CONFIDENTIAL

Status and ENERGY Audit

AT

KS School of Engineering and Management

Holiday Village road, Vajarahalli, Mallasandra, Bengaluru 560109

January 2024

Submitted by:

e-Xcel Energy Bangalore

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Contents

Abbreviation	Description
AC	Air-Conditioner
°C	Degree Celsius
BESCOM	Bangalore Electricity Supply Company
CFL	Compact Fluorescent Lamp
KSIT	Kammavari Sangham Institute of Technology, Ponnampet
DG	Diesel Generator
ECM	Energy Conservation Measures
FTL	Fluorescent Tube lamp
kW	Kilowatt
kWh	Kilowatt hour
kVAr	Capacitor Value
R,Y,B	Phases in a 3 phase system
LED	Light Emitting Diode
NAAC	National Assessment and Accreditation Council
IEC	International Electro Commission
SEC	Specific Energy Consumption
TR	Tons of Refrigeration
TL-40	40W Tube light

1. Executive Summary

Electricity requirements of the KSSEM campus are met by BESCOM Bangalore as a primary power source to meet the entire requirement of the campus with the help of an outdoor, oil cooled 11kV/433V stepdown transformer of 500kVA capacity installed outdoor in a dedicated yard, this is supported, during outages by a salient diesel generator set of 250kVA capacity. The major loads at KSSEM are Laboratories of various departments, air-conditioning, lighting, fans, UPS for computers and labs, hostels, sewage treatment plants, and pumps. An Automatic power factor improvement Capacitor panel is installed in the main building with the sensing at the Trafo LT output. Laboratory loads are intermittent and do not load the system except during examinations. This power sources supply the following areas:

1) Main building
2) Civil, Mechanical, Poly-technic and Library blocks
3) Architecture Block and
4) The Boys hostel block

- The loads are unbalanced and a balancing exercise would help in better management of mains power
- The Power factor correction panel should be upgraded after the repairs recommended to an APFC type to reduce the overall kVA of the mains system. Series Chokes / detuned system is recommended to safeguard the capacitors used as there are 3^{rd}, 5^{th}, and 7^{th} harmonic currents.
- The multi data meter at the incomer panel is showing erroneous data thus misguiding the observer.
- Neutral of the transformer secondary is open and is a Safety concern, this has to be attended immediately. As there is a single neutral earth pit it becomes mandatory to create one more earth pit for the same.
- The earth pits for DG1 (250kVA) have failed in their tests and hence have to be re-conditioned.
- The earth pits for DG2 (125kVA) are not traceable, hence new pits have to be provided.
- UPS are spread all over the campus, they can be re-purposed to be placed centrally in two areas for better management of the same.

The audit consisted of an on-site survey, and discussions with KSIT Staff members and support personnel, followed by a technical evaluation of applicable measures that could reduce energy consumption. The site visit encompassed the study of all energy-consuming sources, covering the complete campus.

The summary of the main findings and list of Energy Conservation Measures (ECMs) are presented in this report which had the consent of the KSIT top management team for further action and development and consideration for implementation.

1.1 About Kammavari Sangham

The Kammavari Sangham, a multi-activity non-profit oriented voluntary service organization, was established in the year 1952 with the sole objective of providing charitable service to community and society.

The Sangham has diversified its activities since its establishment over five decades ago. With a firm belief that quality and meaningful education only can lay the strong foundation for bringing about economic and social changes to the lives of thousand, the Sangham went about establishing educational institutions, starting with **K.S. Polytechnic** in 1992

Enthused with this success of its foray into technical education, the Sangham moved forward by starting the **K.S Institute of Technology (KSIT)**, its under graduate Engineering College in the year 1999. In the following years both these institutions have carved for themselves an enviable niche through academic excellence achieved in a very short span of time. By providing FREE hostel accommodation and scholarship to the deserving students in the community, it has furthered its Commitment to education. These successes further lead to the formation of another institution in the name of KS Group of intuitions (KSGI) in 2010 which was renamed as KSSEM in 2011.

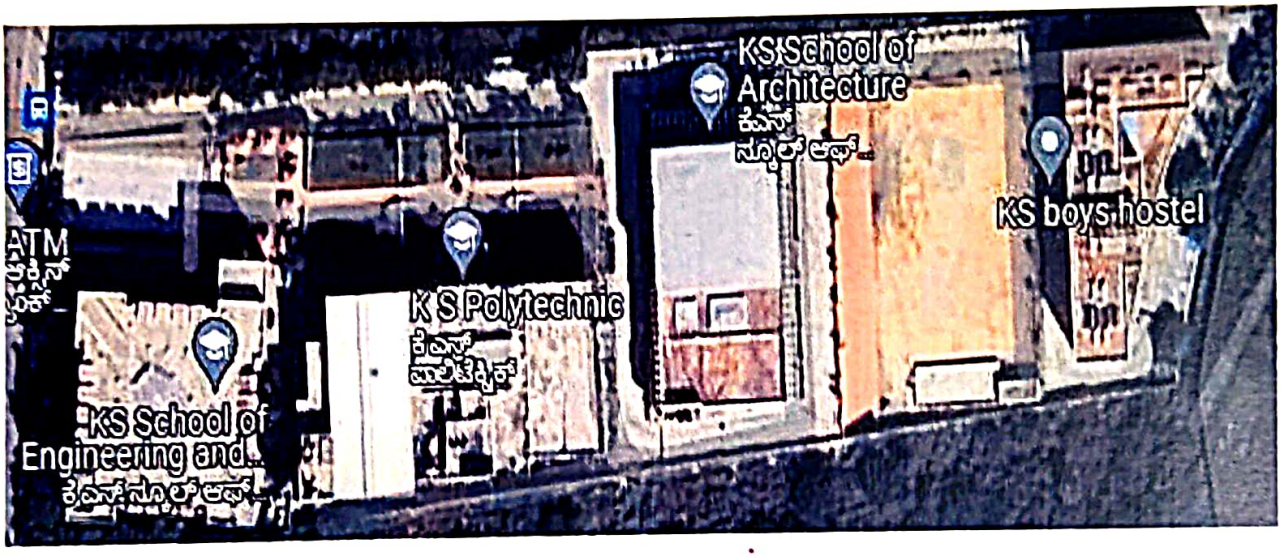
1.2 COLLEGE PROFILE

Description	Status
Name of College	KS School of Engineering and Management
Place	Holiday Village road, Vajarahalli, Mallasandra, Bengaluru 560109
State	Karnataka
Affiliating University	Visvesvaraya Technological University, Belagavi.
Status of the College	Self-Financing
Type of College	Co-Educational
No. of Departments	10
No. of Branches	1
Date of establishment	2011
Location of the College	Bengaluru

1.3 ABOUT COLLEGE

KS School of Engineering and Management (KSSEM) is a private engineering college in Bangalore, Karnataka. After the success of its predecessor KSIT this college was founded by the Sangham in 2010 as KS Group of Institutions (KSGI) which was renamed as KS School of Engineering and Management (KSSEM) in 2011. It is affiliated to the Visvesvaraya Technological University, Belgaum. This institution is NAAC accredited.

Fig 1.1: Campus Layout



2. ENERGY SCENARIO

Electricity, diesel, and LPG are the major energy sources. Electricity is consumed all around the campus by various loads such as lights, fans, UPS for computers, pumps, ACs, and equipment in the Labs. Diesel is used as fuel for Diesel Generator (DG) set. LPG is the main source for cooking at both the Boys Hostel Kitchens and Student's Canteen.

