

NALLAMUTHU GOUNDER MAHALINGAM COLLEGE

(Autonomous Institutions -Affiliated to Bharathiar University)

ISO 9001:2015 Certified and Re-Accredited with B Grade by NAAC



POLLACHI – 642001,

TAMILNADU, INDIA



ENERGY AUDIT REPORT

AUDIT / REPORT BY



ALCHEME GREEN ENERGY COMPANY

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ACKNOWLEDGEMENT

We at ALCHEME GREEN ENERGY COMPANY, Madurai are thankful to the Principal for giving us the opportunity to carry out Energy audit of Nallamuthu Gounder Mahalingam College , Pollachi -642 001, Tamilnadu, India. Alcheme Green Energy Company team is also thankful to all other supporting Officers / Staffs of the above institute for their wholehearted support, hospitality and the courtesy extended to the Audit team during the course of the visit.

The following officers from Alcheme Green Energy Company under the guidance of Mr. C. Jebaraj, B.Tech., have carried out the Energy Audit.

Name	Qualifications	Certification Number
Mr. C. Jebaraj	B.Tech., PDGEM., DIS., BEE Certificated Energy Auditor, IRCA Certified Lead Auditor - OHSMS Internal Auditor-QMS	EA-9847
Mr. S. Lakshmana Kumaran	B. Tech., MSc.,(Env. Science), MBA., IRCA Certified Lead Auditor ISO 14001 EMS	UID - 351851

The following staff from the Institution participated in the audit process

Name	Qualification	Designation
Dr.R.Muthukumar	M.A., M.Phil., B.Ed., Ph.D.,	Principal
Dr.R. Manicka Chezian	M.Sc., M.S., Ph.D.,	IQAC Co-Ordinator
Thiru. K.Srinivisan	M.C.A	Associate Professor Department of Computer Science ERP Co-Ordinator
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Dr.P.Archanaa	M.Com., M.Phil., PGDCA., Ph.D., M.A[HINDI]	Assistant Professor PG Department of Commerce with Computer Applications
Dr.A.Kanakaraj	MCA., M.Sc., M.Phil., Ph.D., DIR	Assistant Professor PG Department of Computer Science

Summary of Audit

Energy audit of Nallamuthu Gounder Mahalingam College and Hostel was carried by Alcheme Green Energy Company. The Audit team has gone through the data related to TNEB GRID Electrical Energy, Renewable Energy , Diesel and LPG consumption. A study was also carried out on Renewable energy utilisation and Energy Conservation measures to reduce energy consumption.

During the visit it was observed that Nallamuthu Gounder Mahalingam College strictly follows reduce, reuse and recycle policy to limit energy usage. The concept of energy conservation is disseminated among the students and staffs through various seminars/workshops and training programs.

We hope that the results presented in the energy auditing report will serve as a guide for the institution on the existing energy related practices and resource usage.

The audit outputs and recommendations are summarised as follows

- Annual electricity consumption from TNEB GRID is around 2,13,063 units during the year 2020-2021. Due to lockdown, energy consumption is less compare to previous years
- Electrical Energy consumption from Diesel Generator – 14,850 units.
- Solar Power Electrical energy consumption- 438 units
- Total Electrical Energy consumption – 2,28,351 units.
- Minimum energy consumption during lock down period is 10,000 units per month.
- More Renewable energy (Grid Interactive Roof Top Solar Power Plant) utilisation shall be planned in the coming years.
- LPG consumption - 1501 Kgs
- Solar water heater capacity of 4,100 LPD installed
- High Volume low speed fans are provided at auditorium to reduce energy consumption
- BEE Star rated appliances are being used.
- Battery Room Housekeeping to be improved.

- Proper History card to be maintained to track the UPS and Battery conditions
- Fire Hydrant system water pump to be serviced
- Lightning arrestor to be provided inside the campus at higher elevation
- Current Harmonics levels are above the limit for 30KVA and 20 KVA ups.

ENERGY SAVING POTENTIALS

1. Conventional tube lights shall be replaced with LED tube lights

Replacement cost for 100 LED tube lights-Rs 200x100= RS 20,000

Payback period-5.5 months

Cost savings for 100 LED tube lights-Rs 44,000 / year

Energy savings for 100 LED tube lights-5,500 units/ year

2. Conventional fans shall be replaced with energy efficient fans

Replacement cost for 100 Nos. ENERGY EFFICIENT FAN-Rs 2,800x100= RS 2,80,000

Cost savings for 100 Nos. ENERGY EFFICIENT FAN -Rs 1,65,600 / year

Energy savings for 100 Nos. ENERGY EFFICIENT FAN -20,700 units/ year

Payback period 20 months

- Remaining Conventional Tube lights shall be replaced with LED tube lights in a phased manner
- 5 Star rated Energy efficient electrical equipments shall be procured in future
- Automatic power switch off systems may be introduced in the required areas

We are happy to submit this detailed energy audit report to the Nallamuthu Gounder Mahalingam College



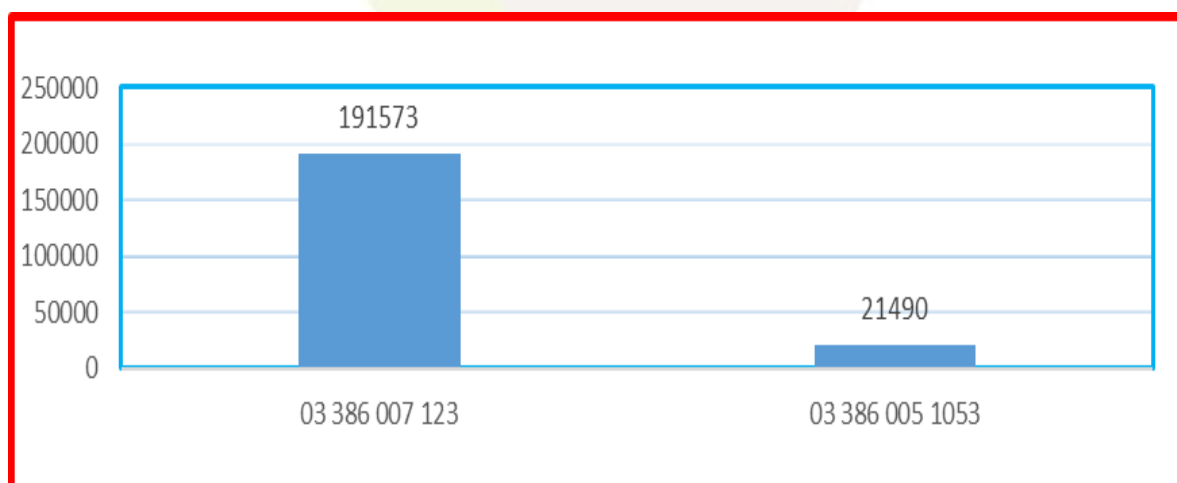
**Alcheme Green Energy Company
Madurai**

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1. Service connection, Tariff, Load and Energy consumption details

TNEB SERVICE CONNECTION DETAILS				
Sl.No	SERVICE NO	BLOCK/BUILDING NAME	Tariff	connected load in KW
1	03 386 007 123	College	LM2B2	149.52
2	03 386 005 1053	Hostel	LM2B2	14.48
	Total			164

