ENERGY AUDIT REPORT

2022-23

VIRUDHUNAGAR HINDU NADARS SENTHIKUMARANADAR COLLEGE

3/ 151-1, College Road,
Virudhunagar,
Tamilnadu – 626 001.

TJ Solutions
4/101, Raja Sir Muthiah Nagar,
Bye- Pass Road,
Ellis Nagar,
Madurai – 625 016.

TJ SOLUTIONS

AUDIT CERTIFICATE

PRESENTED TO

VIRUDHUNAGAR HINDU NADARS SENTHIKUMARA NADAR COLLEGE
VIRUDHUNAGAR

Has been assessed by TJ Solutions for the comprehensive study of the environmental impact on institutional working framework to fulfill the requirement of

ENERGY AUDIT

2022-2023

The energy initiatives carried out by the institution have been verified on the report submitted and found to be satisfactory.

The effort taken by the management and faculty towards Renewable energy and Use of Energy efficient appliances is appreciated .

Bal Raj

Auditor signature

Dr.S.Balraj,M.E.,Ph.D-(EA-15051)

Dr.S.BALRAJ, M.E.,Ph.D.,
Certified Energy Auditor.,
B.E.E. Reg.No: EA-15051

TJ Solutions Madurai-10

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ACKNOWLEDGEMENT

We at TJ Solutions, Madurai are thankful to the Principal for giving us the opportunity to carry out Energy audit of VIRUDHUNAGAR HINDU NADARS SENTHIKUMARAN NADAR COLLEGE, Virudhunagar, Tamil Nadu, India. TJ Solutions 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 TJ Solutions under the guidance of Mr. Chandra Kumar Accredited Energy Auditor, have carried out the Energy Audit.

Name	Qualifications	Certification Number
Mr. BalRaj	BEE Energy auditor	EA-15051
Mr. N. Tamil selvan	B.Sc.,	ISO Lead Auditor / Energy Consultant
Mrs.Tamil selva parvathi	MSc.,DTC.,PGDESD.,	Environmentalist
Mr. R.Manikandan	DEEE	Electrical Data Analyst
Mr.A.Rajendran	B.E	Electrical Engineer C. Licence Holder; C 39095
Mr. P.Deleepan	B.E	Assistant Engineer (Electrical / Energy)

Bal Raj

Date :

Energy Auditor Signature

TJ Solutions ★ Madurai-10 ★

Summary of Audit

Energy audit of VIRUDHUNAGAR HINDU NADARS SENTHIKUMARANADAR COLLEGE and HOSTEL Was carried by TJ solutions. The Audit team has gone through the data related to TNEB GRID Electrical Energy, Diesel Generator Electrical Energy, Solar PV Power Electrical Energy, Solar Water Heater, BIOGAS generation and Diesel & Biomass consumption. A study was also carried out on Renewable energy utilization and Energy Conservation measures to reduce energy consumption.

During the visit it was observed that the VIRUDHUNAGAR HINDU NADARS SENTHIKUMARANADAR COLLEGE strictly follows reduce, reuse and recycle policy to limit energy usage and also to replace non- renewable energy sources with renewable energy sources. The concept of energy conservation is disseminated among the students and staff 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 summarized as follows

Electrical Energy consumption from TNEB GRID alone – 231374 units

Renewable energy from Solar PV power plants - 16461 .5 units

Lots of initiatives are taken to conserve Energy by the institution.

ENERGY SAVING POTENTIALS & RECOMMENDATIONS

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	**-**	**4.5 months**
Cost savings for 100 LED tube lights	**-**	**Rs 52,800 / year**
Energy savings for 100 LED tube lights	**-**	**6,000 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 1,98,000 / year**
Energy savings for 100 Nos. ENERGY EFFICIENT FAN	**-**	**22,500 units/ year**
Payback period	**-**	**17 months**

3.**Saving of LPG by utilising *HOT WATER from Solar Water Heater In* place of ordinary water at normal room temperature in the Hostel mess for cooking**

Investment cost of 1000LPD SWH	**–**	**Rs 2,90,000**
Cost savings per year	**-**	**Rs 92,800**
Payback period	**-**	**38 months**
Energy saved	**-**	**1080 KGS of LPG/year**

- Conventional Fans shall be replaced with energy efficient fans in a phased manner.

Fans No	Existing Fan Watts	Energy Efficient Fan Watts	Power Savings / fan Watts	usage /day Hrs	Energy saving / day WH	VHNS Boys Hostel occupied / year Days	Energy saving potential /year Units
60	60	30	30	12	360	300	36,612

- Remaining Conventional Tube lights shall be replaced with LED tube lights in a phased manner
- 5 Star rating Energy efficient electrical equipment has been installed and shall be procured.
- Smart sensors shall be used in higher capacity AC systems to reduce the power consumption
- Automatic power(sensor based) switch off systems is installed and may be introduced in required areas
- Annual electricity consumption from TNEB GRID is around 231374 units during the year 2022-2023. Management shall target to reduce the consumption
- Flow meter for Biogas plant shall be provided to study the performance
- In future, Green building should be constructed on basis of ECBC norms 2017

We are happy to submit this detailed energy audit report to the VIRUDHUNAGAR HINDHU NADARS SENTHIKUMARAN NADAR COLLEGE.

TJ Solutions
Madurai

TJ Solutions Madurai-10

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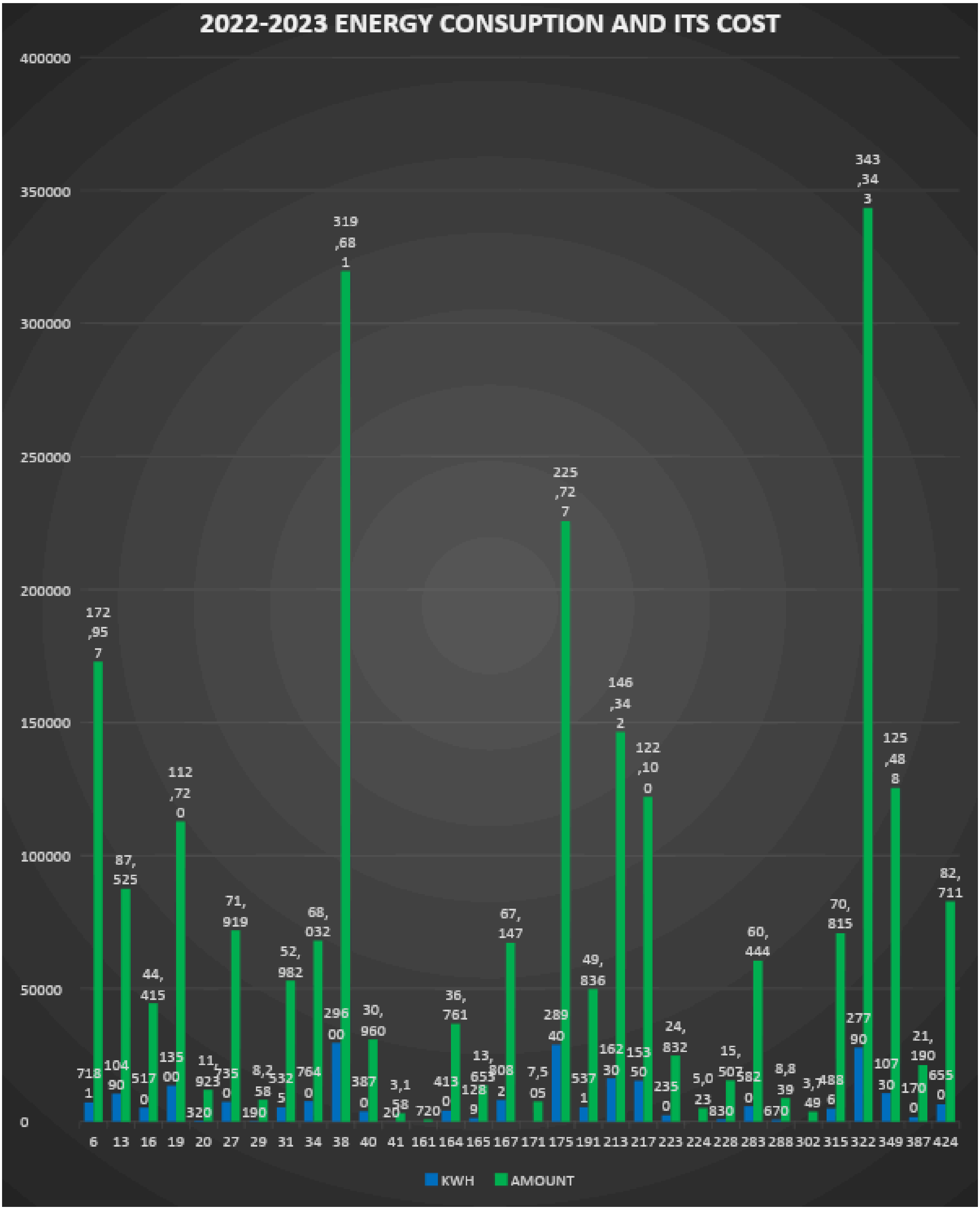
1. TNEB GRID ELECTRICAL ENERGY CONSUMPTIONS