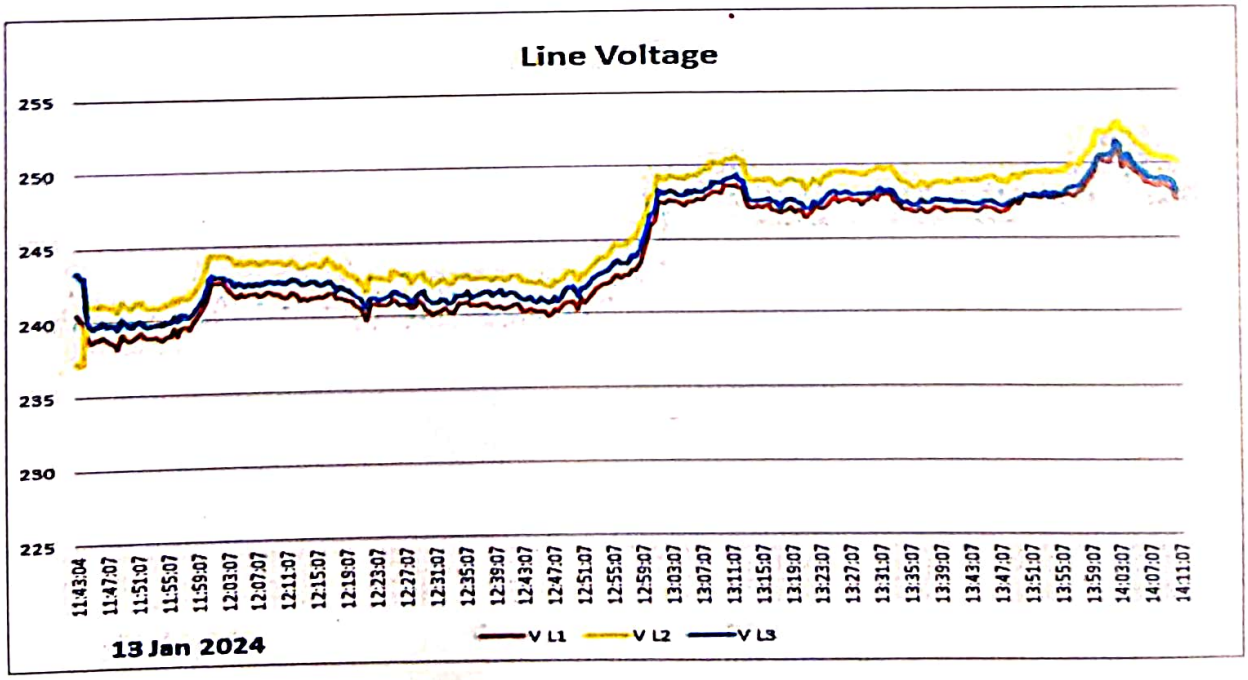
2.1 ENERGY SOURCES AND CONSUMPTION DATA AT THE KSSEM

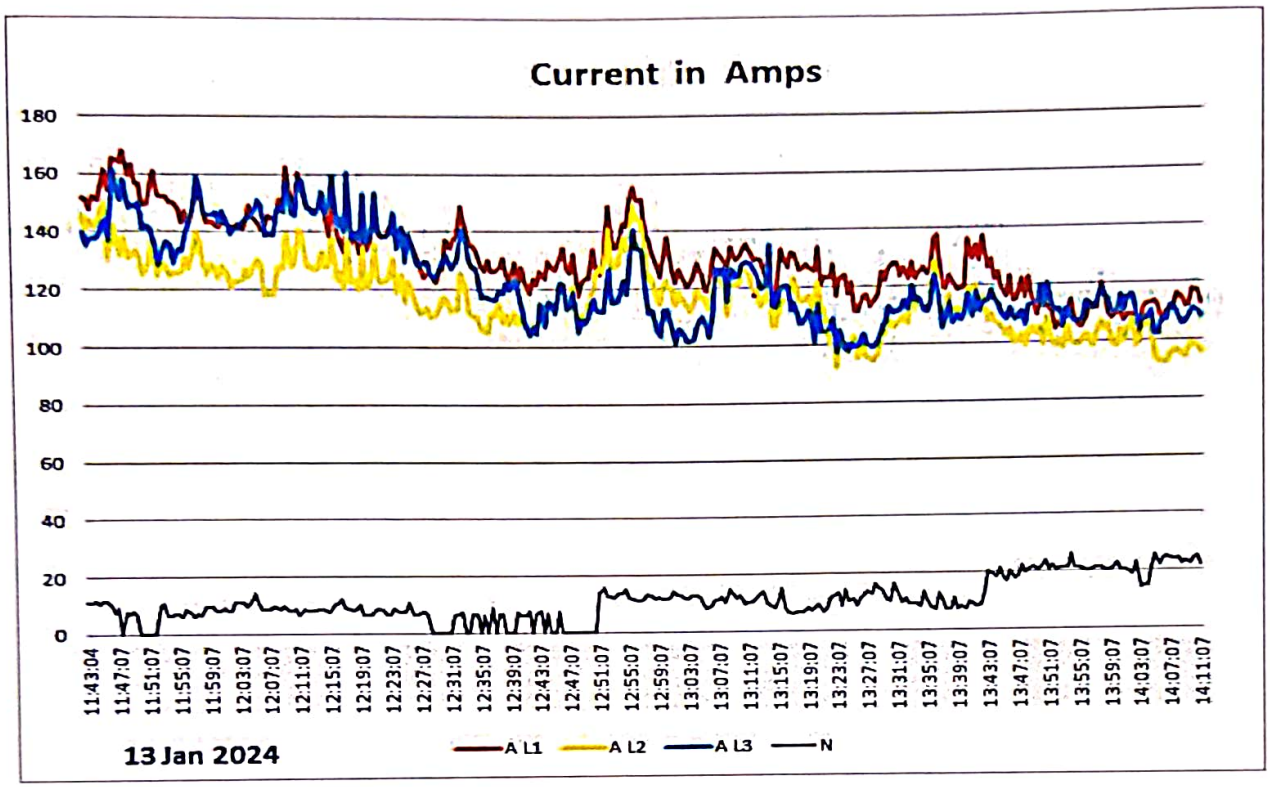
KSSEM utilises BESCOM mains supply received at 11.0 kV as the primary power source. As a backup during Outages from BESCOM, a diesel-fired captive power generation set of 250kVA capacity is installed outdoor at the transformer yard.