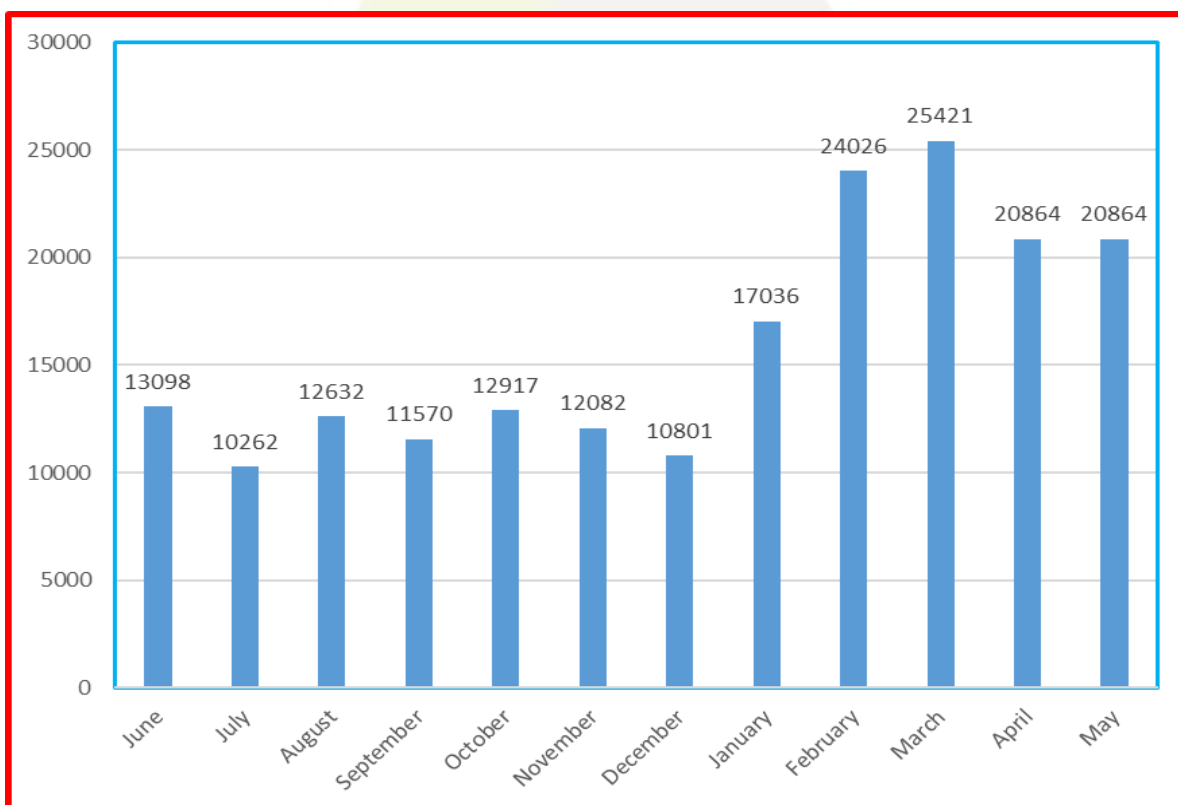
TNEB ENERGY CONSUMPTION					
Sl. No	SERVICE NO	TARIFF	Units Consumed	Bill Amount - Rs	Average Unit cost-Rs
1	03 386 007 123	LM 2B2	191573	1591739	8.31
2	03 386 005 1053	LM 2B2	21490	184489	8.58
	Total		213063	1776228	



College and Hostel Energy consumption during the year 2020-2021

2. Electrical Energy consumption in the college service number 03 386 007 123

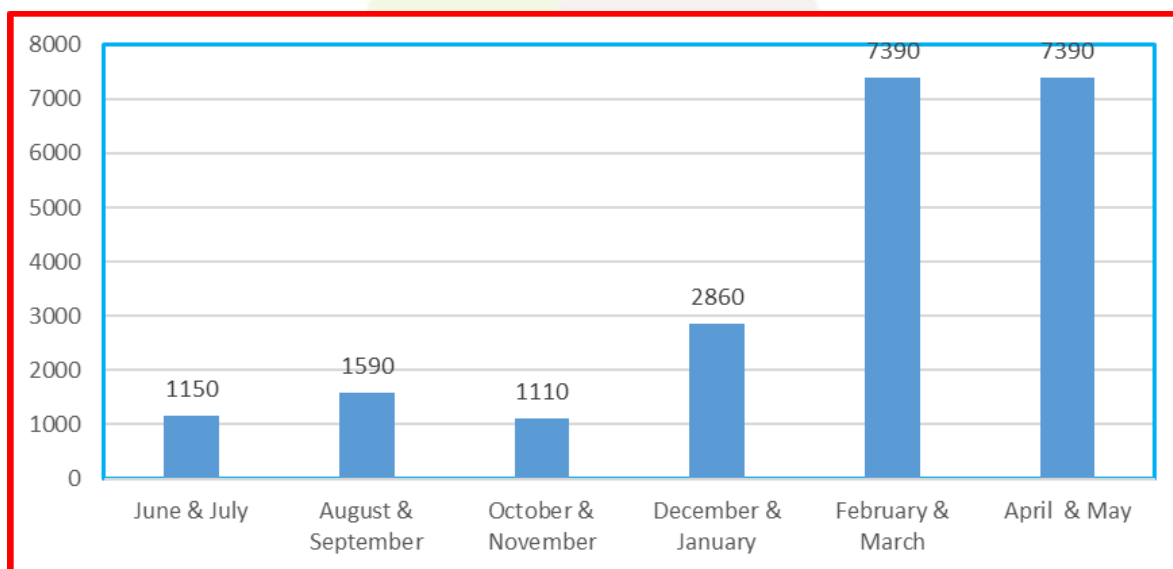
1.Service No 03 386 007 123 149.52 KW 3 Phase Tariff LM2B2					
Sl. No.	Assessment Date	Months	Units Consumed	Bill Amount - Rs	Unit cost-Rs
1	29.06.2020	June	13098	109987	8.40
2	27.07.2020	July	10262	87674	8.54
3	29.08.2020	August	12632	106323	8.42
4	26.09.2020	September	11570	97957	8.47
5	27.10.2020	October	12917	108572	8.41
6	27.11.2020	November	12082	101983	8.44
7	25.12.2020	December	10801	91810	8.50
8	27.01.2021	January	17036	141342	8.30
9	25.02.2021	February	24026	196225	8.17
10	26.03.2021	March	25421	207224	8.15
11	28.04.2021	April	20864	171321	8.21
12	31.05.2021	May	20864	171321	8.21
	Total		191573	1591739	8.31



Month wise Energy consumption in the college

**3. Electrical Energy consumption in the hostel service number
03 386 005 1053**

2.Service No 03 386 005 1053 14.48 KW 3 Phase Tariff LM2B2					
Sl. No.	Assessment Date	Months	Units Consumed	Bill Amount - Rs	Unit cost-Rs
1	24.07.2020	June & July	1150	10862	9.45
2	25.09.2020	August & September	1590	14381	9.04
3	26.11.2020	October & November	1110	10547	9.50
4	28.01.2021	December & January	2860	24371	8.52
5	26.03.2021	February & March	7390	60068	8.13
6	29.05.2021	April & May	7390	64260	8.70
	Total		21490	184489	8.58

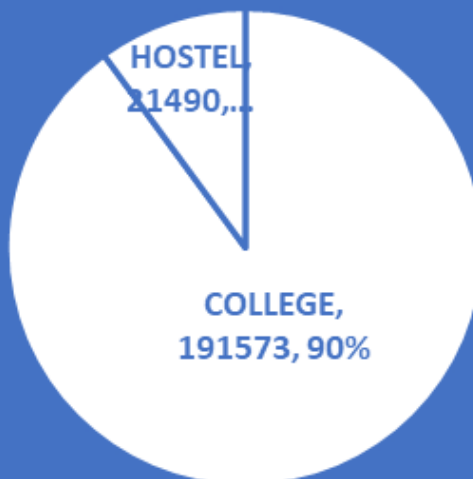


Bi Monthly Energy consumption in the Hostel

4.TNEB Grid Energy consumption pattern in College and Hostel

SL.NO		UNITS CONSUMED
1	COLLEGE	191573
2	HOSTEL	21490
	TOTAL	213063

COLLEGE AND HOSTEL ENERGY CONSUMPTION



5.DG set Electrical Energy consumption

College Diesel Generator



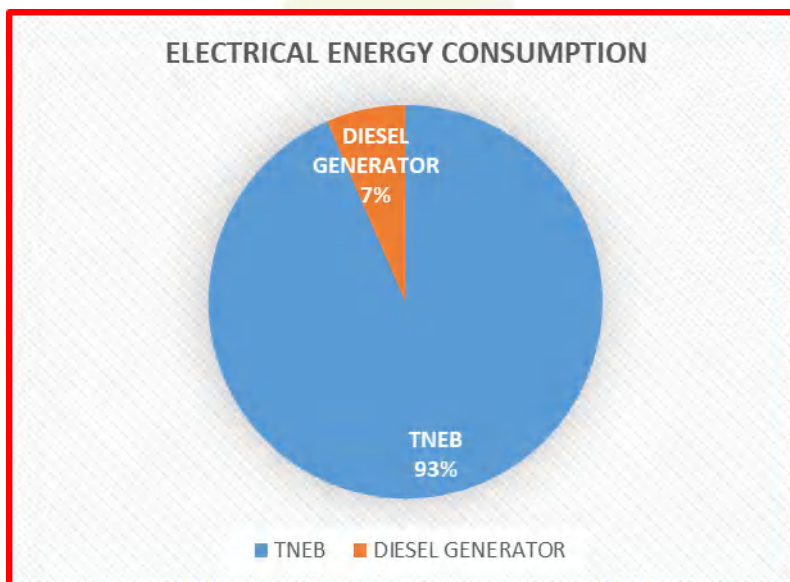
Hostel Diesel Generator



- Total Diesel consumption-4950 litres
- Power generation -14,850 units

6.Total Conventional Electrical Energy Consumption details

SL.NO		UNITS CONSUMED
1	TNEB	213063
2	DIESEL GENERATOR	14850
	Total	227913



7.Renewable Electrical Energy-Solar Electrical energy Consumption



- Solar Street Lights -5 Nos
- Power of LED lamp-20watts
- Total power generation - 438 units