S.No	Service No	Location	Consumed Units (2022-2023)	Amount (2022-2023)
1	6	Navamara Kinaru	7181	1,72,957
2	13	Science Block western Wing	10490	87,525
3	16	Dharmarajan - Build	5170	44,415
4	19	Arts Block Eastern wing	13500	1,12,720
5	20	NRSB Cycle Shed	320	11,923
6	27	Science Block North –Physics	7350	71,919
7	29	Gymnasium Building	190	8,258
8	31	Auditorium	5325	52,982
9	34	V.N.M.A Hall GJB	7640	68,032
10	38	Office	29600	3,19,681
11	40	Pavilion Builiding	3870	30,960
12	41	Old Canteen - Pandi	20	3,158
13	161	Engg. Hostel Mess	00	720
14	164	UGC Maths Building	4130	36,761
15	165	Old Canteen - N.S.S. Girls Unit Room	1289	13,653
16	167	Library Building	8082	67,147
17	171	SSAM Ladies Hostel	00	7,505
18	175	Hobby Work Shop - NCC	28940	2,25,727
19	191	Peria Vallikulam Pump (Bore well II)	5371	49,836
20	213	Power Supply Aathi P. Thangamani Build.	16230	1,46,342
21	217	Main Well Behind Library	15350	1,22,100
22	223	S.S.A. Hostel	2350	24,832
23	224	N.S.S.Boys Unit (Old Canteen Velmani)	00	5,023
24	228	Teachers Quarters street light	830	15,507
25	283	Zoology Building	5820	60,444
26	288	Vetri Vinayagar Kovil	670	8,839
27	302	Peria Vallikulam Pumb (Bore Well I)	00	3,749
28	315	VVR & VVRJ Block	4886	70,815
29	322	Swimming Pool	27790	3,43,343
30	349	M.S.R. Computer Block	10730	1,25,488
31	387	APK.Road Street Light	1700	21,190
32	424	Students Welfare Canteen	6550	82,711

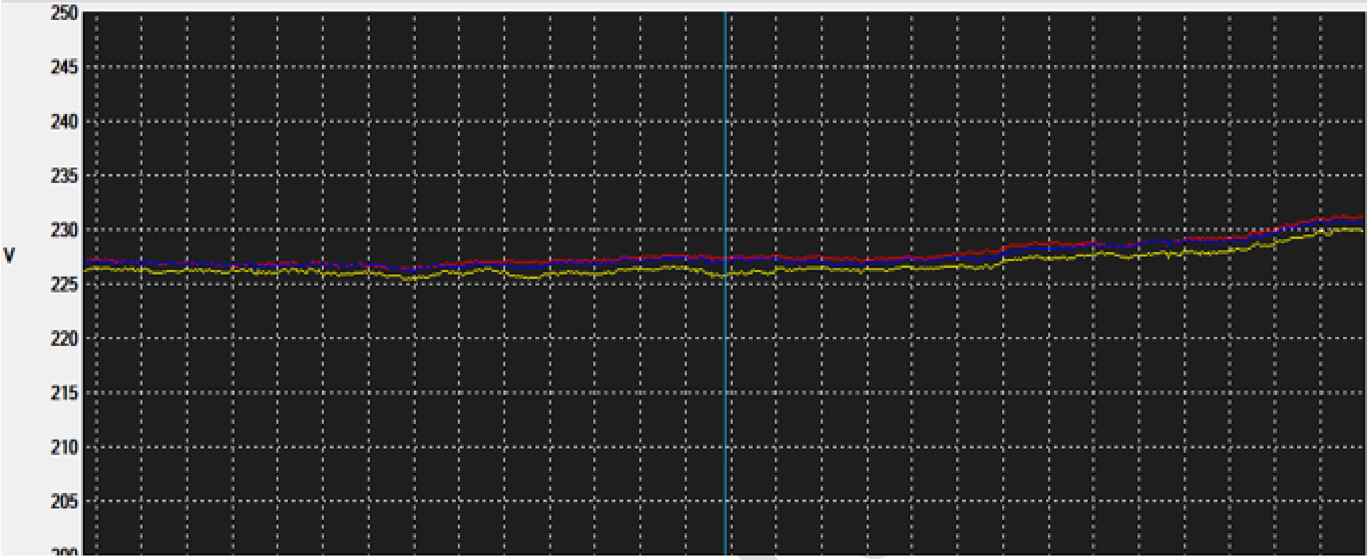

2022-2023 ENERGY CONSUPTION AND ITS COST
KWH
AMOUNT

2. LOAD PERFORMANCE AT POWER ANALYSER:

SC No :38 Waveform :

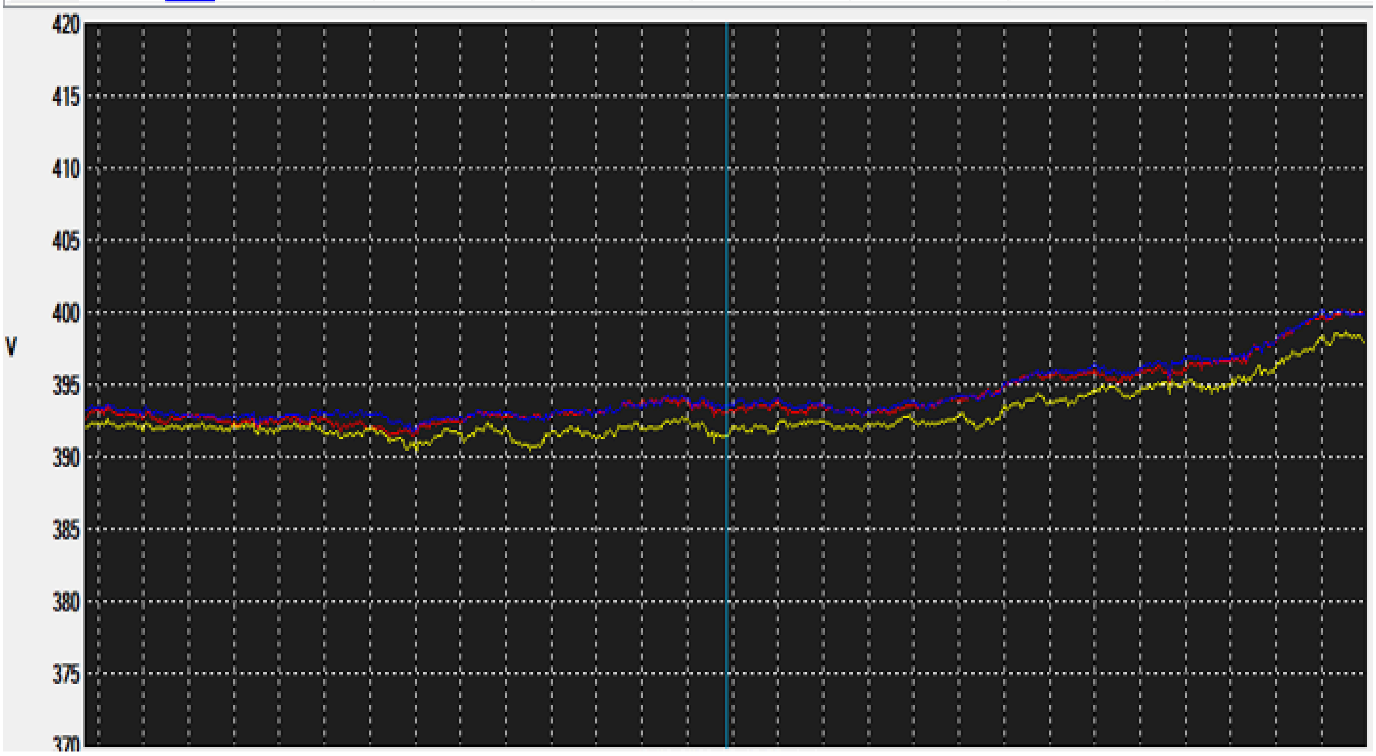
L-N Voltage Waveform :

Channel	Color	Cursor MIN	Cursor AVG	Cursor MAX	Window MIN	Window AVG	Window MAX
V1-N RMS		227.2 V	227.2 V	227.2 V	226.1 V	227.8 V	231.3 V
V2-N RMS		225.7 V	225.7 V	225.7 V	225.3 V	226.7 V	230.1 V
V3-N RMS		227.1 V	227.1 V	227.1 V	226 V	227.6 V	230.9 V