2.11 Average 150 minutes Power consumption at the Main Incomer of 500kVA BESCOM transformer

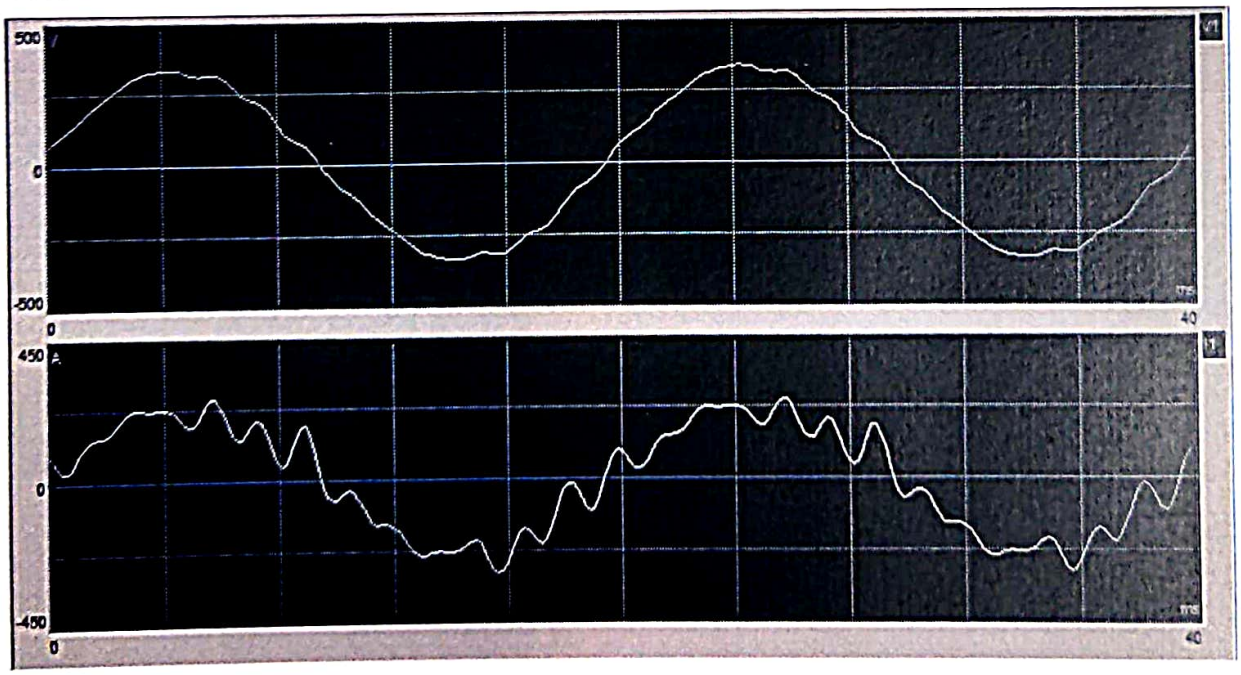
	V	I(Amps)	kW	kVA	kVAr	pf	H3	H5	H7	H11	H13
R	244.1	130.9	20.99	31.92	-8.84	-0.908	5.71	18.3	18.3	17.9	18.0
Y	244.9	116.3	28.91	28.59	-7.83	-0.896	5.09	9.69	20.9	17.8	17.8
B	244.7	122.9	29.69	30.08	1.43	+/-0.97	0	11.48	20.4	15.9	21.8
	TOTAL	10.8N	79.59	96.59	-15.24						

Table 2.1

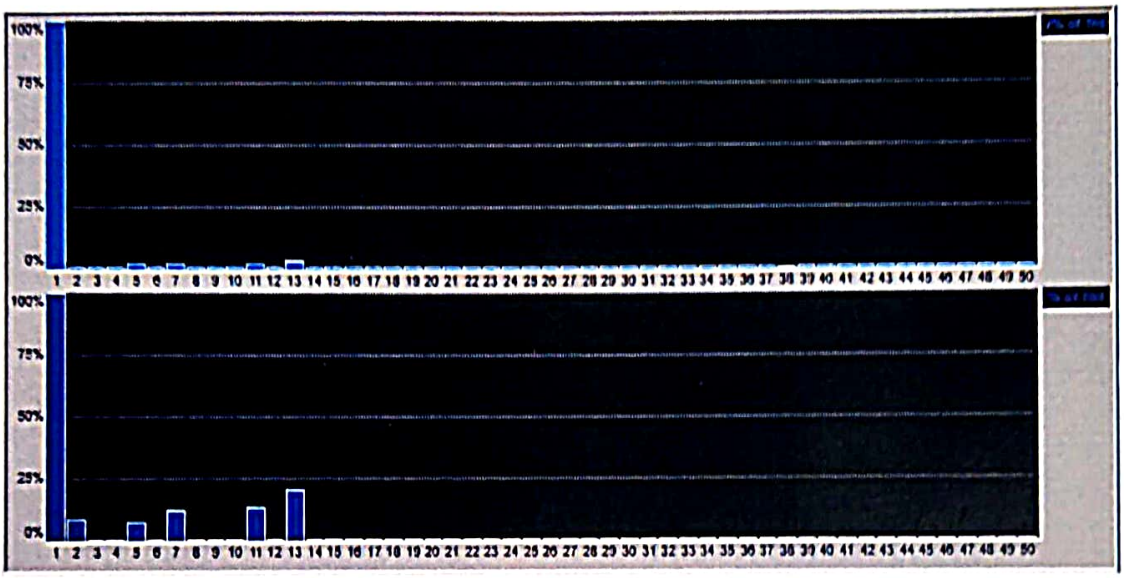




Voltage and Current Waveforms



Frequency Spectrum



Harmonic Current in Amps

Phase	Fund	H3	H5	H7	H11	H13
R	130.9	5.71	18.3	18.3	17.9	18.0
Y	116.3	5.09	9.69	20.9	17.8	17.8
B	122.9	0	11.5	20.4	15.9	21.8

Table 2.2

Observations:

1) Line voltages is varying between 240V to 250V which is on the higher side, leading to a small amount of energy loss.

2) Neutral current is present and is varying between 10A to 20A, this is partially due to unbalance in the loads and partially on account of Harmonic currents.

3) The harmonic currents are distorting the load current waveform as shown above

4) Presence of harmonic currents is because of 6-pulse (H5 & H7) and 12-pulse (H11 & H13) rectifiers in the UPS systems being used without any filtering devices.

Recommendations:

1) The "Tap" setting in the transformer to be adjusted to get an output voltage in the range of 230V to 235V, this will not only save energy but will also protect electrical/Electronic instruments using mains supply.