ALGEO

8. Conventional Thermal Energy consumption – LPG & Diesel (for Transport)

LPG

LPG cylinders used- commercial cylinders of 19 kgs capacity

- LPG consumption in the hostel mess during the year 2020-2021- 78 cylinders
- LPG consumption in the college during the year 2020-2021- 1 cylinder.
- **Total LPG consumption during the year 2020-2021- 1501 KGs(79 Cylinders)**



Transport

- ❖ College is not operating any bus for students
- ❖ Encourage maximum students to come by public transport

9. Renewable Thermal Energy

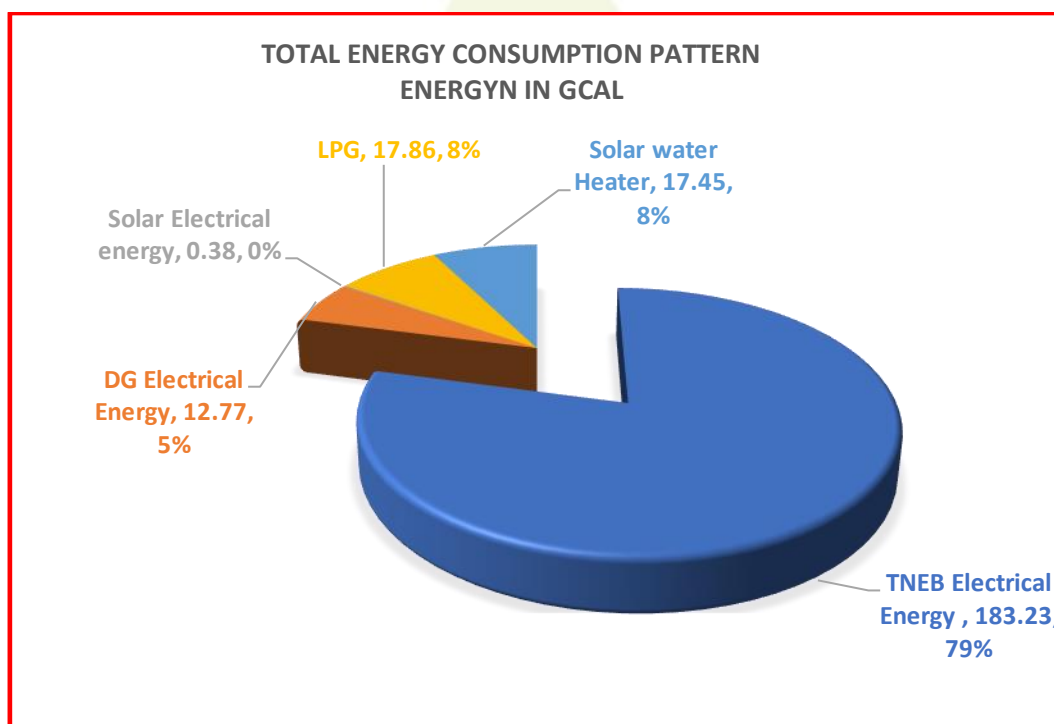
Total capacity of Solar Water Heaters-4100 Litters Per Day

	Boys Hostel 1000 LPD X 1
	Girls Hostel 1000 LPD X 1
	Girls Hostel 1000 LPD X 2 100 LPDX1

Due to more numbers of online classes, Hot water from the Solar Water Heaters are utilised for less no of days (79 days)

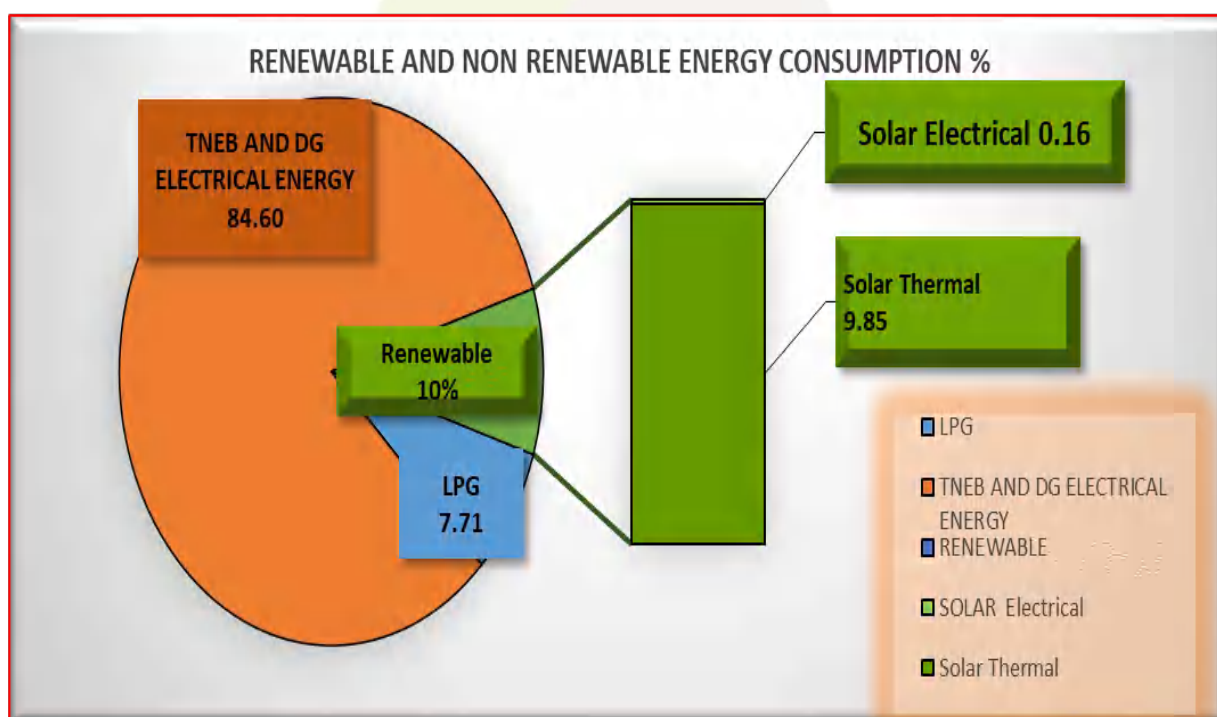
10.Total Energy consumption

SL.NO	TYPE OF ENERGY	ENERGY -GCAL
1	TNEB Electrical Energy	183.23
2	DG Electrical Energy	12.77
3	Solar Electrical energy	0.38
4	LPG	17.86
5	Solar water Heater	17.45
	Total	231.7



11. Renewable and Non Renewable(conventional) energy distribution

ENERGY CONSUMPTION	PERCENTAGE
NON RENEWABLE	
LPG	7.71
TNEB AND DG ELECTRICAL ENERGY	84.60
RENEWABLE	
SOLAR Electrical	0.16
Solar Thermal	9.85



12.The energy conservation measures followed

- High volume Low Speed fans are provided in the auditorium
- Maximum utilisation of day lights at auditorium, hostel and colleges
- Staff and Students are made aware of using public transport system
- Individual vehicle usage is reduced to the minimum level
- Periodical maintenance and overhauling of generators is being carried out
- The fans, lights, air-conditioners and other electronic and electrical equipments are switched off when not in use.
- Lights and fans are switched off by the students whenever they are out of hostel rooms
- Replacing conventional electrical light fittings with energy efficient Light-Emitting Diode (LED) bulbs.
- Replacing old high energy consuming appliances with star rated energy efficient appliances.
- Computers are switched to sleep mode or hibernate mode automatically when not in use.
- At the end of every practical session, Computer monitors and UPS are switched off.
- Soft copies are maintained instead of hard copies, to reduce power consumption and paper.