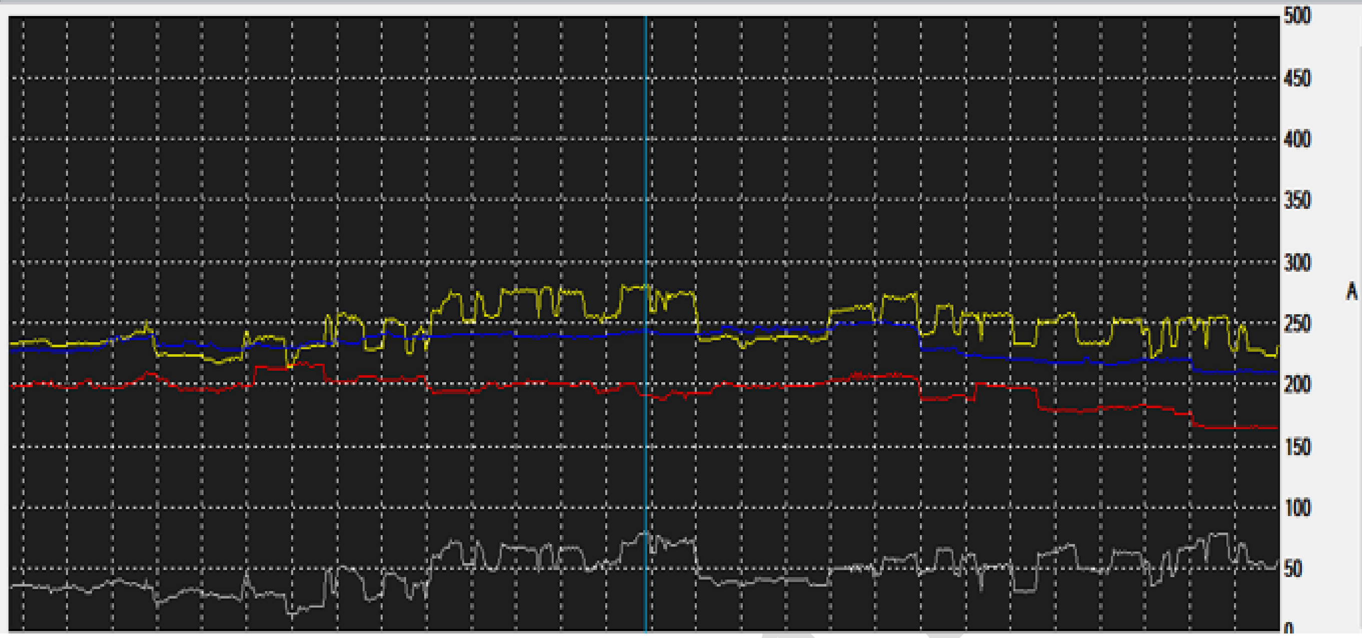
L-L Voltage Waveform :

Channel	Color	Cursor MIN	Cursor AVG	Cursor MAX	Window MIN	Window AVG	Window MAX
V1-2 RMS		393 V	393 V	393 V	391.2 V	394.1 V	400.2 V
V2-3 RMS		391.5 V	391.5 V	391.5 V	390.5 V	392.9 V	398.8 V
V3-1 RMS		393.4 V	393.4 V	393.4 V	391.6 V	394.4 V	400.2 V

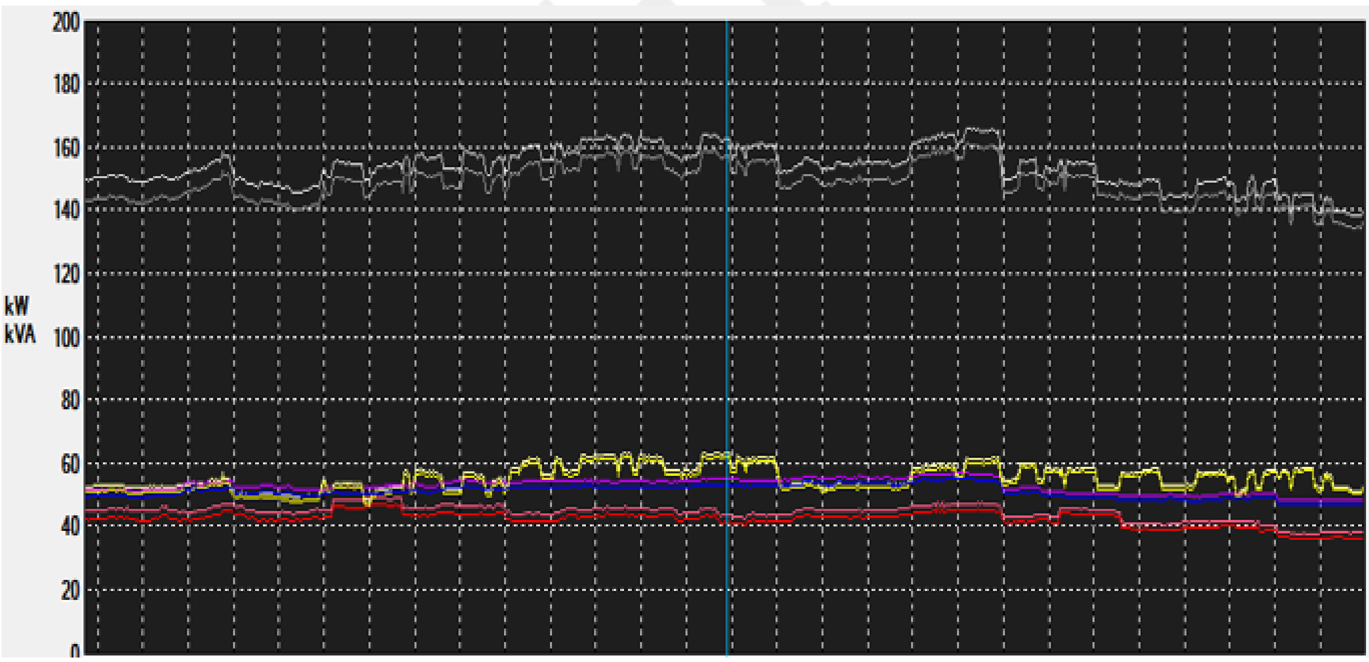


Current Waveform (A):

Channel	Color	Cursor MIN	Cursor AVG	Cursor MAX	Window MIN	Window AVG	Window MAX
A1 RMS		192 A	192 A	192 A	164.8 A	196.3 A	219.3 A
A2 RMS		281.3 A	281.3 A	281.3 A	214.9 A	248 A	282.1 A
A3 RMS		244.3 A	244.3 A	244.3 A	209.8 A	233.7 A	252.1 A
AN RMS		80.1 A	80.1 A	80.1 A	12.9 A	51.2 A	80.7 A



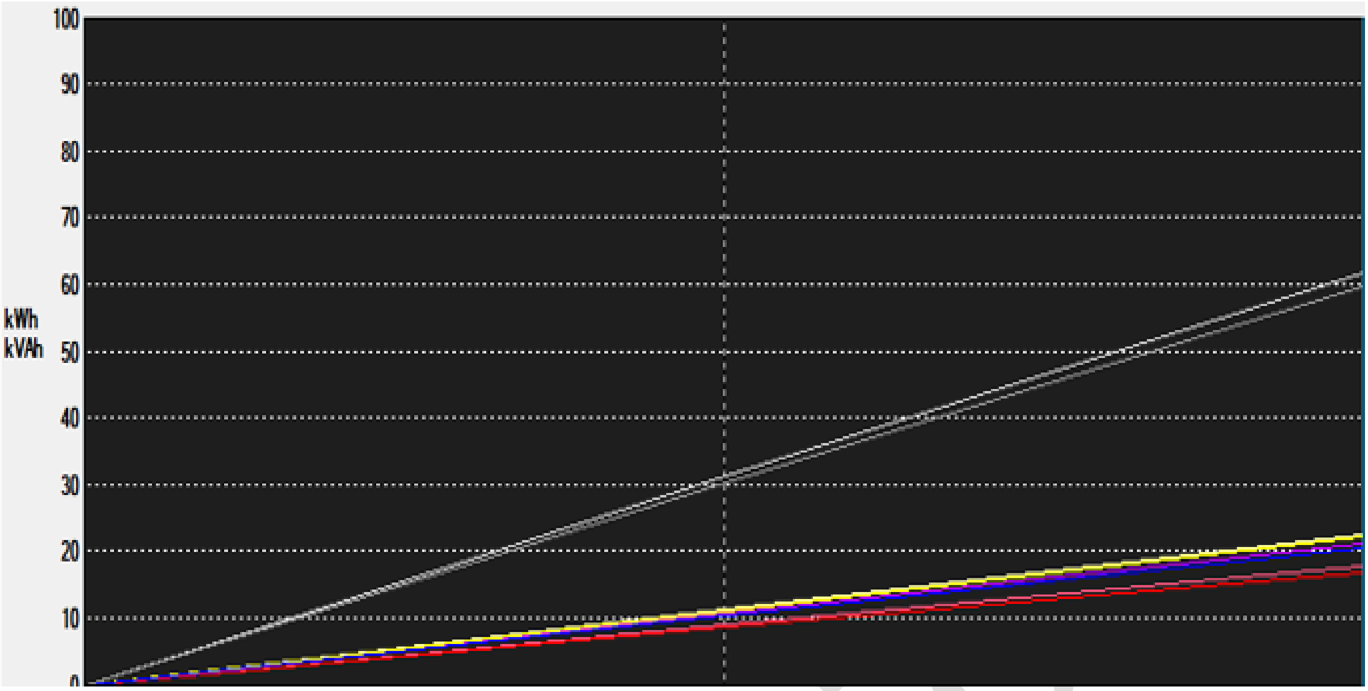
Power Waveform (KW,KVA):