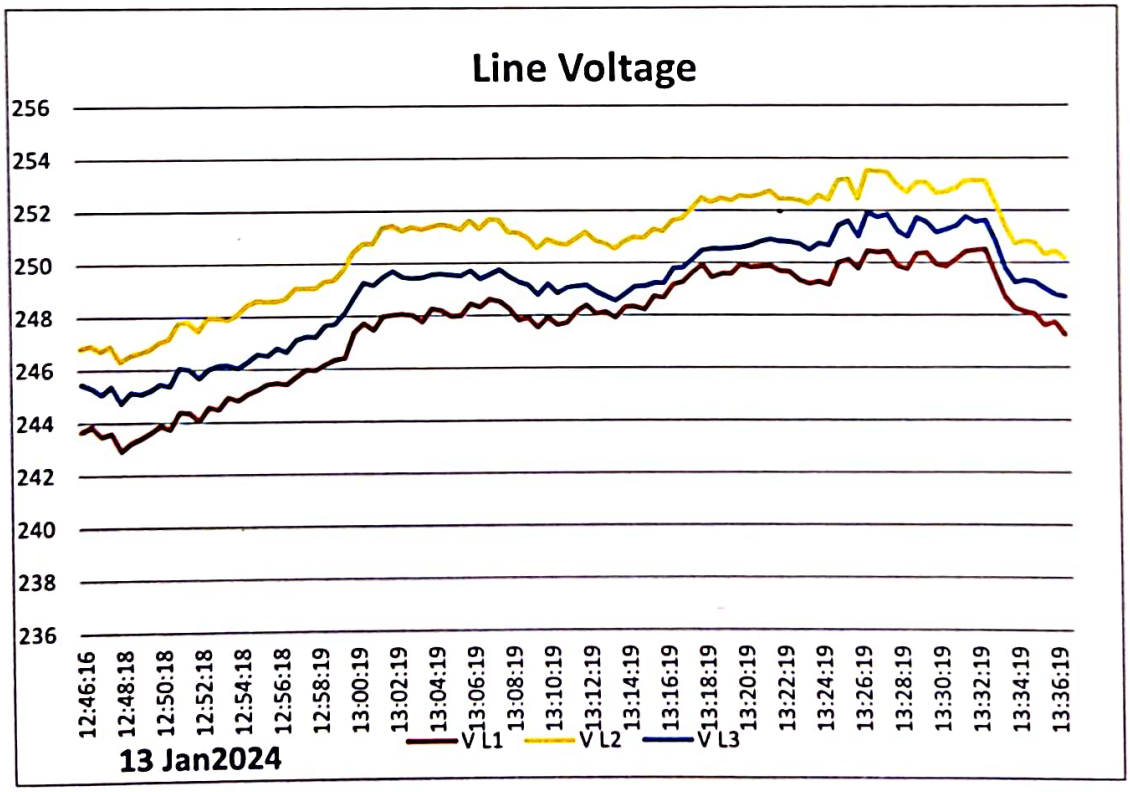
2) Load Balancing exercise to be carried out to shift some single phase loads from R phase to Y & B phases.

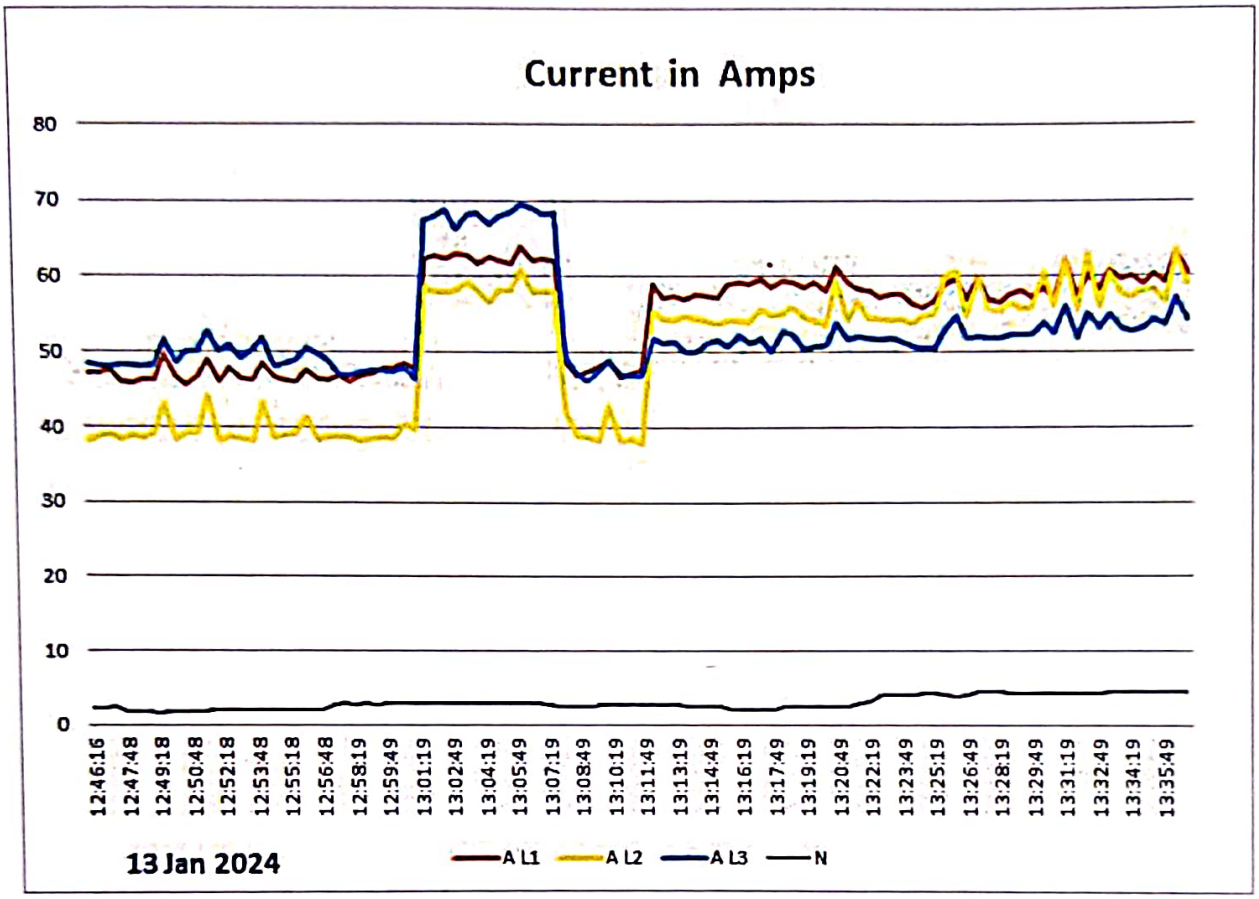
3) Mitigation of harmonics is necessary to smoothen the current waveform particularly the 5th,7th 11th and 13th Order harmonic currents.

2.12 Average 50 minutes Power consumption at the Incomer of 500kVA (at Main Building)

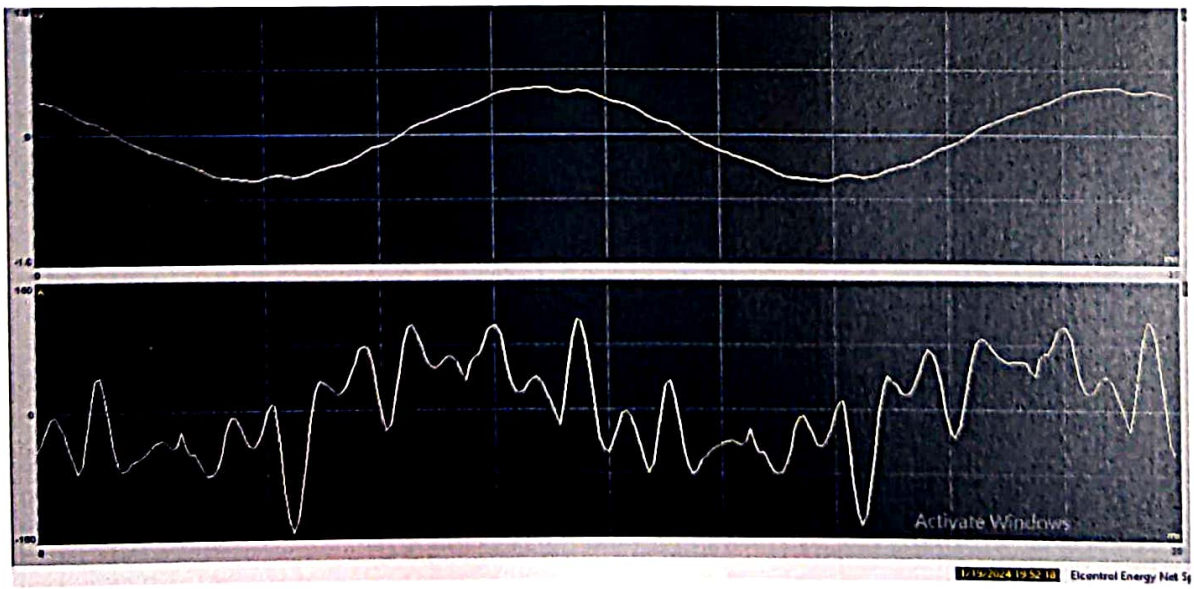
	V	I(Amps)	kW	kVA	kVAr	pf
R	247.7	46.1	7.39	11.42	-8.71	-0.647
Y	250.7	45.9	5.91	11.51	-9.85	-0.513
B	244.7	40.3	5.63	9.86	-8.11	-0.571
N		4.4				
	TOTAL		18.93	32.79	-26.67	-0.577

