factor Correction system to improve PF to unity & reduce billing units in kVAh billing system.**
4. **Cost Saving measure - Reduce contract demand to last recorded highest demand to reduce the excess demand charges being paid each month.**

Yours truly,

UPENDRA G. DEUSKAR
BEE Certified Energy Auditor.
Regn. No.- EA -1674

AISSMS
COLLEGE OF ENGINEERING
ज्ञानम् सकलजनहिताय
Accredited by NAAC with "A+" Grade

Report on Case study of

ENERGY AUDIT OF AISSMS COE

By

Varun Marathe	22ME 082
Akhilesh Kulkarni	22ME072
Atharva Kendre	22ME 066
Atharva Kulkarni	22ME074
Manas Kulkarni	22ME075

AY 2022-2023

Guide

Mr. V. R. Patil

AISSMS
COLLEGE OF ENGINEERING

ज्ञानम् सकलजनहिताय

Accredited by NAAC with "A+" Grade

Department of First Year Engineering

CERTIFICATE

This is to certify that Mr. Varun Marathe, Mr. Akhilesh Kulkarni, Mr. Atharva Kendre,Mr. Atharva Kulkarni,Mr. Manas Kulkarni of FE (Mechanical)Division B has successfully completed the activity under Project Based Learning (110013) -Case Study entitled *"**Energy Audit of AISSMS COE**"* under my supervision, in the partial fulfillment of First Year Bachelor of Engineering (Choice Based Credit System) (2019 Course) of Savitribai Phule University of Pune

Date:

Place: Pune

Mr. V. R Patil
Guide

AISSMS COLLEGE OF ENGINEERING PUNE

Mr. S.S. Patil
PBL Coordinator

Dr. D. V. Nighot
Head Department of First Year Engg
AISSMS COE, Pune

PRINCIPAL
AISSMS, COE, PUNE-1

ACKNOWLEDGEMENT

The satisfaction that accompanies the successful completion of this review would be incomplete without the mention of the people who made it possible, without their constant guidance and encouragement would have made the efforts go in vain. We consider ourselves privileged to express gratitude and respect towards all those who guided us through the completion of this Project.

We convey thanks to our project g u i d e **Mr.V. R. Patil** of First Year Engineering Department for providing encouragement, constant support and guidance which was of great help to complete this first stage successfully.

Student Name 1 – Varun Marathe

Student Name 2 – Akhilesh Kulkarni

Student Name 3- Atharva Kulkarni

Student Name 4- Atharva Kendre

Student Name 5- Manas Kulkarni

Dr.D. S. Bormane
Principal

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Dr.D. S. Bormane
Principal

1. INTRODUCTION

An energy audit is a survey in which the study of energy flows for the purpose of conservation is examined at an organization. It refers to a technique or system that seeks to reduce the amount of energy used in the Organization without impacting the output. The audit includes suggestions of alternative means and methods for achieving energy savings to agreater extend. Conventionally, electrical energy is generated by means of fossil fuels, hydraulic and wind. The availability of fossil fuels and their depletion rate, insist the need for alternate energy systems and conservation of electric energy. Energy audit programme provide aid in maintaining a focus on energy price variations, energy supply availability and efficiency, determining an appropriate energy mix, identifying energy-saving technology, retrofitting for energy-saving equipment and so on. In general, an energy audit process dealt with the driving conservation concepts into reality by giving technically possible solutions within a specified time limit while also considering the economic and other organizational issues. It also dealt with the uncover ways to cut operating expenses or reduce energy use per unit of productionin terms of savings. It serves as a "benchmark" (reference point) for managing energy in the organization for planning more energy efficient use across the board.

2. NEED OF ENERGY AUDIT

Energy has the highest potential for cost reduction, and thus the energy audit becomes a crucial exercise. Energy Audit will help to understand more about the ways energy and fuel are used in any industry, and help in identifying the areas where waste can occur and where scope for improvement exists.