13.Major Electrical load details

Sl No	Equipment	Watts	Nos	Total watts	KW
1	Ceiling Fan	75	932	69900	69.9
2	Computer	180	560	100800	100.8
3	Printer	115	30	3450	3.45
4	LCD	240	30	7200	7.2
5	Light	36	199	7164	7.164
6	light	18	68	1224	1.224
7	Light	16	4	64	0.064
8	Light	11	131	1441	1.441
9	LED	32	88	2816	2.816
10	LED	18	193	3474	3.474
11	LED	20	235	4700	4.7
12	LED	9	236	2124	2.124
13	CFL	27	3	81	0.081
14	CFL	18	13	234	0.234
15	CFL	12	6	72	0.072
16	CFL	4	4	16	0.016
17	Sodium Light	250	27	6750	6.75
18	Pedestal Fan	60	12	720	0.72
19	Wall mounted fan	55	10	550	0.55
20	Xerox Printer	2100	5	10500	10.5
21	Water Doctor	750	12	9000	9
22	1 Ton AC	1000	9	9000	9
23	1.5 T AC	1500	20	30000	30
		HP	Nos		KW
1	Ceiling Fan	3	2	6	4.5
2	Motor	3	1	3	0.003
3	Motor	7.5	3	22.5	0.0225
4	Motor	5	1	5	0.005
5	Motor	2	1	2	0.002
6	Motor	1	1	1	0.001
	Hostel				
	Equipment	Watts	Nos	Watts	KW
1	Wet Grinder	1300	1	1300	1.3
2	Wet Grinder	750	1	750	0.75
3	Mixi	1500	1	1500	1.5
4	Mixi	750	1	750	0.75
	UPS				
	30 KVA	1			
	20 KVA	6			
	10KVA	1			
	6 KVA	1			
	3KVA	10			

Lighting Load

Total Lighting load	30.16	KW	
Contribution on Total lighting Load			%
LED Load	13.11	KW	43.48
CFL load	0.40	KW	1.34
Conventional lights	16.64	KW	55.18

Diesel Generators

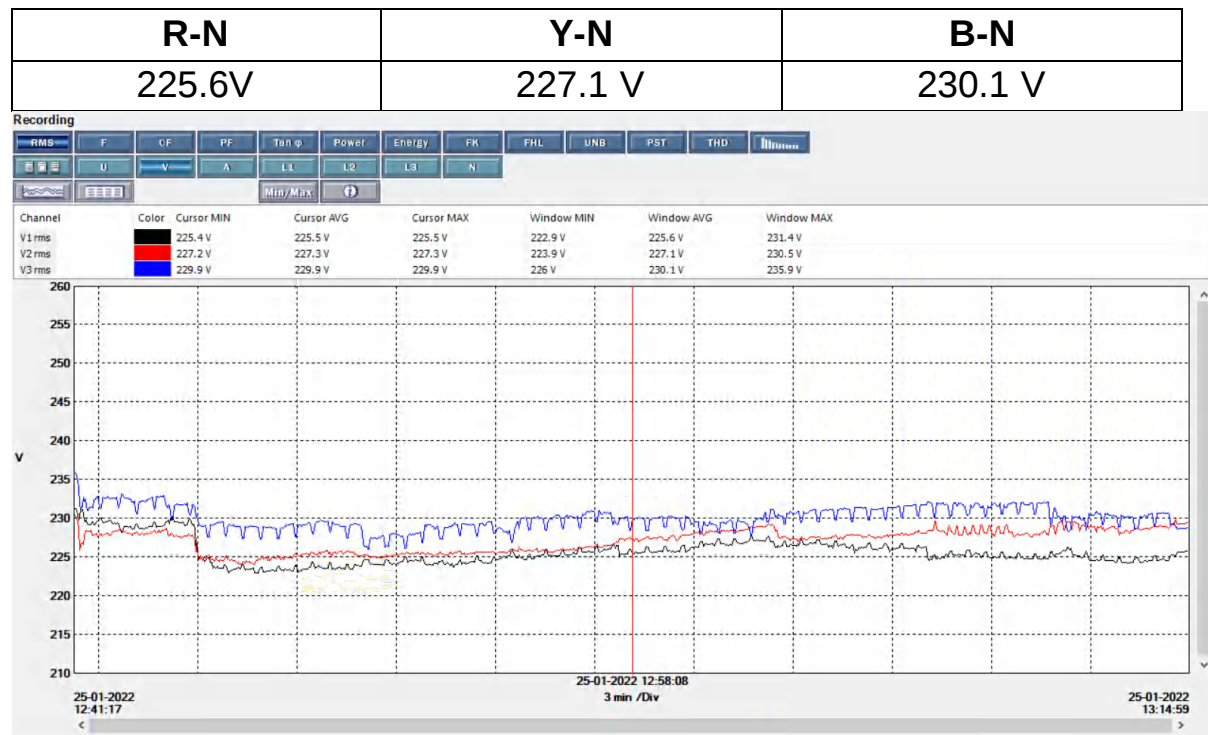
1. 200 KVA- 1- College
2. 62.5 KVA- 2 - College
3. 25 KVA-1- Hostel