Table 2.3

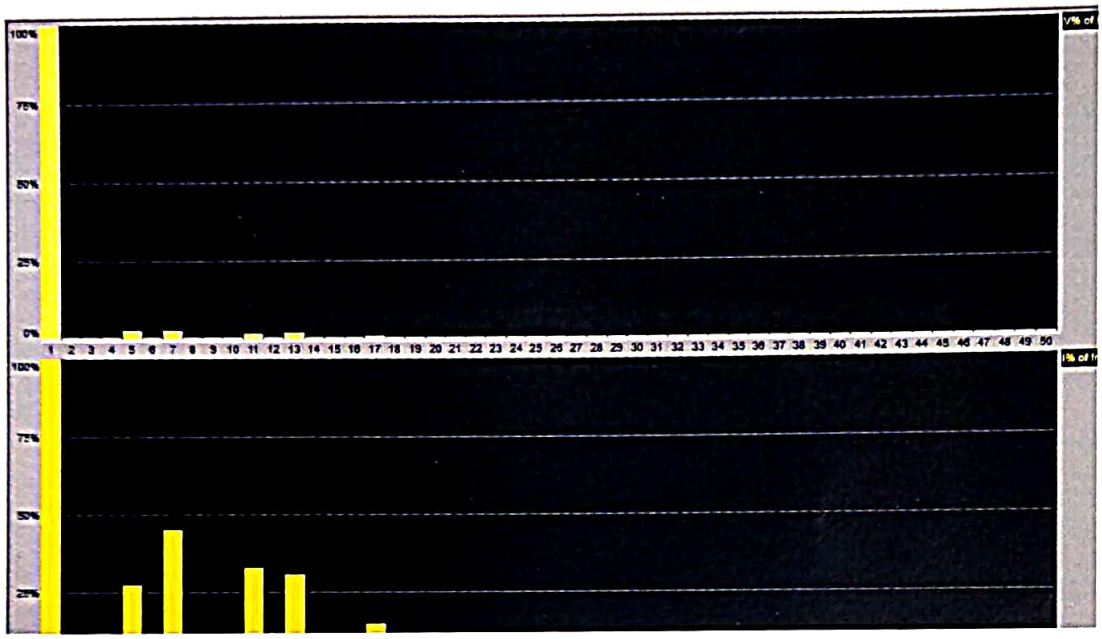




Voltage and Current Waveforms



Frequency Spectrum



Phase-wise Fundamental and harmonic currents (In Amps)

Phase	Fund	H3	H5	H7	H11	H13
R	46.1	5.26	11.1	21.9	15.8	19.5
Y	45.9	4.28	12.4	20.5	14.9	19.9
B	40.3	4.17	11.6	19.6	14.9	21.2

Table 2.4

2.13 Eight step APFC Capacitor Bank function test

Step	kVAr	Observations	Recommendations
1	10	R not working	To be replaced
2	15	Y Phase weak	To be replaced
3	15	Ok, working	NIL
4	20	Not working	To be replaced
5	12.5	Ok, working	NIL
6	12.5	Ok, working	NIL
7	15	MCB off	To be checked
8	20	B Phase not working	To be replaced

Table 2.12

Observations:

1. As reported earlier the Line voltages are varying between 240V to 250V which, is on the higher side, leading to a small amount of energy loss.
2. A very small Neutral current is present and is varying between 2A to 5A, this is partially due to unbalance in the loads and partially on account of Harmonic currents.
3. The harmonic currents are distorting the load current waveform as shown above waveform figure.
4. Presence of harmonic currents is because of 6-pulse (H5 & H7) and 12- pulse (H11 & H13) rectifiers in the UPS systems being used without any filtering devices.
5. The average PF (power factor) of the main building loads is leading and around 0.577 as shown in the above table.
6. As indicated in the earlier section, here also the Pf is leading and quite low indicating a high drawl of load current this is primarily due to UPS as the main load.
7. Phase-wise Loading pattern is unbalanced and varying.
8. Power factor improvement equipment is contributing to a leading Pf and a good number of the capacitors are underperforming or not working.
9. Harmonic currents are present, especially, 3rd, 5th and 7th order currents.
10. Periodic general housekeeping (Cleaning and dust removal) has to be put in place.
11. Insulation floor mats missing in front of panels.

Recommendations:

1) As recommended in the earlier section, the "Tap" setting in the transformer to be adjusted to get an output voltage in the range of 230V to 235V, this will not only save energy but will also protect electrical/Electronic instruments using mains supply.
2) Load Balancing exercise to be carried out to shift some single phase loads from R & Y phases to B phase, if possible.
3) The PF correction, equipment needs servicing as a good number of the capacitors are underperforming or not working.
4) Mitigation of harmonics is necessary to smoothen the current waveform

particularly the 5th,7th 11th and 13th Order harmonic currents.

2.13 Sub Panel (Mech, Civil, Polytech & Library building) @ I/C of 630A Motorised MCCB (B2, B1, G+5)

	V	I(Amps)	kW	kVA	kVAr	pf	H3*	H5*	H7*
R	244.1	52.3	10.19	12.77	7.69	0.798	3.20	8.10	4.50
Y	246.6	46.2	8.72	11.39	7.31	0.765	3.00	9.20	4.10
B	245.6	38.7	7.47	10.40	7.23	0.780	3.45	5.50	4.80
N		9.5							
	TOTAL		26.38	34.560	22.23	0.781	Av		

Table 2.3

2.14 Sub Panel (Architecture Building Basement) @ I/C of 400A MCCB (B2, B1, G+3)

	V	I(Amps)	kW	kVA	kVAr	pf
R	243	22.82	5.05	5.55	2.31	0.91
Y	246	19.71	4.32	4.85	1.32	0.89
B	244	21.51	4.67	5.25	2.35	0.89
N		7.51				
	TOTAL		14.04	15.65	5.98	Av0.896

Table 2.4 No significant harmonic currents

2.15 Sub Panel (Boy's hostel and Kitchen) @ I/C of 400A MCCB (B2, B1, G+3)

	V	I(Amps)	kW	kVA	kVAr	pf	H5	H7
R	238	77.2	16.21	18.37	8.63	0.882	3.70	3.60
Y	238	57.6	15.13	13.71	6.21	0.859	4.18	4.50
B	228	58.7	12.21	13.38	5.45	0.912	3.81	3.90
N		13.3						
	TOTAL		43.55	44.29	20.294	0.884	Av	