The Energy Audit would give a positive orientation to the energy cost reduction, preventive maintenance and quality control programmes which are vital for production and utility and activities. Such an audit programme will help to keep focus on variations which occur in the energy costs, availability and reliability of supply of energy, decide on appropriate energy mix, identify energy conservation technologies, retrofit for energy conservation equipment etc.

In general, Energy Audit is the translation of conservation ideas into realities, by lending technically feasible solutions with economic and other organizational considerations within a specified time frame. The primary objective of Energy Audit is to determine ways to reduce energy consumption per unit of product output or to lower operating costs.

3. M AND OBJECTIVE OF AN ENERGY AUDIT

An energy audit is a useful tool for developing and implementing comprehensive energy management plans of an organization. The aim of an energy audit is to identify the energy efficiency, conservation and savings opportunities at the premises of the audit sites in a systematic manner.

The audit process is carried out as per the following.

1) Review of energy saving opportunities and measures implemented in the audit sites.
2) Identification of additional various energy conservation measures and saving opportunities.
3) Implementation of alternative energy resources for energy saving opportunities and decision making in the field of energy management.
4) Providing a technical information on how to build an energy balance as well as guidance to be sought for particular applications.

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5) Detailed analysis on the calculation of energy consumption, analysis of latest electricity bill of the campus, understanding the tariff plan provided by the central and State Electricity Board
6) Use of bulb and tube lights, fans, air conditioners, equipment and instruments installed in the organization
   (for example- 60-watt bulb x 4hours x number of bulbs = kwh).

4. PROBLEM STATEMENT – INCREASING GLOBAL CARBON FOOTPRINT

#What is a carbon footprint? : A carbon footprint is the total amount of greenhouse gases (including carbon dioxide and methane) that are generated by our actions.

The average carbon footprint for a person in the United States is 16 tons, one of the highest rates in the world. Globally, the average carbon footprint is closer to 4 tons. To have the best chance of avoiding a 2℃ rise in global temperatures, the average global carbon footprint per year needs to drop to under 2 tons by 2050.

Lowering individual carbon footprints from 16 tons to 2 tons doesn't happen overnight! By making small changes to our actions, like eating less meat, taking fewer connecting flights and line drying our clothes, we can start making a big difference.

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5. METHODOLOGY

In order to conduct an energy audit, several methods are adopted in the audit sites in which walk-through audit is conducted. The balance of total energy inputs with total energy outputs and identification of all energy streams in a facility are taken into account. The amount of energy used by each of its energy streams are calculated.

The top three operating expenses of the Organization are typically observed to be energy (Both electrical and thermal), labour and materials. During the audit, physical verification of Lighting, Ceiling, Table and Exhaust Fans, A/C machines, verification of installed energy efficient system's capacities are carried out. Inspection of when the cost or prospective cost savings in each of the above components are considered, energy always wins, and the energy management task becomes a key cost reduction area. The energy audit assisted in better understanding how energy and fuel are used in the Organization as well as identifying waste factors and development. potential towards energy savings opportunities. Finally, after the audit process, the energy audit included suggestions for energy cost reduction, preventive maintenance and quality control activities, all of which are critical for the utility operations in the auditee (Organization). The audit involved visiting the campus and physical verification of the loads and sources installed. The entire campus is divided into different sections and those sections are audited in which electrical fittings and energy supply are monitored.

The production process flow is studied and electricity consumption are measured. Location of electrical machines, conditions of them and their accessories are inspected through physical verification. The energy bill from the supply is audited and assessed for the load demand requirement and efficient consumption of energy. Stakeholders are interacted with the scope for improvement and energy management during the audit. Potential areas in which the scope of energy conservation and saving opportunities available in the current context have been identified and suggested for implementation to the Organization. The level of carbon dioxide might be measured in different places across the Organization using a portable CO_2 Analyzerto calculate the carbon footprint. It may be useful to check where carbon emission is prominent which could be taken into account to reduce.