14. Power Quality Study

14.1 Power quality study at Main power incomer point

14.1.1 Phase to Neutral- Voltage



Phase to neutral voltage is 225-230 V

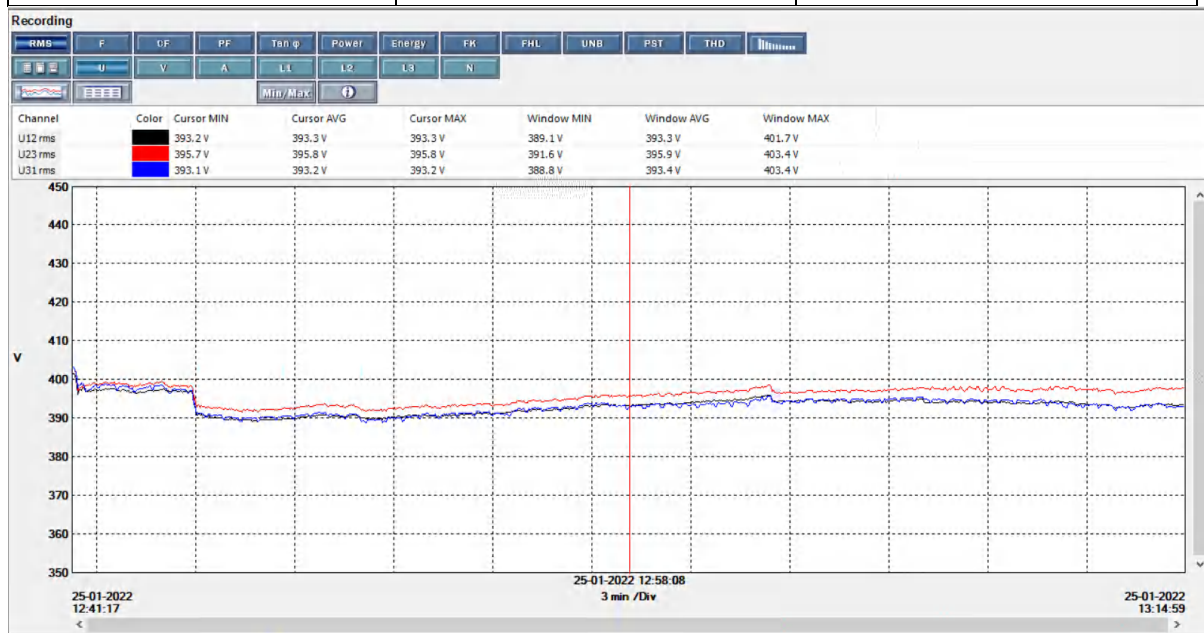
14.1.2 Phase to Neutral - Current



Phase to Neutral Current- 13.6 A

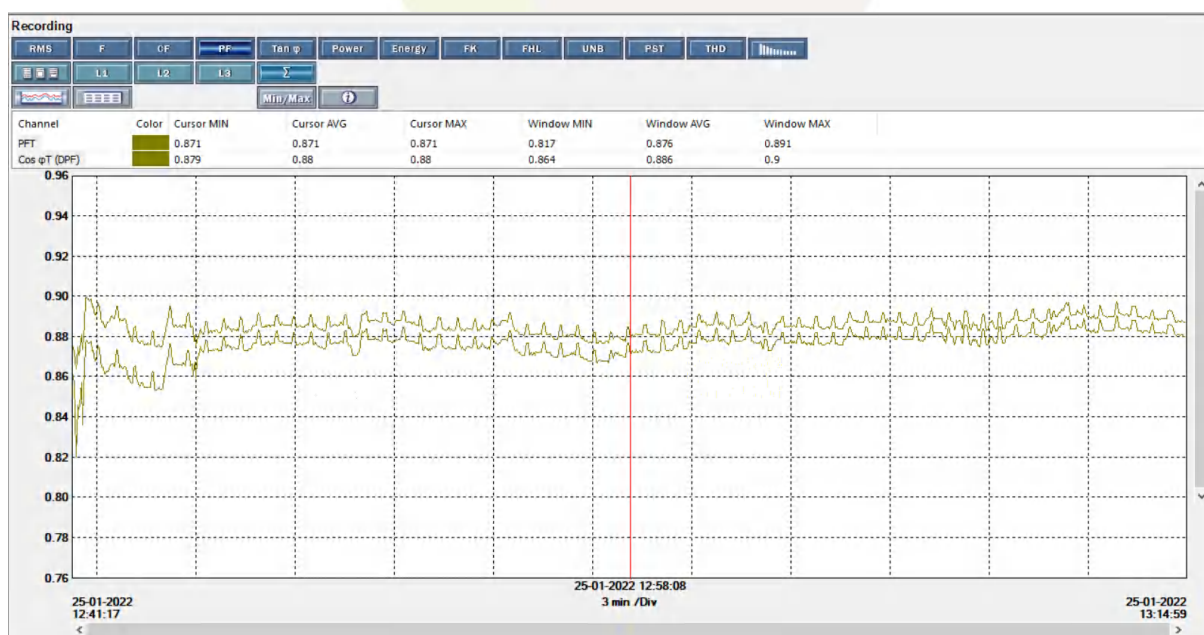
14.1.3 Phase to Phase – Voltage

RY	YB	BR
393.3V	395.9V	393.4V



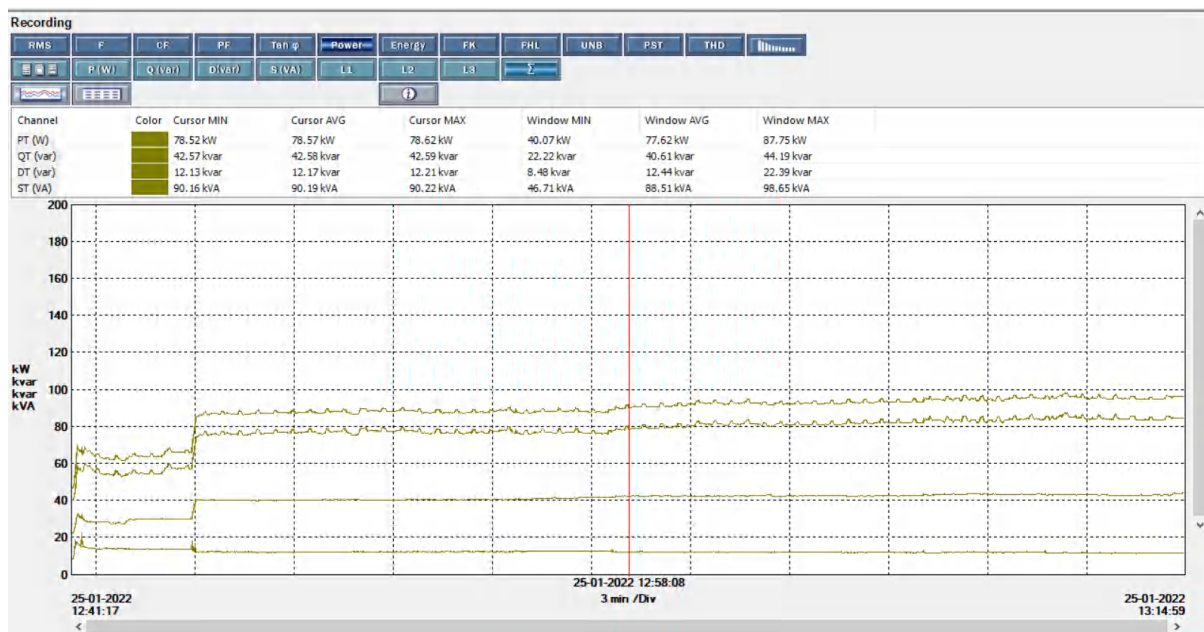
Voltage is between 393-396V only

14.1.4 Power Factor



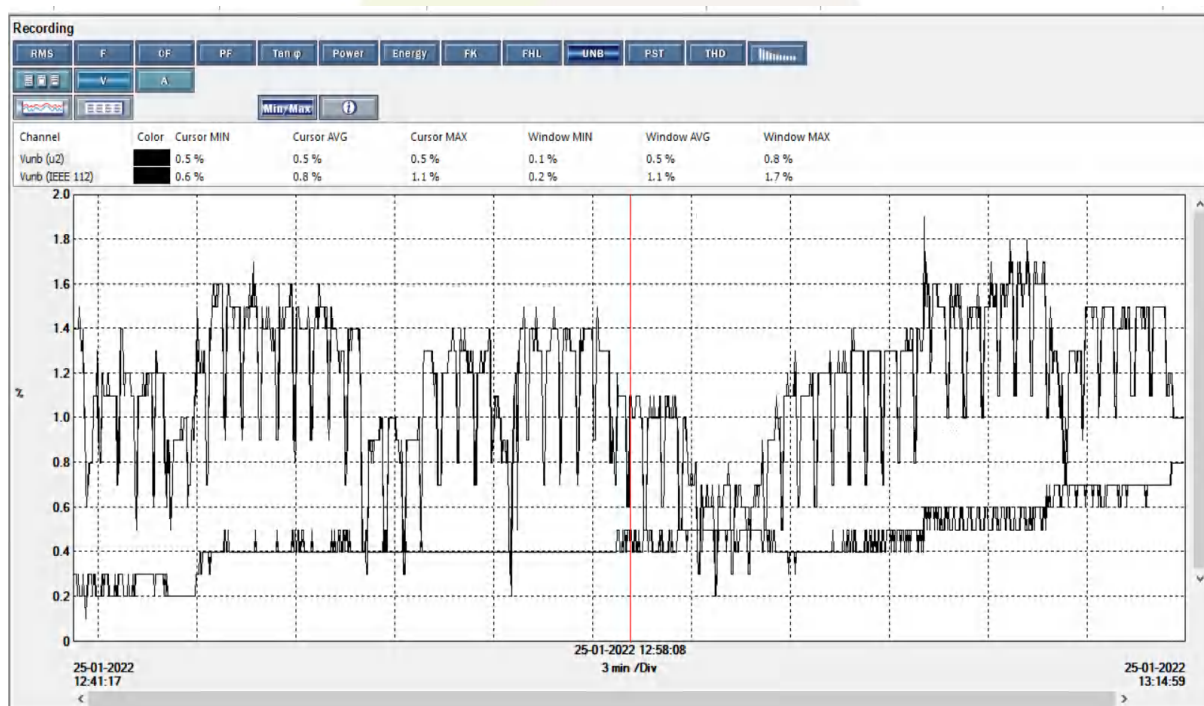
Power factor at 52 % Load- 0.886

14.1.5 Power



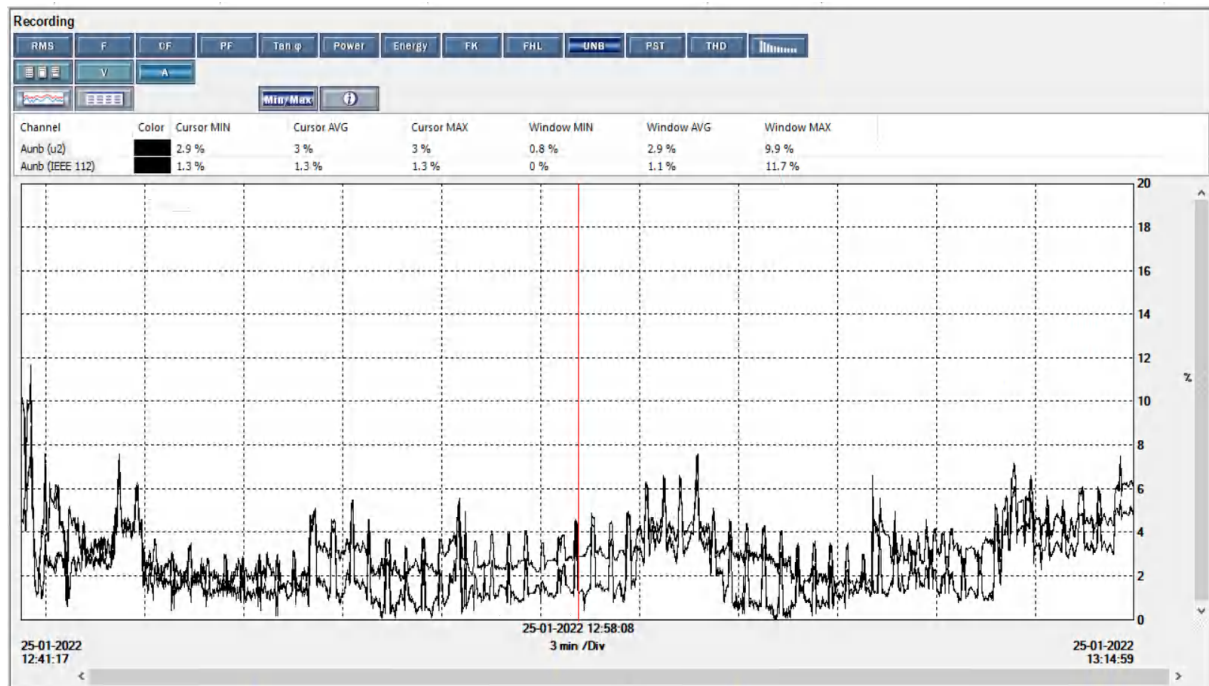
Maximum power reached during audit- 77.62 KW