Table 2.5

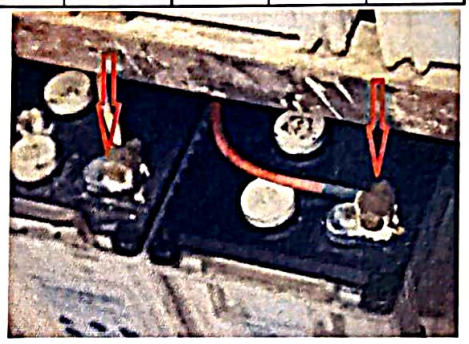
3 UPS 3 Phase Input with single Phase output parameters

3.1 Mech, Civil & Diploma Block

3.1.1 AADS-1 Power Net PNS 30kVA 30batteries 180Ah (near FM lab)

Input	V	I(Amps)	kW	kVA	kVAr	pf	H3	H5	H7
R	246.7	5.52	1.08	1.36	0.83	0.795	-	2.40	1.50
Y	244.2	5.66	1.01	1.38	0.94	0.731	-	2.67	1.10
B	247.7	6.01	1.13	1.49	0.97	0.761	-	3.00	0.91
		TOTAL	3.23	4.23	2.74	0.762	O/P Freq 49.6		
Output	235.4	9.81	-1.83	2.31	-1.41	-0.793	3.3	1.9	1.4

Table 2.6



Observations:

- Ten years old (2013)
- Batteries are in bad condition need Cleaning/maintenance

3.1.2 AADS-2 Alpha 30kVA 30batteries 180Ah (near FM lab)

Input	V	I(Amps)	kW	kVA	kVAr	pf	H3	H5	H7
R	246.8	4.43	0.91	1.09	0.61	-0.831	-	2.05	1.41
Y	248.6	4.44	0.89	1.10	0.65	-0.810	-	2.06	1.31
B	247.9	4.41	0.92	1.09	0.59	-0.844	-	2.76	1.29
		TOTAL	2.73	3.29	1.84	-0.828		O/P Freq 49.7	
Output	230.7	8.71	1.30	2.01	-1.54	-0.645	3.3	1.9	1.4

Table 2.7

Observations:

- Fairly new installed in 2022 and is in good condition
- Batteries need Cleaning/maintenance

3.1.3 Power line (RT nagar) 25kVA 30batteries 180Ah (near FM lab)

Input	V	I(Amps)	kW	kVA	kVAr	pf	H3	H5	H7
R	247.6	4.15	0.54	1.03	0.87	-0.529	-	1.50	0.81
Y	248.2	4.42	0.64	1.10	0.89	-0.582	-	1.60	0.91
B	247.1	4.47	0.60	1.10	0.93	-0.544	-	1.76	0.92
		TOTAL	1.78	3.23	2.69	-0.552	O/P Freq 50.0		
Output	228.6	14.6	2.22	3.34	-2.50	-0.664	3.75	1.59	1.97

Table 2.8

Observations:

- Ten years old (2013)
- Batteries are in bad condition need Cleaning/maintenance

3.2 2nd Floor Mech, Civil, Polytech Block

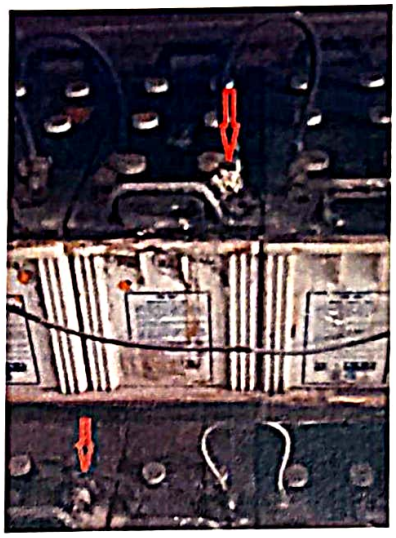
3.2.1 Kowsik 25kVA 30 batteries 180Ah (Second floor)

Input	V	I(Amps)	kW	kVA	kVAr	pf	H3	H5	H7
R	235.8	8.16	0.62	1.92	-1.82	-0.320	-	4.71	5.73
Y	230.8	8.23	0.74	1.90	-1.75	-0.392	-	4.81	4.99
B	244.6	10.51	0.98	2.57	-2.38	-0.381	-	4.77	5.78
		TOTAL	2.34	6.39	-5.95	-0.364	O/P Freq 50.08		
Output	222.4	5.39	0.90	1.20	-0.79	-0.749	2.89	1.7	1.52

Table 2.8

Observations:

- Ten years old (2013)
- Batteries are in bad condition need Cleaning/maintenance/replacement



3.2.2 Power line 15kVA (Second floor)

Input	V	I(Amps)	kW	kVA	kVAr	pf	H3	H5	H7
R	215	1.35	0.08	0.29	-0.28	-0.260	-	-	-
Y	205	1.54	0.09	0.32	-0.30	-0.281	-	-	-
B	236	1.31	0.08	0.31	-0.30	-0.264	-	-	-
		TOTAL	0.25	0.92	-0.88	-0.268	O/P Freq 50.08		
Output	225.1	0.637	0.08	0.14	-0.12	-0.577	-	-	-

Table 2.9

Observations:

- Ten years old (2013)
- Batteries are in bad condition need Cleaning/maintenance/replacement
- Three phase Input voltages are low, to be investigated and rectified
- UPS Output Not loaded

3.2.3 Power line 15kVA (Second floor)

Input	V	I(Amps)	kW	kVA	kVAr	pf	H3	H5	H7
R	240	6.55	0.45	1.57	1.51	0.288	-	2.76	6.73
Y	241	8.32	0.55	2.01	1.93	0.275	-	2.81	6.89
B	241	8.38	0.60	2.02	1.93	0.299	-	2.57	5.87
		TOTAL	1.61	5.60	5.36	0.287	O/P Freq 50.08		
Output	212	7.13	1.00	1.51	-1.14	-0.659	3.89	1.98	6.52

Table 2.9

Observations:

- Ten years old (2013)
- Batteries are in bad condition need Cleaning/maintenance/replacement
- Very low Pf at 3 Phase Input voltages are low, to be investigated and rectified

3.3 Architecture Building

3.3.1 30kVA (Basement)

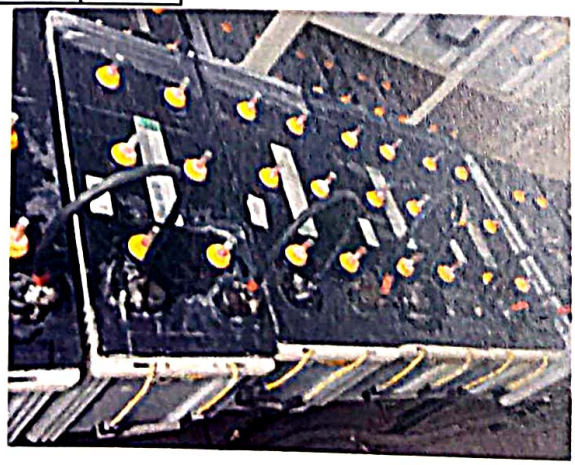
Input	V	I(Amps)	kW	kVA	kVAr	pf	H3	H5	H7
R	244.6	6.52	1.31	1.59	-0.91	-0.821	-	1.76	2.43
Y	243.7	6.28	1.24	1.53	-0.89	-0.813	-	1.78	2.89
B	248.9	6.31	1.32	1.57	-0.85	-0.842	-	1.57	2.71
		TOTAL	3.88	4.70	-2.65	-0.825	O/P Freq 50.1		
Output	231	14.2	2.40	3.28	-2.23	-0.733	3.87	2.53	1.91

Table 3.0

3.3.2 Standby 6kVA Single Phase (Basement)

	V	I(Amps)	kW	kVA	kVAr	pf	
Input	236.3	1.65	0.14	0.39	-0.37	-0.351	
Output	231.0	1.41	0.10	0.33	-0.31	-0.313	50.1Hz

Table 3.1



Observations:

- The UPS seems to be in good condition
- Batteries need Cleaning/maintenance.