Channel	Color	Cursor MIN	Cursor AVG	Cursor MAX	Window MIN	Window AVG	Window MAX
P1 (W)		41.55 kW	41.58 kW	41.6 kW	36.47 kW	42.52 kW	47.43 kW
P2 (W)		61.89 kW	61.97 kW	62.05 kW	47.22 kW	54.85 kW	62.37 kW
P3 (W)		53.69 kW	53.71 kW	53.73 kW	47.02 kW	51.37 kW	55.62 kW
PT (W)		157.2 kW	157.3 kW	157.3 kW	134.5 kW	148.7 kW	161.7 kW

Channel	Color	Cursor MIN	Cursor AVG	Cursor MAX	Window MIN	Window AVG	Window MAX
S1 (VA)		43.7 kVA	43.73 kVA	43.75 kVA	38.05 kVA	44.62 kVA	49.69 kVA
S2 (VA)		63.21 kVA	63.29 kVA	63.38 kVA	48.59 kVA	56.11 kVA	63.72 kVA
S3 (VA)		55.46 kVA	55.48 kVA	55.51 kVA	48.34 kVA	53.11 kVA	57.35 kVA
ST (VA)		162.5 kVA	162.5 kVA	162.5 kVA	138.3 kVA	153.8 kVA	166.7 kVA

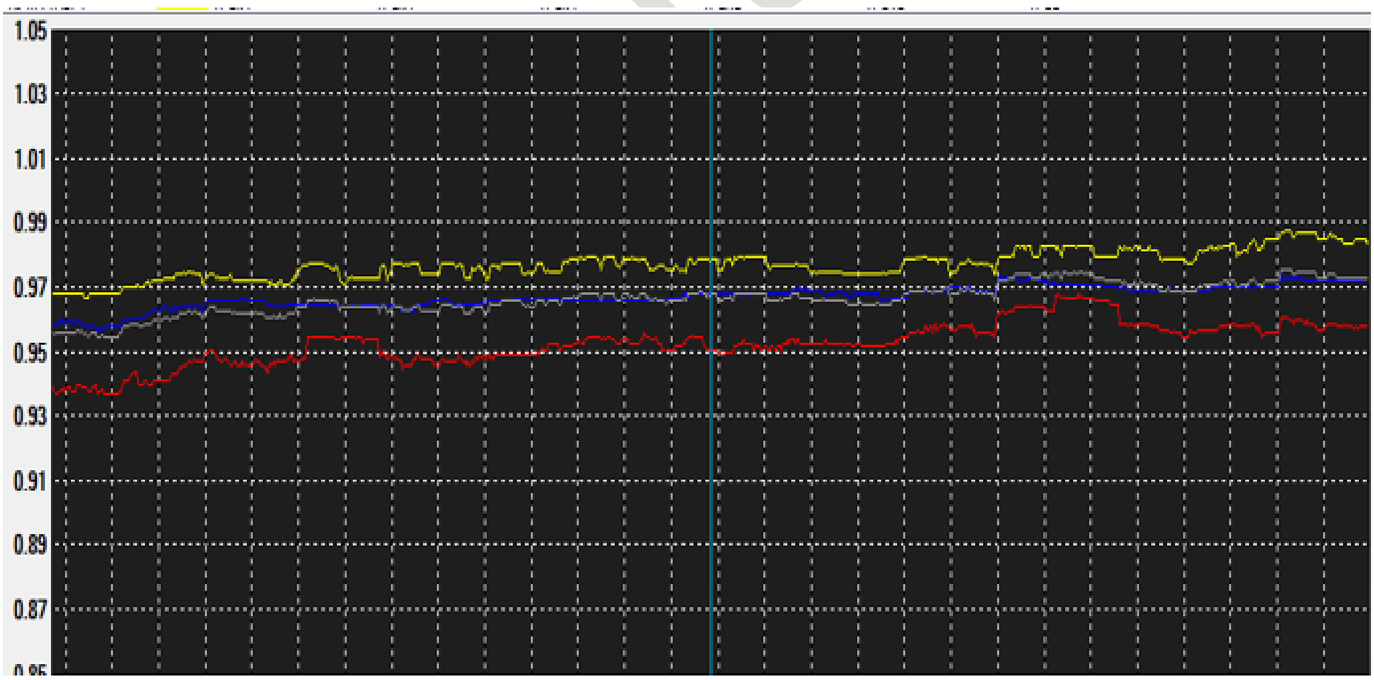
Energy Waveform (KWH, KVAH):



Channel	Color	Cursor	Window Energy
P1 (Wh)		16.98 kWh	16.98 kWh
P2 (Wh)		22.19 kWh	22.19 kWh
P3 (Wh)		20.59 kWh	20.59 kWh
PT (Wh)		59.76 kWh	59.76 kWh

Channel	Color	Cursor	Window Energy
S1 (VAh)		17.78 kVAh	17.78 kVAh
S2 (VAh)		22.68 kVAh	22.68 kVAh
S3 (VAh)		21.27 kVAh	21.27 kVAh
ST (VAh)		61.73 kVAh	61.73 kVAh

Power Factor Waveform:

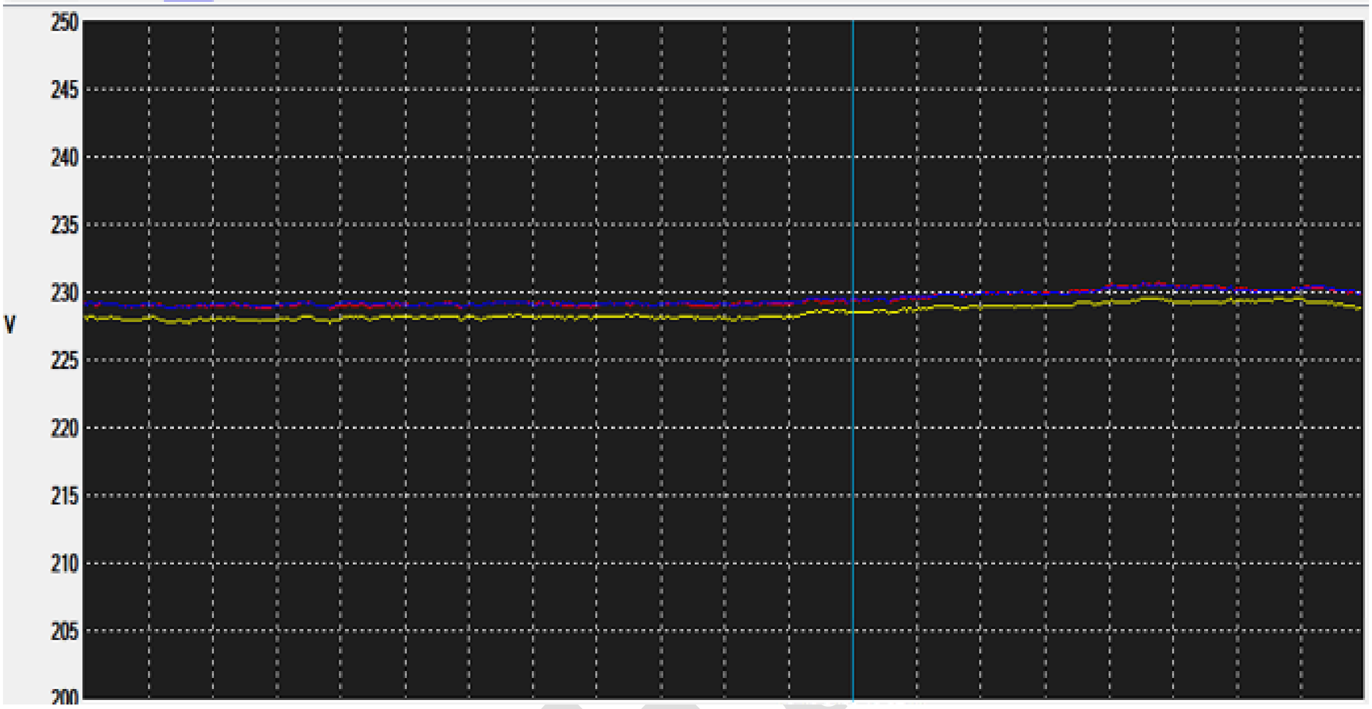


Channel	Color	Cursor MIN	Cursor AVG	Cursor MAX	Window MIN	Window AVG	Window MAX
PF1		0.951	0.951	0.951	0.937	0.953	0.968
PF2		0.979	0.979	0.979	0.967	0.977	0.988
PF3		0.968	0.968	0.968	0.957	0.967	0.974
PFT		0.968	0.968	0.968	0.955	0.967	0.976