14.1.6 Voltage Unbalance (Percentage)



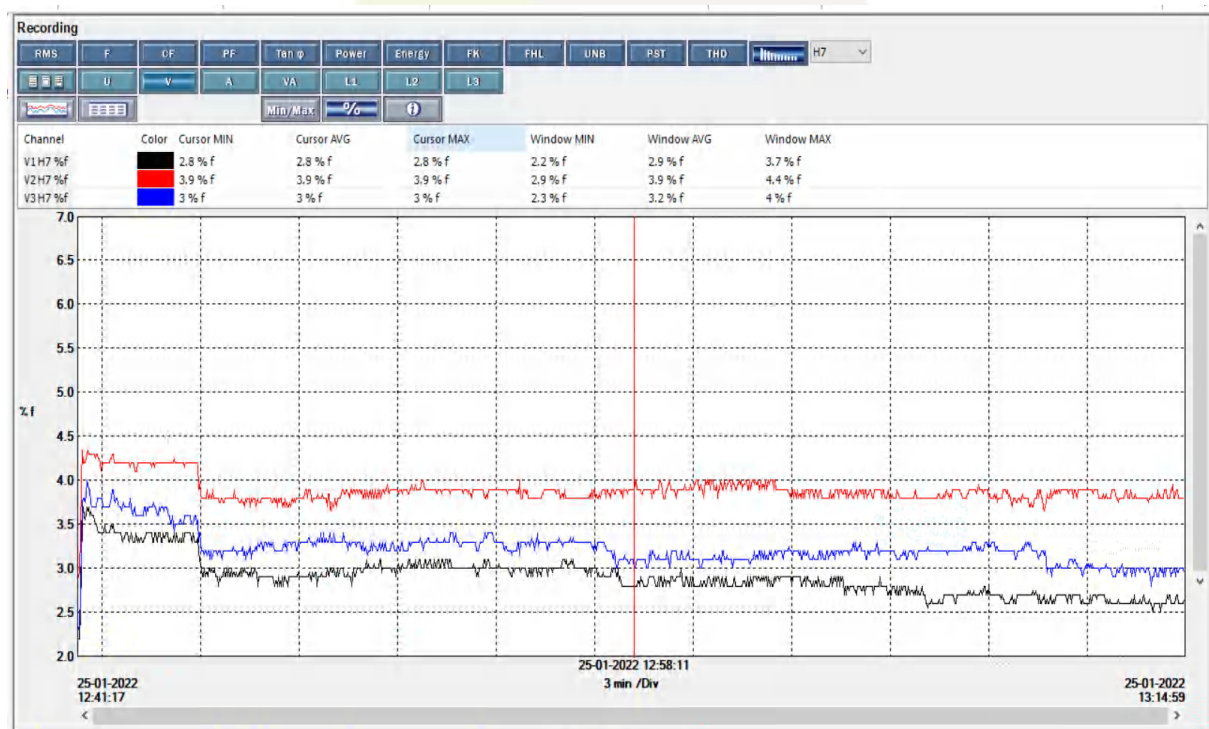
Voltage unbalance is 1.1% only

14.1.7 Current Unbalance (Percentage)



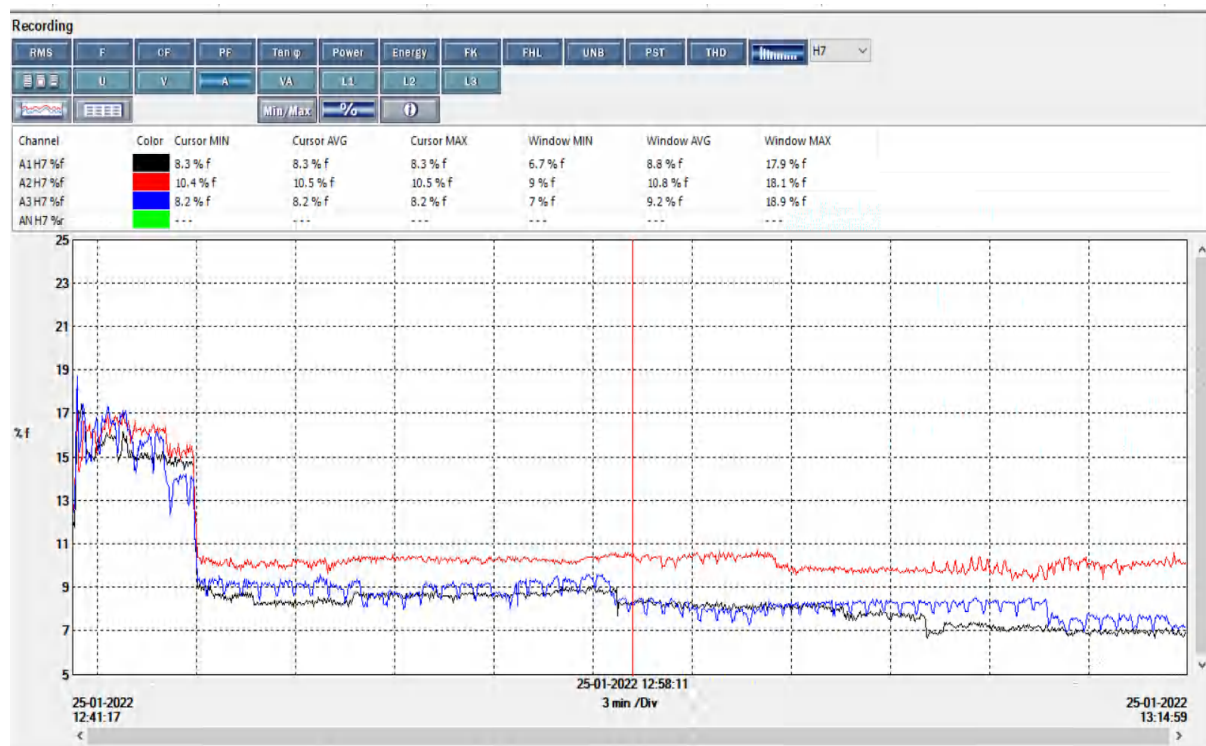
Current unbalance is 1.1 %

14.1.8 Voltage Harmonics (7th Harmonics -in Percentage)



Maximum value is 3.9 %

14.1.9 Current Harmonics (7th Harmonics -in Percentage)



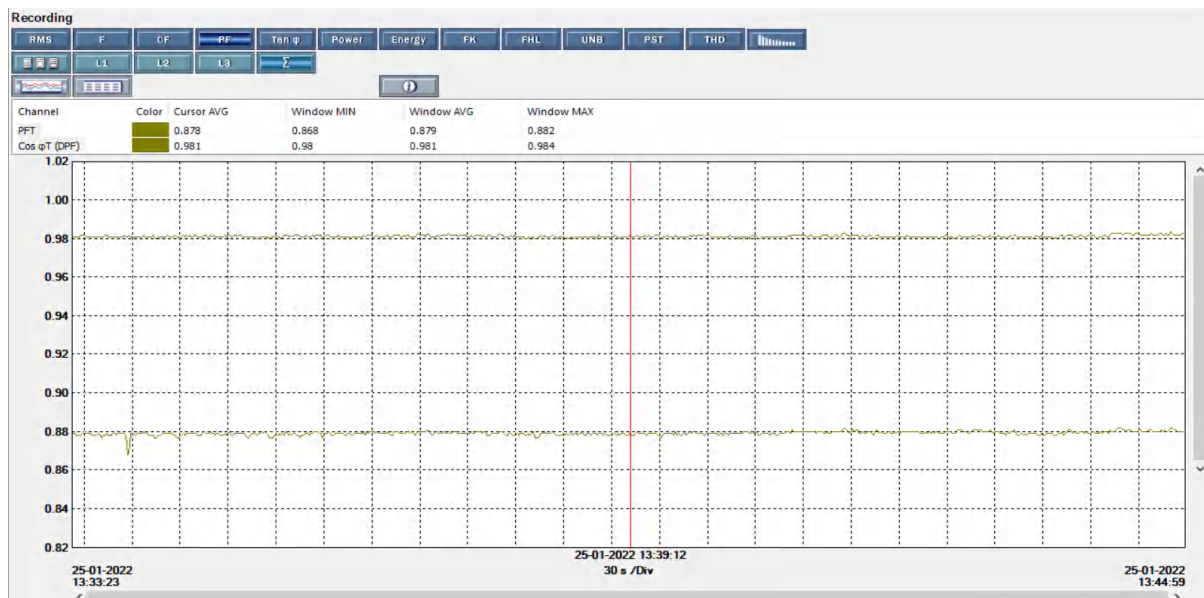
Maximum value is 10.8 %

14.1.10 Remarks

1. Bimetallic clamps to be provided in the power drawing point at EB post to improve the incoming voltage
2. Transformer Neutral earth to be revamped
3. Auto Power Factor control panel to be provided in the main power line to improve the power factor to 0.99 and reduce the energy losses
4. Voltage unbalance is within the limit
5. Current unbalance is within the limit
6. Voltage and Current harmonics levels are acceptable for main incomer
7. During the energy audit, maximum load given was 77.26 KW