6. PROCESS

Steps Involved

Step 1: Opening meeting among the audit team.

Step 2: Planning and organizing the energy audit.

Step 3: Conduct a walk-through audit at different sites

Step 4: Macro data collection and listing observations.

Step 5: Analysis of data collected from the Organization.

Step 6: Best practices followed in the Organization towards energy savings

Step 7: Recommendations for further improvement.

7. PLANNING AND ORGANISING THE ENERGY AUDIT

1. Walk-through Audit Process,

   Simple audit, screening audit or visual audit are the other names, by which walkthrough audits are addressed. The main purpose of the walk-through audit is to obtain general information about the sites in which electrical energy is being used at the maximum. More specific information has been obtained from the maintenance and operational people during the time walk-through audit. It also included a walk-through of the facility to become familiar with the building's operation and a brief evaluation offacility utility bills (amount paid for electricity) and other operating data. During the audit the primary problem areas are discovered.

2. Macro Data collection and observation

   Current level operation and practices within the campus are assessed and then the data regarding the number of electrical loads connected in each section are collected. The power ratings of each component and their respective hours of operation are alsoobserved and documented for preparing the recommendations to the Organization.

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3. Measurements in the Energy Audit process

An energy audit required measurements, such as the energy identification and quantification, and these quantities necessitate the instruments used in a consistent way. Some of the basic electrical parameters are monitored during the energy audit such as Voltage (V), Current (I), Kilowatt (KW) and other parameters that are analysed during the audit depending upon the requirements.

8. SAMPLE CALCULATION

(Here 1 Tube light consumes 40 watts and 1 fan consumes 60 watts electricity.)

SR. NO.	FLOOR	POWER CONSUMPTION OF DEVICES PER FLOOR In KW	ENERGY UNITS CONSUMED PER DAY In KWH	PROPOSED POWER CONSUMPTION PER DAY In KWH	WATT CONSUMPTION AFTER REPLACING In KW *8
1.	1st	7.780	62.240	9.648	6.574
2.	2nd	13.780	110.240	17.856	11.548
3.	3rd	22.360	178.880	36.432	17.806
4.	4th	16.400	131.200	23.608	13.448
TOTAL		60.320	482.560	87.554	395.008

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Cost analysis:

(Assuming daily 8 hours of operations and electricity at prevailing rate given below)

SR.NO.	ELECTRICITY BILL TILL NOW PER MONTH In INR	PROPOSED SAVINGS PER MONTH In INR	ELECTRICITY BILL AFTER SAVING PER MONTH In INR
1	65,145	11,820	53,326

(Rate of Electricity considered

0 to 100 units at Rs.3.50 per unit. 101 to 300 units at Rs 7.34 per unit and 301 to 500 at Rs. 10.37 per unit and above 500 units its Rs 11.86 per unit. Other charges extra)

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9. CONCLUSION

Considering the fact that the organization is a well-established, long time run establishment with good reputation, there is significant scope for conserving energy and make the campus as self-sustained in it. The energy conservation initiatives taken up by the institution are substantial.

Energy efficient lighting schemes, awareness created among stakeholders and necessary power backups are being practiced by the institution. There are some best Practices followed on Energy Audit in the Organization like Transformers, Generators and UPS are protected properly with fencing and kept awareness boards on 'Dangers' and 'Warnings'.

It is observed that the most of places, sign board of 'Switch ON' and 'Switch OFF' are kept towards saving energy measures to the stakeholders. Electrical wires, switch boxes and stabilizers are properly covered without any damage which will cause any problems to the staff and student members.

Adaptation of sprinkler irrigation in the campus to minimize the energy potential are well appreciated.

Few recommendations, in addition, can further improve the energy savings of the Organization. This may lead to the prosperous future in context of Energy Efficiency Campus and thus sustainable environment and community development to the stakeholders in coming years to come.

Reference

1. Energy Literacy training program