Sc No : 175 Waveform :

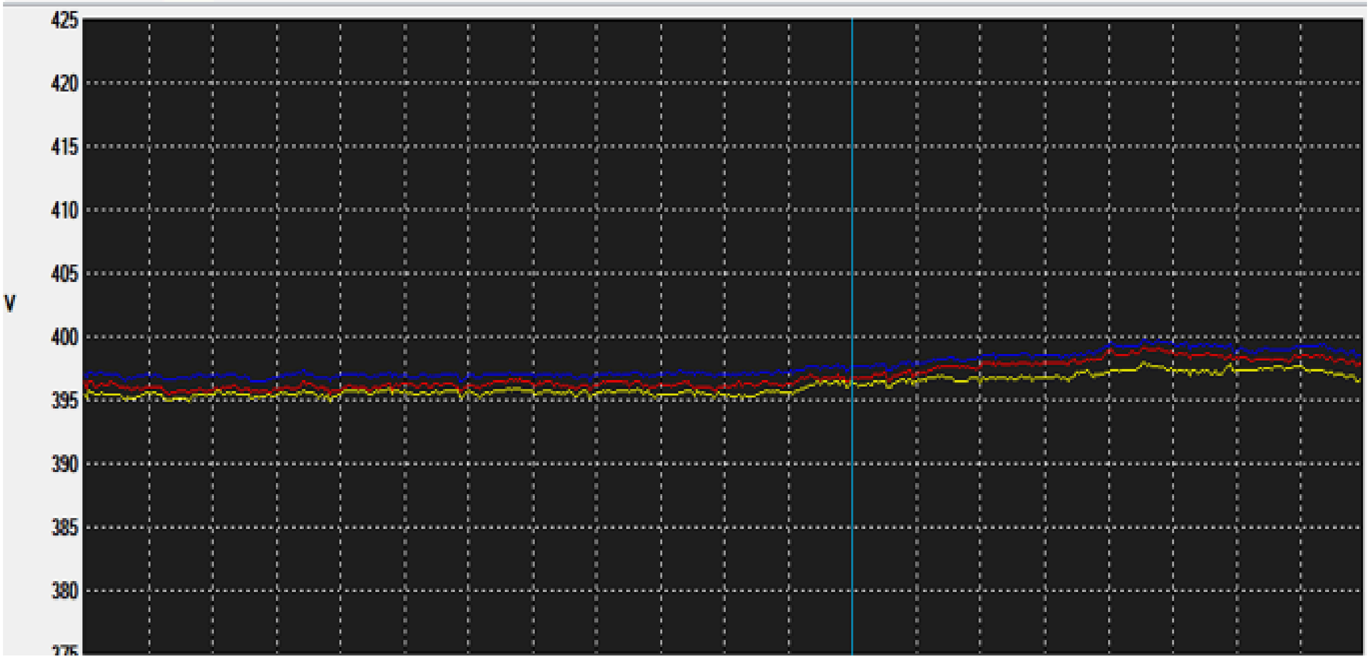
L-N Voltage Waveform :

Channel	Color	Cursor AVG	Window MIN	Window AVG	Window MAX
V1-N RMS		229.3 V	228.7 V	229.5 V	230.7 V
V2-N RMS		228.6 V	227.7 V	228.5 V	229.6 V
V3-N RMS		229.5 V	228.8 V	229.5 V	230.7 V



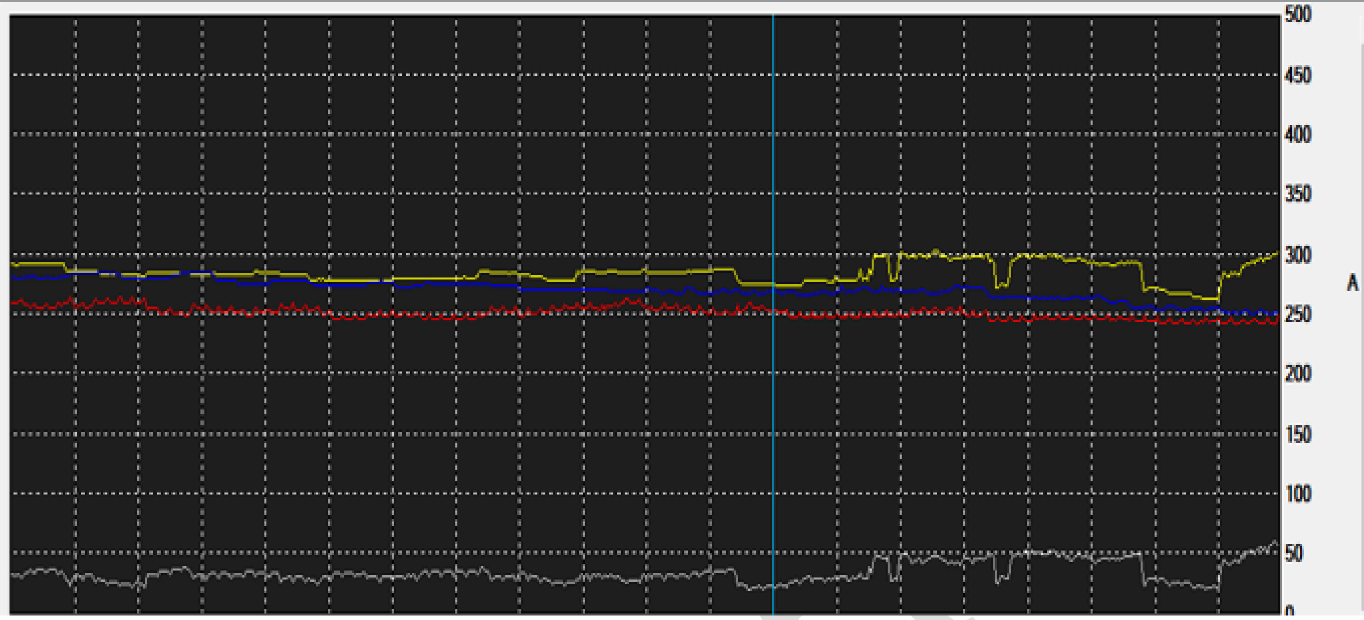
L-L Voltage Waveform :

Channel	Color	Cursor AVG	Window MIN	Window AVG	Window MAX
V1-2 RMS		396.7 V	395.4 V	396.9 V	399.1 V
V2-3 RMS		396.3 V	394.9 V	396.1 V	397.9 V
V3-1 RMS		397.6 V	396.4 V	397.7 V	399.7 V

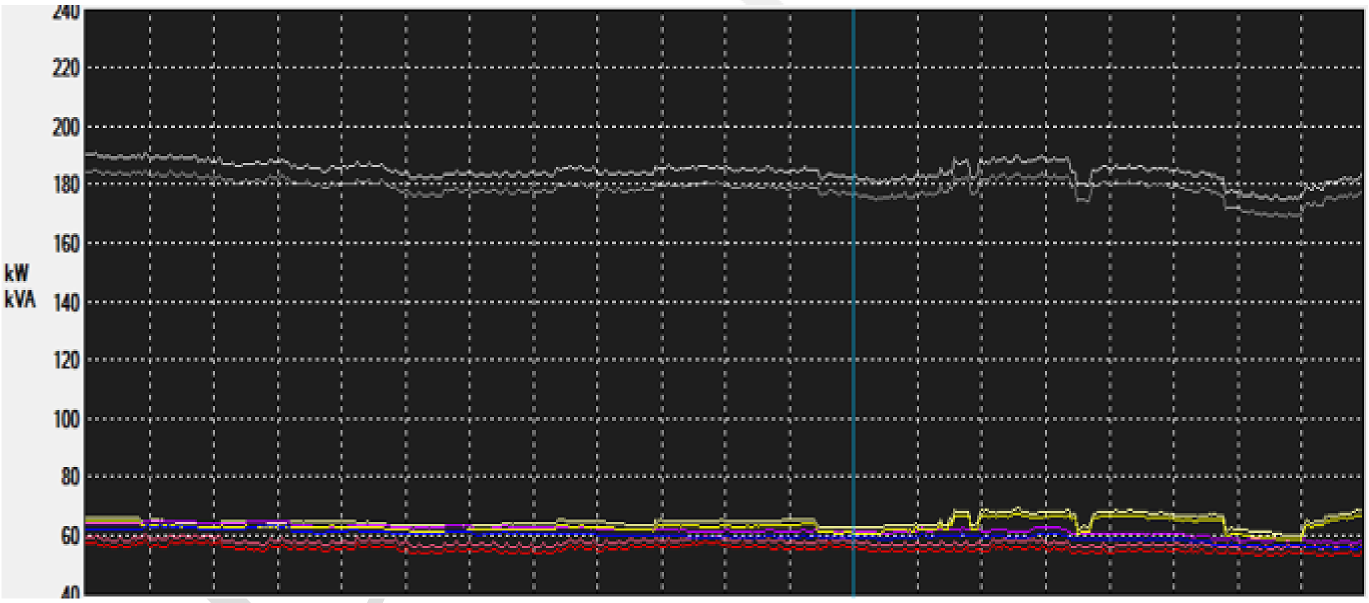


Current Waveform :