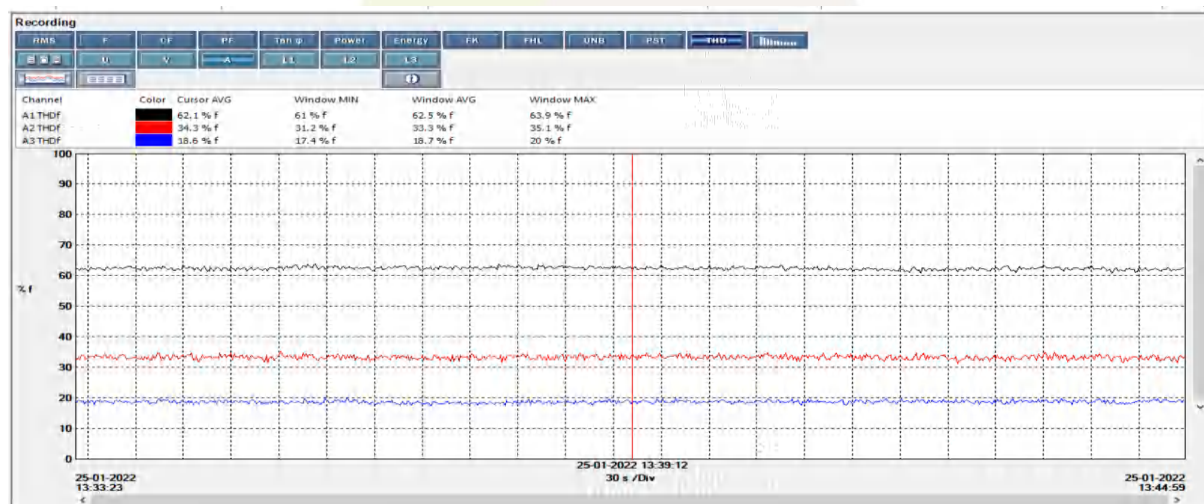
14.2 Power Quality study on OLD -20 KVA UPS- 3 Nos

14.2.1 Power Factor



Power Factor 0.981

14.2.2 Total Harmonics Distortion (Current)



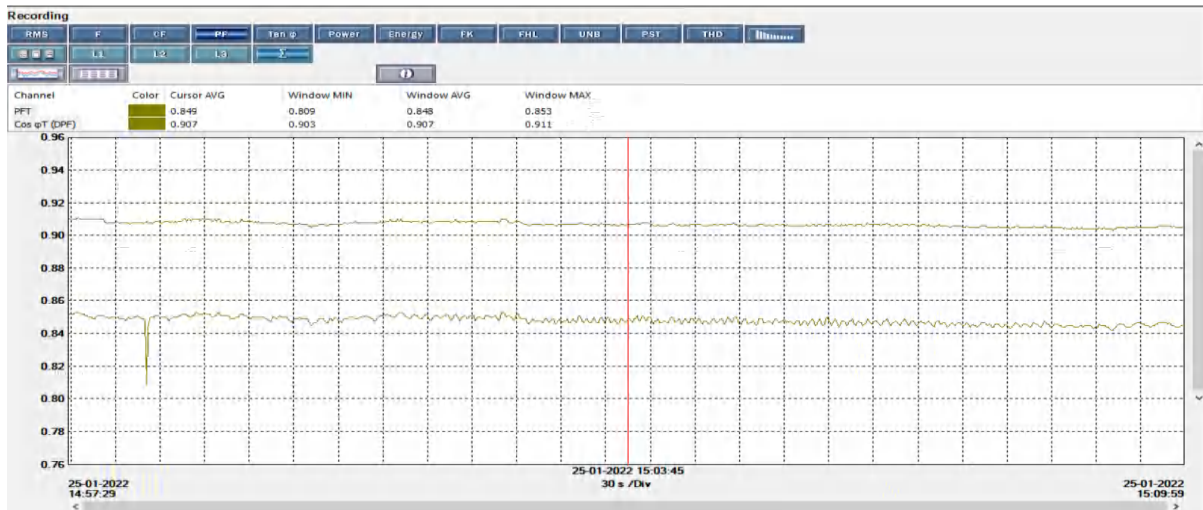
THD value is 62.5 %

14.2.3 Remarks

1. Current THD is 62.5 %. Limit is 8 %
2. Harmonics filter to be provided to reduce the harmonics level
3. Power Factor is normal

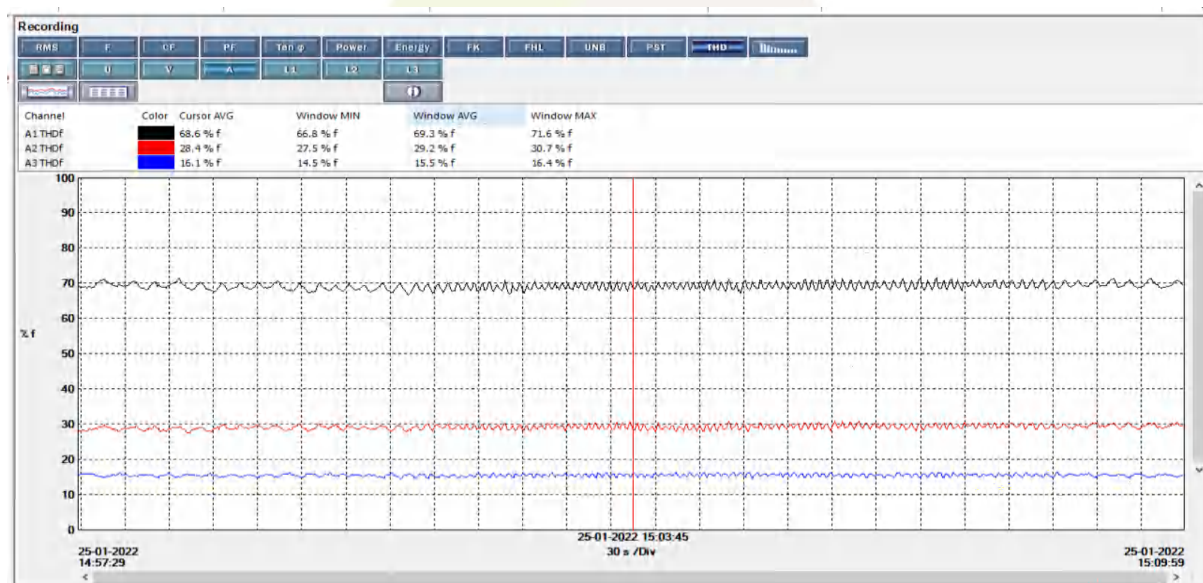
14.3 Power Quality study on 30KVA UPS 1 No & 20 KVA UPS-2 Nos

14.3.1 Power factor



Power factor is 0.907

14.3.2 Total Harmonics Distortion in percentage (Current)



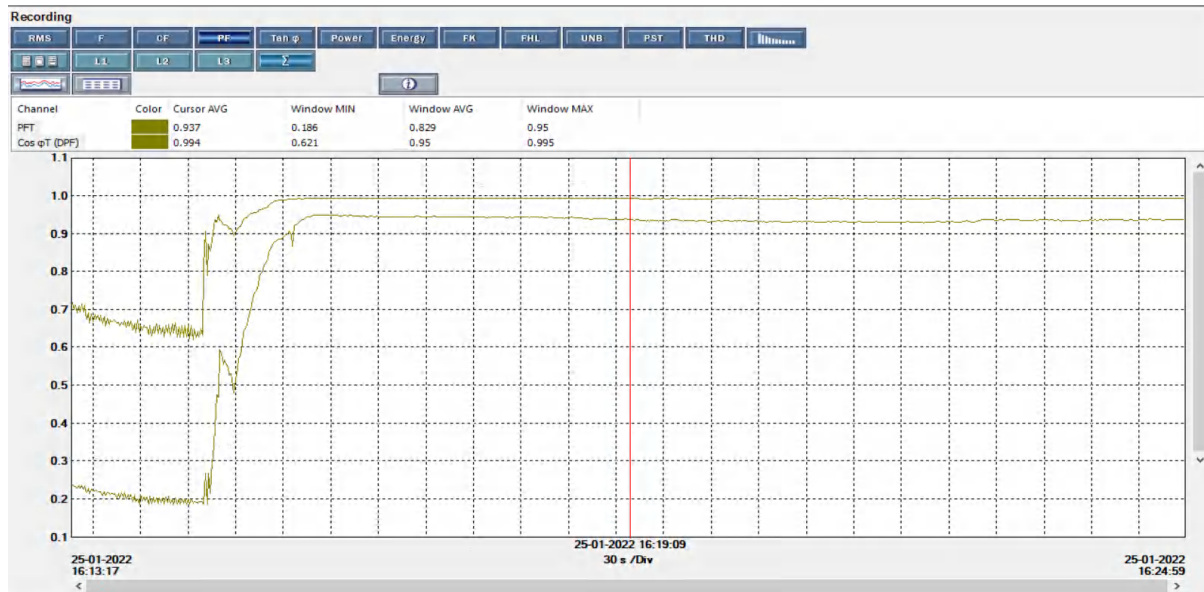
THD value is 69.3 %

14.3.3 Remarks

1. Current THD is 69.3 %. Limit is 8 %
2. Harmonics filter to be provided to reduce the harmonics level
3. Power Factor is within the acceptable level