3.4 Admin Main Building

3.4.1 5th Floor HyKom 25kVA (next to Boys Toilet)

Input	V	I(Amps)	kW	kVA	kVAr	pf	
R	240	2.14	0.21	0.51	0.47	0.417	
Y	242	3.01	0.31	0.73	0.66	0.427	
B	240	2.54	0.23	0.61	0.56	0.377	
		TOTAL	**0.76**	**1.85**	**1.69**	**0.407**	
Output	230	1.33	0.18	0.31	0.25	0.584	50.1Hz

Table 3.2 No harmonics or Neutral current

3.4.2 5th Floor 30kVA 508 (next to Faculty Room 507) PCS2317722

Input	V	I(Amps)	kW	kVA	kVAr	pf	
R	240	6.371	0.78	1.53	1.32	0.508	
Y	241	6.061	0.58	1.46	1.34	0.399	
B	240	6.293	0.70	1.51	1.34	0.465	
		TOTAL	**2.06**	**4.50**	**3.99**	**0.457**	
Output	230	5.106	0.90	1.17	0.75	0.769	50.1Hz

Table 3.3 No harmonics or Neutral current

3.4.3 4th Floor 25kVA 408 (next to Faculty Room 407)

Input	V	I(Amps)	kW	kVA	kVAr	pf	
R	241	8.787	1.19	2.12	-1.75	-0.561	
Y	241	8.671	1.25	2.09	-1.67	-0.599	
B	229	8.531	1.10	1.95	-1.61	-0.565	
		TOTAL	**3.54**	**6.16**	**-5.04**	**-0.575**	
Output	219	7.314	1.09	1.60	-1.17	-0.681	50Hz

Table 3.4 H3 2.9A; H5 1.9A; H7 1.5A present at output

3.4.4 4th Floor 30kVA (next to Boys Toilet)TCS2317721

Input	V	I(Amps)	kW	kVA	kVAr	pf	
R	241	3.941	0.38	0.95	-0.87	-0.403	
Y	240	3.816	0.40	0.92	-0.82	-0.441	
B	241	3.577	0.30	0.86	-0.81	-0.351	
		TOTAL	**1.09**	**2.73**	**-2.50**	**-0.398**	
Output	229	3.191	0.40	0.73	-0.61	0.553	50Hz

Table 3.5 UPS Good Batteries good

3.4.5 1st Floor HyKon 25kVA A118 (next to Boys Toilet)

Input	V	I(Amps)	kW	kVA	kVAr	pf	
R	240	8.34	0.56	2.00	-1.92	-0.278	
Y	239	4.64	0.45	1.11	-1.01	-0.407	
B	241	5.17	0.54	1.25	-1.12	-0.435	
		TOTAL	**1.55**	**4.36**	**-4.06**	**-0.373**	
Output	237	1.31	0.17	0.31	-0.26	0.551	50.1Hz

Table 3.6 UPS Good Batteries good

3.4.6 1st Floor HyKon 30kVA (Near Dep Library) PFC2234413

Input	V	I(Amps)	kW	kVA	kVAr	pf	
R	240	5.511	1.13	1.32	-0.68	-0.857	
Y	242	5.415	1.14	1.31	-0.65	-0.867	
B	240	5.267	1.08	1.26	-0.65	-0.856	
		TOTAL	**3.35**	**3.90**	**-1.99**	**-0.860**	
Output	230	12.46	2.26	2.87	-1.76	0.788	50.1Hz

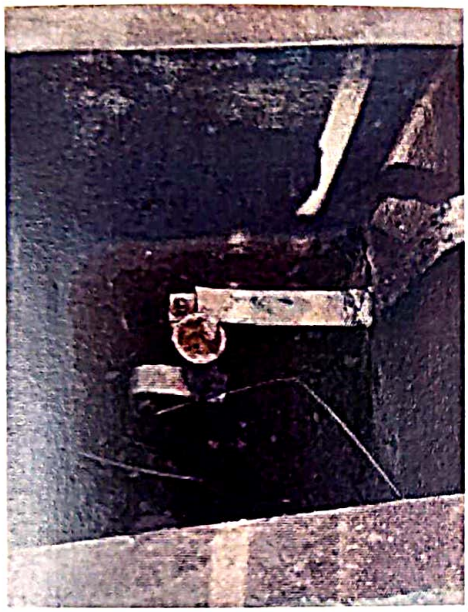
Table 3.7 UPS Good Batteries good

Observations and Recommendations:

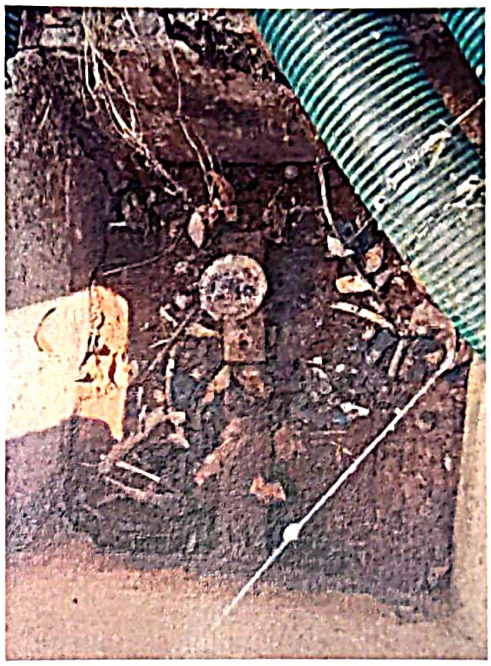
- All the UPS at the main Admin building seem to be in good condition
- All Batteries at the Main Admin building are also in good condition, however, they need regular cleaning
- The Batteries at the Architecture building need Cleaning/maintenance.
- The UPS at the Mech, Civil and Polytech block are very old and their efficiencies are low i.e. conversion from 3 Phase to 1 Phase output, hence replacement of them to be considered.
- **It would be a good idea to consider 3 Phase input to 3 Phase output type of UPS, as they are generally more efficient. The batteries associated with these also may need replacement.**

4 Earth Pit -Test Results

The major electrical Sources installed in KSSEM as listed above are the outdoor oil-cooled 500kVA transformer and a DG of capacity of 250kVA. For the safety of the users it is **mandated** that these sources MUST have their neutral conductors earthed through Copper flat conductors to a well maintained earth pits whose ground resistances should be less than 2Ω. The tested values are well within this limit and are given in the table below. However, they need periodic maintenance and replacement of the connecting fasteners as some of them are found to be oxidised.