Channel	Color	Cursor AVG	Window MIN	Window AVG	Window MAX
A1 RMS		254.2 A	241.9 A	251.4 A	265.3 A
A2 RMS		274.9 A	263.4 A	285 A	303.4 A
A3 RMS		270.3 A	250.3 A	270.7 A	285.5 A
AN RMS		22 A	19.7 A	35.4 A	59.6 A

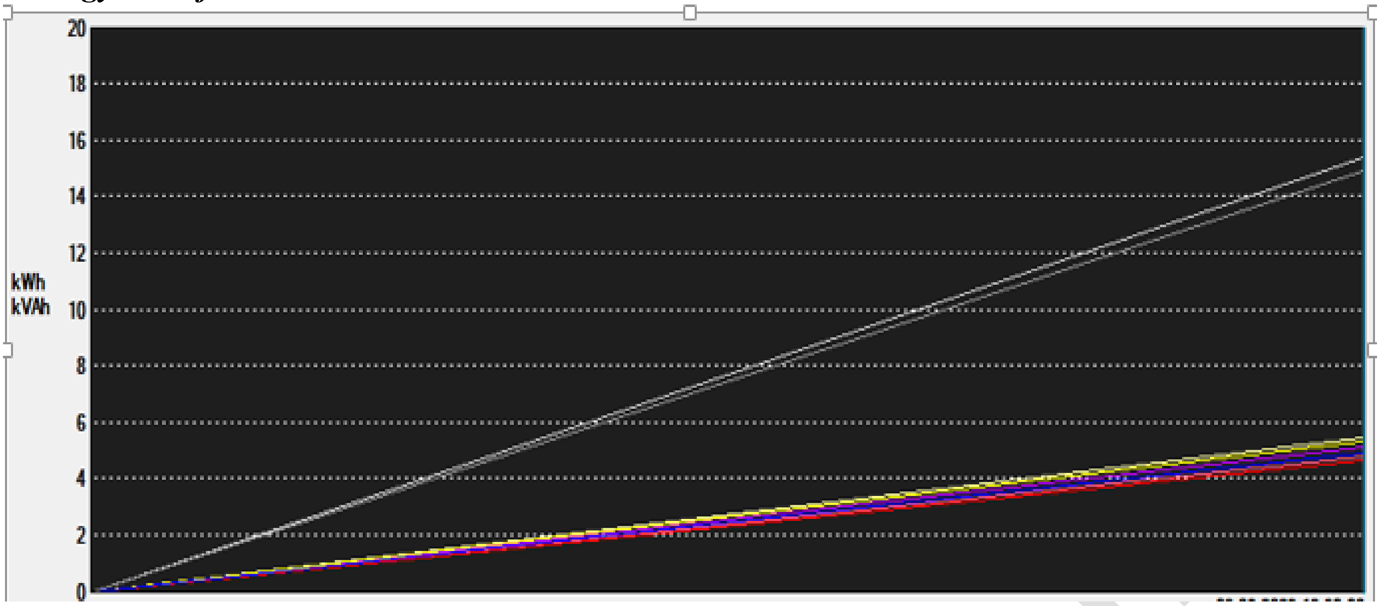


Power Waveform (KW,KVA) :



Channel	Color	Cursor AVG	Window MIN	Window AVG	Window MAX
P1 (W)		59.35 kW	44.84 kW	58.96 kW	61.45 kW
P2 (W)		60.39 kW	46.35 kW	58.83 kW	63.68 kW
P3 (W)		52.71 kW	36.44 kW	51.38 kW	54.73 kW
PT (W)		172.5 kW	127.8 kW	169.2 kW	179 kW
S1 (VA)		75.87 kVA	71.15 kVA	77.07 kVA	79.74 kVA
S2 (VA)		70.38 kVA	70.1 kVA	76.43 kVA	83.06 kVA
S3 (VA)		63.38 kVA	60.12 kVA	65.83 kVA	70.53 kVA
ST (VA)		209.6 kVA	204.5 kVA	219.3 kVA	232 kVA

Energy Waveform :

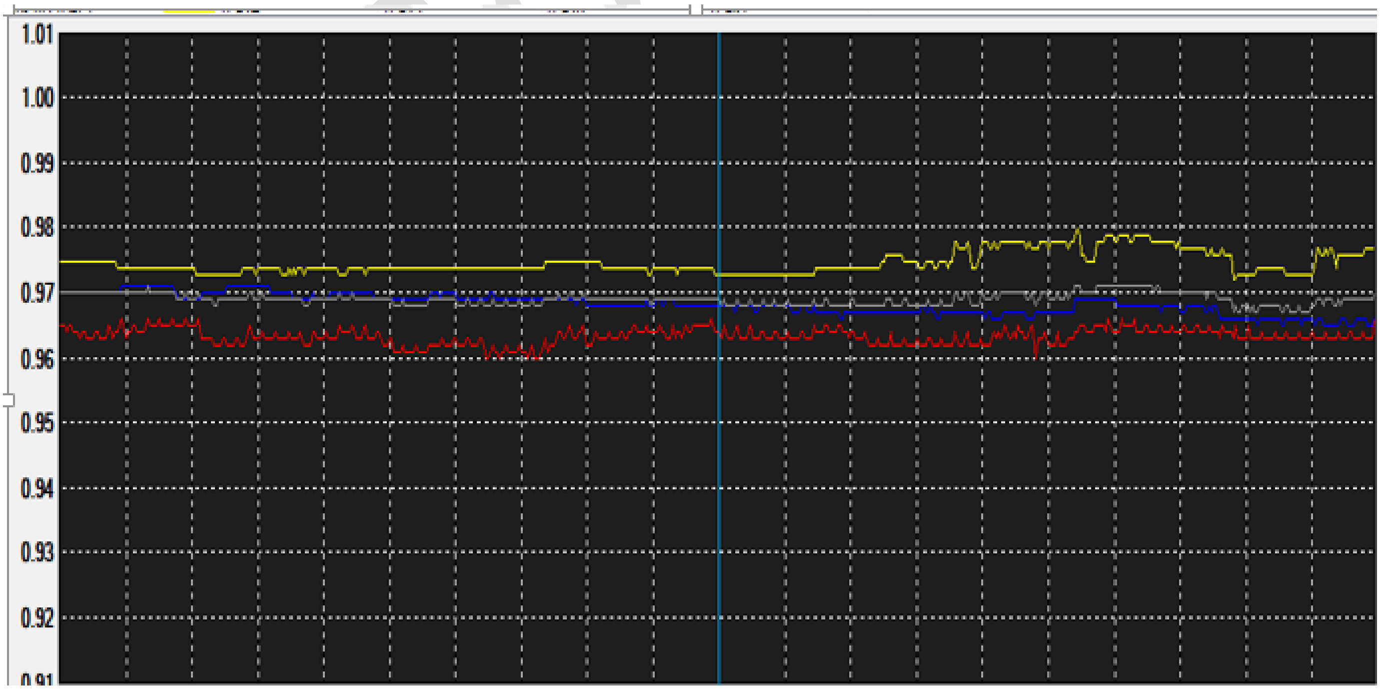


Channel	Color	Cursor	Window Energy
P1 (Wh)		4.633 kWh	4.633 kWh
P2 (Wh)		5.339 kWh	5.339 kWh
P3 (Wh)		4.959 kWh	4.959 kWh
PT (Wh)		14.93 kWh	14.93 kWh

Channel	Color	Cursor	Window Energy
S1 (VAh)		4.808 kVAh	4.808 kVAh
S2 (VAh)		5.474 kVAh	5.474 kVAh
S3 (VAh)		5.126 kVAh	5.126 kVAh
ST (VAh)		15.41 kVAh	15.41 kVAh

Power Factor Waveform:

Channel	Color	Cursor AVG	Window MIN	Window AVG	Window MAX
PF1		0.964	0.96	0.963	0.966
PF2		0.973	0.972	0.975	0.98
PF3		0.968	0.965	0.968	0.971
PFT		0.969	0.967	0.969	0.971



3. DIESEL POWER ELECTRICAL ENERGY GENERATION

Diesel Generator- Electrical energy generation in 2022-2023

Sl. No	Unit Consumption	Amount (Rs)	Diesel Consumption (L)	Units/Litre
1	15,600	494000	5200	3