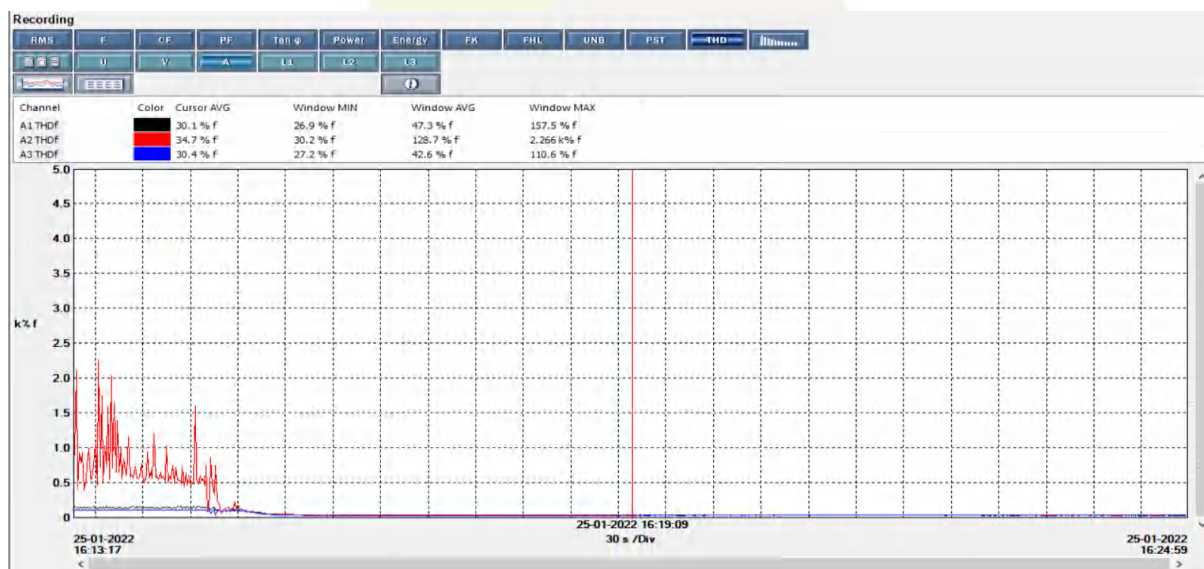
14.4. Power Quality study on 20 KVA New UPS-1 No

14.4.1 Power Factor



Power Factor is 0.95

14.4.2 Total Harmonics Distortion in percentage(Current)



THD value is 128.7 %

14.4.3 Remarks

1. Current THD is 128.7 %. Limit is 8 %
2. Harmonics filter to be provided to reduce the harmonics level
3. Power Factor is within the acceptable level

15.COMMON OBSERVATION AND FEEDBACK

1. Fire Extinguishers and Fire sand buckets to be kept at LPG gas cylinders storage area to use at emergency situation
2. Hands on training to operate Fire Extinguishers shall be given to all teaching and non- teaching staffs on periodical manner
3. Lightning arrestor system is not available inside the campus
4. DG sets should be kept under roof to avoid rain water entry and rust formation on silencer.
5. DG set Diesel tank, fuel addition point to be kept closed properly
6. Unwanted materials to be removed from power room
7. Energy conservation program for all staffs shall be planned on regular basis
8. Display of Emergency contact numbers to be posted on prominent places
9. History card to be maintained for all UPS and batteries.
10. Proper History card to be maintained to track the UPS and Battery conditions
11. Battery Purchase details, Warranty periods to be maintained.
12. Combustible Materials not to be kept inside Battery room
13. Proper ventilation to be ensured in battery and UPS storage room
14. Solar Street light system battery conditions to be checked on periodical manner
15. Five star rated energy efficient appliances to be procured in the future



Roof to be provided & Vegetation around Earth pits to be removed & maintained properly



Fire Hydrant Pump to be serviced



Unwanted materials to be removed from electrical room



Combustible material not to be kept in the battery room



Solar street light system, battery conditions to be checked periodically



Fire Extinguisher and Fire Sand Bucket to be kept near LPG storage area

17. AUDIT FINDINGS & ENERGY SAVING POTENTIAL

Findings

- Annual electricity consumption from TNEB GRID is around 2,13,063 units during the year 2020-2021. Due to lockdown, energy consumption is less compared to previous years
- Electrical Energy consumption from Diesel Generator – 14,850 units.
- Solar Power Electrical energy consumption- 438 units
- Total Electrical Energy consumption – 2,28,351 units.
- Minimum energy consumption during lock down period is 10,000 units per month.
- More Renewable energy (Grid Interactive Roof Top Solar Power Plant) utilisation shall be planned in the coming years.
- LPG consumption - 1501 Kgs
- Solar water heater capacity of 4,100 LPD installed
- High Volume low speed fans are provided at auditorium to reduce energy consumption
- 5 Star rated Energy efficient electrical equipments shall be procured in future
- In total Lighting loads, 43.5 % lighting loads are converted into LED lighting system. Remaining Conventional Tube lights shall be replaced with LED tube lights in a phased manner
- Battery Room Housekeeping to be improved.
- Proper History card to be maintained to track the UPS and Battery conditions
- Fire Hydrant system water pump to be serviced
- Lightning arrestor to be provided inside the campus at higher elevation
- Students and staff may be advised to shift over to E- Vehicle
- Automatic power switch off systems may be introduced in the required areas
- Current and Voltage unbalance are within the limit
- Current Harmonics levels are above the limit for 30KVA and 20 KVA ups.
- Harmonics filters to be provided to reduce the unexpected failures of electronics equipments

- Auto Power Factor Control system to be provided to maintain the power factor near 0.99 to reduce energy losses

Renewable Energy

- Minimum energy consumption during Lockdown period was around 10,000 units for a month
- For minimum of 25 KW solar power plant operation, base loads are existing throughout 365 days.
- Solar power plant shall be planned in a phased manner in future to achieve 50 % renewable energy target

Energy saving potentials

1. Conventional tube lights shall be replaced with LED tube lights

Conventional tube light (with electronic choke) energy consumption-40 watts/hr

LED Tube lights energy consumption-20 watts/ hr

Savings per tube light -20 watts/hr

No of hours usage per day in the hostel– 10 hrs

No of days hostel occupied with students-275 days(During normal Days)

Energy savings per tube light per year - $275 \times 10 \times 20 = 55,000 \text{ wh} = 55 \text{ units}$

Average energy cost- Rs 8/unit

Cost saving per year per tube light- $55 \times 8 = \text{Rs } 440$

Cost savings per month-Rs 36.6

Approximate Cost of LED tube light -Rs 200

Payback period-5.5 months

Replacement cost for 100 LED tube lights-Rs $200 \times 100 = \text{RS } 20,000$

Cost savings for 100 LED tube lights-Rs 44,000 / year

Energy savings for 100 LED tube lights-5,500 units/ year

Payback period-5.5 months

2. Conventional fans shall be replaced with energy efficient fans

Conventional FAN energy consumption-75 watts/hr

ENERGY efficient fan energy consumption-28 watts/ hr

Savings per fan -47 watts/hr

No of hours usage per day in the hostel– 16 hrs

No of days hostel occupied with students-275 days (During normal Days)

Energy savings per fan per year - $275 \times 16 \times 47 = 206,800 \text{wh} = 207 \text{ units}$

Average energy cost- Rs 8 /unit

Cost saving per year per FAN- $207 \text{ units} \times 8 = \text{Rs } 1656$

Cost saving per month-Rs 138

Cost of ENERGY EFFICIENT FAN -Rs 2800

Payback period 20 months

Replacement cost for 100 Nos. ENERGY EFFICIENT FAN-Rs
 $2,800 \times 100 = \text{RS } 2,80,000$

Cost savings for 100 Nos. ENERGY EFFICIENT FAN -Rs 1,65,600 /
year

Energy savings for 100 Nos. ENERGY EFFICIENT FAN -20,700
units/ year

Payback period 20 months