DG Neutral EP



Trafo Neutral – 2 EP

Test Report for Neutral Earth Pits

Tested On Date:12/01/2024
Next Due On : 11/01/25

Report No.: EE/02/01-24
Page No.: 1 of 1

Site : **KSSEM**
Holiday Village road,
Vajarahalli, Mallasandra,
Bengaluru 560109 Karnataka

Standards Used: -

Nomenclature	Make	Serial Number	Trace ability	Cal. Validity
Earth Tester	CIE DET 2000	200019690	EIC	Sep.2024

Sl No	Location Description	Resistance Ω	Remarks
	DG Area		
01	Earth Pit-01 250kVA DG Neutral	0.62	Bolts rusted
	Transformer Yard		
04	Earth Pit-02 Trafo Neutral - 1	0.27	Passed
05	Earth Pit-03 Trafo Neutral - 2	0.30	Passed

Note:

1) Please mark the borders of the pit with Yellow/Green paint and the lid/Cover with yellow and black stripes.
2) The resistance value with the test and Due dates to be marked on the lids/Covers

TESTED BY		For e-XCEL ENERGY
Vishwanath V	E-XCEL ENERGY BANGALORE	
Technican		Authorized Signatory

5 LIST OF RECOMMENDED ENERGY SAVINGS OPPORTUNITIES AT KSSEM

ENERGY CONSERVATION MEASURES

ECM-1: To replace the battery and UPS systems spread in various locations in the Mech, Civil and polytechnic block to one or two centeralised locations

PRESENT LOCATION OF THE SYSTEM AND PROPOSAL

- Consolidation of UPS system in the above area and to change them 3 Phase input to 3 Phase output type, which, are generally more efficient, would contribute to energy savings.
- The batteries associated with these also may need replacement.

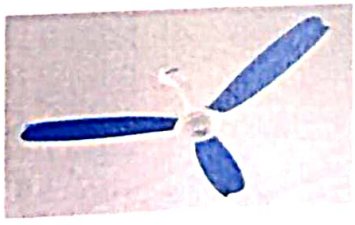
ECM-2: Replace identified ceiling fans with energy-

efficient fansPRESENT SYSTEM

- KSIT has all conventional ceiling fans installed and operated in the class rooms, labs and hostels at the college campus
- Ceiling fans are the major loads at the KSSEM campus.
- Rated power for the existing fans are around 80W and will consume around 80 watts at full speed

PROPOSAL

- Replace existing conventional fan with high energy-efficient fans
- The rated power of the proposed fans will be around 35 W at maximum speed and will consume powervarying 10 W to 35 W based on the speed
- The proposed fan is available with variance of color and comes with handy remotes too.



PROPOSED FAN

ESTIMATED BENEFITS

Recurring annual cost savings	: Rs. 95,722 (17,172 units saved)
Capital Investment (approximate)	: Rs. 10,10,000
Payback Period	: 126 months
Savings measurement	: Direct

ECM-3: Install Solar Water Heaters

PRESENT SYSTEM

- KSIT has Geysers installed at the Boy's and Girl's Hostels
- At 3hours a day for 300 working days, the energy consumption is estimated to be 32,400 units.
- This costs KSIT about Rs 180,500 annually.

PROPOSAL

- Use the solar Water heater water in a mixing tank which acts as the feed water to the heap pumps with suitable set point so that the Heat pumps will operate only when the temperatures are low from the solar tank.

ESTIMATED BENEFITS

Recurring annual cost savings	: Rs. 1,80,500 (32,400 units saved)
Capital Investment	: Rs. 21,70,500
Payback Period	: 12 months
Savings measurement	: Direct

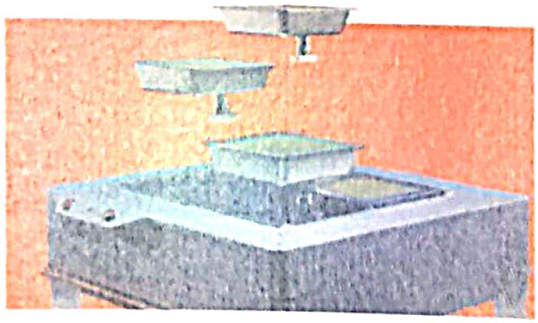
ECM 4: REPLACE CONVENTIONAL TYPE LPG FIRED STOVES WITH AN ENERGY-EFFICIENT BURNER TO SAVE GAS CONSUMPTION

PRESENT SYSTEM

- Kitchen gas stoves are installed with conventional type burners
- Maximum thermal efficiency of conventional type burner is in the range of 36 - 45 %
- For ease of ignition purpose the idle gas is continuously blown in each kitchen gas burners irrespective of gas stove usage. See typical pictures in the following section of existing type burners

PROPOSAL

- Replace conventional type LPG gas stove and burners with patented energy-efficient radiant heating technology using the same LPG. The 24 gas stoves are recommended for replacement with the new radiant heating stoves.
- The proposed heating system thermal efficiency is in the range of 65 - 68 % which is equivalent to about 30 % savings in LPG
- Proposed heating system is indirect heating, so it improves even heat distribution over the vessel/pan and there is no carbon soot formation on the vessels
- This scheme is successfully implemented in several Hotels and staff canteens across India including Taj and ITC group of hotels.



PROPOSED ENERGY-EFFICIENT STOVES

ESTIMATED BENEFITS

Recurring annual cost savings	: Rs. 220,977
One-time cost of implementation	: Rs 670,000
Payback period	: 36 months
Savings measurement	: Direct

6 Bio Waste Management

Bio waste is segregated and that which can be composted are diverted to the Compost/vermi-culture area and the compost used for the garden could be implemented in the Campus.

8 OBSERVATIONS

Along with the above other initiatives mentioned in the previous section the same will be considered by the management based on the feasibility and cash flow of the institution.

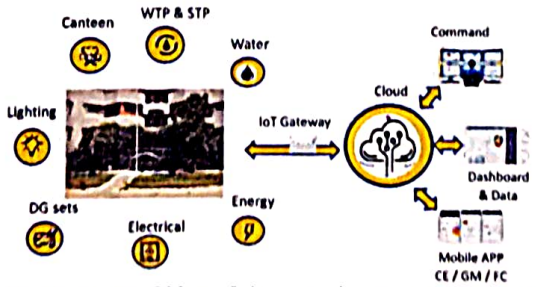
Internet of Things (IoT) based Automation Solutions:

Today the conventional method of monitoring and controlling is getting replaced/upgraded with Artificial Intelligence (AI) – Internet of Things (IoT) based automated solutions. AI-IoT automation promises "intelligent solutions," where management can run the facility wherever they are instead of physically from control room or in-situ. Intelligent automated operations are far simpler, easy to understand and operate, have accurate information all the time, eliminate inefficiencies, sustain the gains. Accordingly, AI-IoT automation is the new normal.

On a need basis, KSSEM could take the assistance of e-XCEL for detailing out IoT schemes as a separate assignment. In such a case, if desired by KSSEM, Proof-of-Concept (PoC) can be carried out by E-XCEL for meeting any priority requirements.

Benefits of AI IoT based automated solutions

- Identify the pain points and adapt mitigating solutions which would concurrently yield monetary benefits.
- Through the sensors and monitors coupled with connected load, will automate the utility equipment operation and control energy consumption based on optimum level without hindering the operation of the facility.
- Other key monitoring sensors and meters will help in the benchmarking, 365-day monitoring of major key energy areas and help management to help reduce operating cost.



A typical representation of IoT based Automation System for a College Campus

Note: These are observations from the data collected during the audit period; any changes subsequently made are not part of the report.