4. SOLAR PV ELECTRICAL ENERGY GENERATION

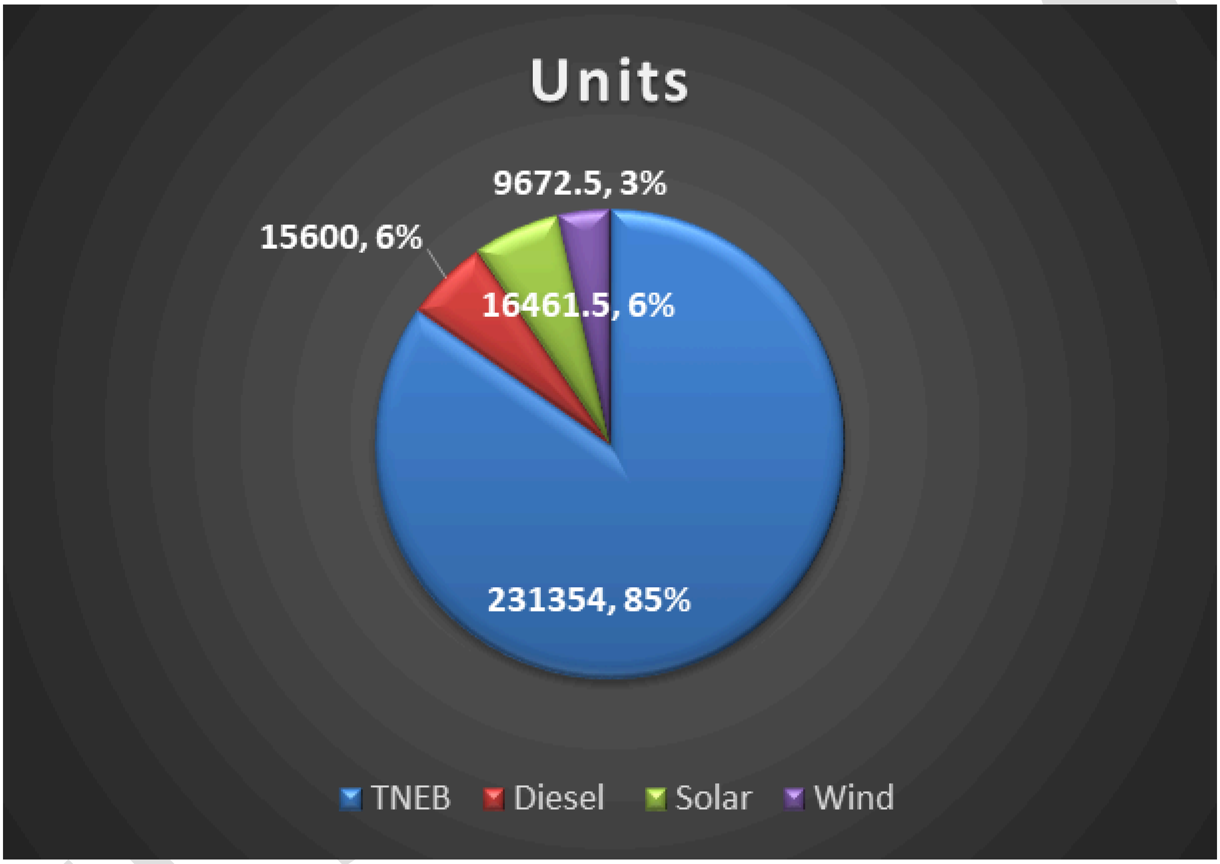
Sl. No	Solar Capacity KW	Solar Power Generation Units
1	11 KW	16461.5/year

4(a) . WINDMILL ENERGY GENERATION :

Sl.No	Wind Mill Capacity KW	WindMill Generation Units
1	**1.8 KW**	**9672.5**

5. TOTAL ELECTRICAL ENERGY CONSUMPTION

Sl.No	Source of electrical energy	No of units
1	TNEB Grid	231374
2	Diesel generators	15600
3	Solar power plants	16461.5
4	WindMill Power Plant	9672.5
Total		273108



6. UPS BACKUP TIME CALCULATIONS:

Consider a Computer Science block Lab,Consider a load of 10 Computers the calculations below,

A Computer Consumes 30W to 70W depending upon uses and its processor working. Let's we refer 70W for this calculations,

So in a Computer Science Lab totally 25 computers total watts = 70W X 25 Nos = 1,750 W
6KVA UPS with 20 Nos 65Ah /12 V Batteries.

Back up Time = Battery Ah X Battery Voltage / Watts.
65Ah X 420 (Battery Voltage without charging) / 1,750 W

Back up Time = 15.6 Hours **

Above the calculations the 25 computers with given UPS Specifications it take 15.6 hours of back up time.

** It denotes the backup time may varies depends upon number of computers usage and battery voltage.

7. POWER CONSUMPTION CALCULATIONS :

Consider a Computer Lab Total Computers 25 Nos,

Total Computer Wattage = 70 W X 25 Nos = 1,750 W

1,750 W

Watt- Hour (WH) Calculations :
Consider the usage of 1 hour
WH = W X Time => 1,750 X 1 = 1,750 W
Kilo Watts Hours (KWH (units)) Calculations :
KWH = WH / 1000 => 1,750 / 1000 = 1.75 KWH**
Consumptions Charges Calculations per hour :
INR = 7.65 rs X 1.75 KWH = 13.3 INR
Annual Consumptions Charges Calculations :
Annual INR = 13.3 X 300 days = 4,000.5 INR

Note : Total Energy consumption of a Computer lab is 1.75 KWH a day in an hour and its annual consumption charges is 4,000.5 INR per year.

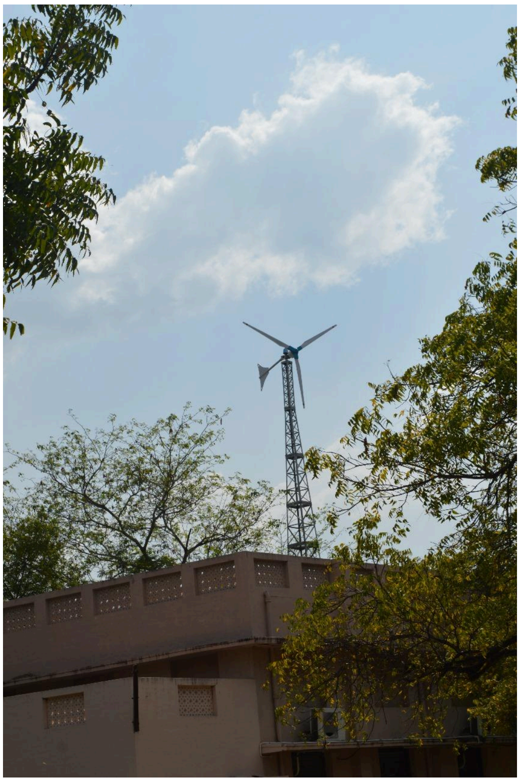
** This value may vary depending upon usage and equipment's aging or any Voltage variation.

8. EQUIPMENTS LIST:

Location	Service No	No of Rooms	No of ceiling Fan	No of Tubes	Pump 3P HP	Motor 1P	Pedestal Fan	Table Fan	No Of Computers	No Of Printer	Xerox/ Scanner	CFL	LED	Hollogen /Floor Lamp	Sodium vabour lamp	T.V	No of A/C
Boys Hostel MSPSS	30	53	60	105													
T.V.Hall	25			7												1	
Hostel/Dining Hall Gents			8	33		3+2+0.5											
Boys Hostel Mess Office	219		8	23					2	2							
Boys Hostel Room	222			6													
Boys Hostel Well Motor				2	7.5												
PSC Hostel	21		60	112													
M.S.P Engineering Hostel	15		47	88													
B.Ed Building	175		99	121					39	3	2	22	1	22W*12			3
Girls Hostel I		34	36	36					1						250W*1	1	
Varanda				40													
Girls Hostel II		58	130	222													
College Canteen	424		17	33				2									
RO Plant	212		1	3	2+3+5	2											
English Dpt & Dharmaraj Building	16	13	47	53					7	4							
Swimming Pool	322		1	26	10*2+2+5										250W*6		
Old Auditorium	31		32	26				3				72		250*2			
Control Office	31			8					5	2	3						
Indoor Stadium	175		8	140								4		125W*27			
Auditorium	171		20										200W*10 100W*44				
Zoology Building	283		27	102			1	6	6	4	2						3
Main Gate Road	387	1		3										250W*1			
	175	14	31	34					2	2			22W*9	12W*4			
Controller Office	175	8	19	24			2	7			8						0.5/1
NCC Rooms	175	3	4	14													
P.T.Room	40	4	7	19			1									1	
Main Library	167	9	16	80													
Gym Room & Volley Ball	175		3	9	0.5									500W*16			
Commerce Department	19		70	90													
Botany Department	19		39	120					12	4							

Location	ROOM NAME	No of ceiling Fan	Table Fan	Pedestal fan	No of Tubes	No of CFL Bulb	LED	No of Focus Lamp with watts	No of Top Light Fitting	No of Xerox Machine	No Of Computers	No Of Printer	No of A/C
VVR Building P.G	Room No 1	3			2								
	Room No 2	3			2								
	Room No 3	3			2								
	Room No 4	1			3								
	Room No 5	6			4						1	1	
	Room No 6	3			4								
	Room No 7	4			6								
IRC Building	Room No 8	3			3								
	Room No 9	3			3								
	Room No 10	3			3								
	Room No 11	3			3								
	Room No 12	3			3								
	Varanda				29								
	P.G Tamil Dpt	4				18W*20					1	1	
Commerce Department	Room No 1	3			3			10					
	Room No 2	3			3								
	Room No 3	3			3								
	Room No 4	5			5								
	TOP	6			6						2	1	
	S.F 1	3			3								
	S.F 2	3			3								
	Multimedia Hall				40						1		3
	M.Com, CA class Room	3			3								
	Ladies Bathroom				3								
	Kanagamani Conference Hall	29			21	18W*24							
	IRC Building Boordico							10					
	Near Conference hall	1			4	18W*32		125W*3					
B.Com S.F	S.F		3	2			12W*2			2	6	3	

MAJOR LOADS	NUMBERS / LOCATIONS	RATINGS
Solar W Heater	500 lts -1 nos	100 lts 1 no
Genset	5 nos	125 KVA
	2 Nos	15 kva
pump		64 HP
Exhust Fan	13 nos	90 watts
Fridge	9 Nos	160 Watts
Fan	1313Nos	60Watts
	105 nos	38 Watts
T Lights	1744 Nos	40 Watts
T Lights	806 Nos	22 Watts
On line Ups/Ivverter		183KVA
Solar st lights	30 nos	40Watts
Solar power plant		11 Kw
Wind Mill	1 Nos	1.8 Kw
Diesel used	Genset	4800Lts
	Genset	400 Lts
	Buses	5200 Lts
LPG	Hostel	900 cylinders
	College& canteen	20 Nos
AC	1Ton	7
	2 Ton	69
	1.5 Ton	11



9. COMMON OBSERVATION & FEEDBACK

Battery rooms

- Petroleum jelly is applied to battery terminals to avoid corrosion
- Water levels in the batteries are maintained
- Fire extinguishers in the area are in good condition
- History card to be maintained for all UPS and batteries
- Unwanted materials (Not related to UPS/Battery) not to be kept in the battery room.
- Cable identification tag to be provided.
- Battery earth pits conditions to be checked periodically

Earth Pits:

- Earth pit identification to be done
- Resistance value to be checked periodically & marked
- Records to be maintained for all earth pits
- Earth pits which are disturbed due to construction activities are to be restored as early as possible.

10. ENERGY SAVING RECOMMENDATIONS & FINDINGS

- Conventional Fans shall be replaced with energy efficient fans in a phased manner.
  - o Conventional Fans power consumption is around 60 watts
  - o Energy efficient Fans power consumption is 30 watts
- Remaining Conventional Tube lights shall be replaced with LED tube lights in a phased manner
- 5 Star rating Energy efficient electrical equipment shall be procured
- Smart sensors shall be used in higher capacity AC system to reduce the power consumption
- Automatic power switch off systems may be introduced in required areas
- Flow meter for Biogas plant shall be provided to know the performance of the Biogas plant and utilize the plant to a maximum capacity
- Earth pits conditions to be checked in the hostel.
- Energy conservation training program for all staffs shall be planned periodically
- Some more displays on energy conservation shall be put up in suitable locations
- A power saving day is to be observed every year
- The fans, lights, air-conditioners and other electronic and electrical equipment are switched off when not in use.
- Computers are switched to sleep mode or hibernate mode automatically when not in use
- Electrical equipment like CROs, Oscillators, Sodium lamps are switched off in the laboratory when the students complete their observations.
- At the end of every practical session, Computer monitors and UPS are switched off.
- In addition, post occupancy activities like utilizing renewable energy, minimizing waste generation to the least, proper disposal of E-waste to be disposed through the authorized E waste collector
- 5 Star rating Energy efficient electrical equipment has been installed.
- Automatic power (sensor based) switch off systems are installed and may be introduced in required areas.
- Some Electrical DB Boxes are open. It leads to electrical accidents in Refer Image Below.,

- Open type DG sets induced more noise pollution Refer Image Below.,

- Install the AC Power Saving Device to all the Air conditioners it enhances to improve the energy saving upto 5%-8% of savings.

DESCRIPTION	Without Saver	With Saver
Tonnage	**2.0 Tr**	**2.0 Tr**
Numbers of units	**65 Nos**	**65 Nos**
Total Tonnage	**130 Tr**	**130 Tr**
2.0 Tr Air Conditioner Watts	**2000 W**	**2000 W**

Total Watts (65 Nos) = W X 65	**1,30,000 W**	**1,04,000 W of 20% saving**
Watt Run Hour Calculation (8 Hrs) = 8 X W	**10,40,000 Wh**	**8,32,000 Wh of 20% saving**
Energy Calculation = Wh / 1000	**1,040 Kwh / 8 Hrs**	**832 Kwh / 8hrs of 20% saving**
Energy Consumption for a year (300 days) = Kwh X 300	**3,12,000 Kwh / 300 days**	**2,49,600 Kwh / 300 days**
Annual Cost (10.00 Rs / Kwh) = Kwh X 10.00 Rs	**31,20,000 Rs**	**24,96,000 Rs**
Energy Savings per 8Hrs / day	**208 Kwh of Savings**	
Annual Energy Cost Savings	**6,24,000 Rs Savings / Annum**	
Total Investment = 6,500 Rs X 65	**4,22,500 Rs**	
ROI (Return of Investment)	**0.6 Years**	
Annual Cost Percentage of Savings	**20 %**	
1.5 Tonnage AC Calculations		
DESCRIPTION	**Without Saver**	**With Saver**
Tonnage	**1.5 Tr**	**1.5 Tr**
Numbers of units	**21 Nos**	**21 Nos**
Total Tonnage	**31.5 Tr**	**31.5 Tr**
1.5 Tr Air Conditioner Watts	**1500 W**	**1500 W**
Total Watts (21 Nos) = W X 21	**31,500 W**	**25,200 W of 20% saving**
Watt Run Hour Calculation (8 Hrs) = 8 X W	**2,52,000 Wh**	**2,01,600 Wh of 20% saving**
Energy Calculation = Wh / 1000	**252 Kwh / 8 Hrs**	**201 Kwh / 8hrs of 20% saving**
Energy Consumption for a year (300 days) = Kwh X 300	**75,600 Kwh / 300 days**	**60,300 Kwh / 300 days**
Annual Cost (10.00 Rs / Kwh) = Kwh X 10.00 Rs	**7,56,000 Rs**	**6,03,000 Rs**
Energy Savings per 8Hrs / day	**51 Kwh of Savings**	
Annual Energy Cost Savings	**1,53,000 Rs Savings / Annum**	
Total Investment = 6,500 Rs X 21	**1,36,500 Rs**	

ROI (Return of Investment)	**0.8 Years**
Annual Cost Percentage of Savings	**20 %**

Refer the image below of AC Power Saver Device.,

- Replace the normal AC ceiling fans in hostel rooms into BLDC Fans, The Savings calculation listed below

COLLEGE	Ordinary Fan	BLDC Fan
Normal AC Fans Watts	**75 W**	**35 W**
Total Normal AC Fans Watts (1313 Nos) = W X 1313	**98,475 W**	**45,955 W**
Watt Run Hour Calculation (12 Hrs) = 12 X W	**11,81,700 Wh**	**5,51,460 Wh**
Energy Calculation (12 Hrs) = Wh / 1000	**1,181 Kwh / 12 Hrs**	**551 Kwh / 12 Kwh**
Energy Consumption for a year (300 days) = Kwh X 300	**3,54,300 Kwh / 300 days**	**1,65,300 Kwh / 300 days**
Annual Cost (10.00 Rs / Kwh) = Kwh X 10.00 Rs	**35,43,000 Rs**	**16,53,000 Rs**
Energy Savings per day	**630 Kwh of Savings / Day**	
Annual Energy Cost Savings	**18,90,000 Rs Savings / Annum**	
Total Investment = 3500 Rs X 1313	**45,95,500 Rs**	
ROI (Return of Investment)	**2.43 Years**	
Annual Cost Percentage of Savings	**53.3 %**	

11. ELECTRICAL SAFETY AWARENESS:

How Much Electricity is Dangerous Current through the body, even at levels as low as 3 milli amperes, can also cause injuries of an indirect or secondary nature in which involuntary muscular reaction from the electric shock can cause bruises, bone fractures and even death resulting from collisions or falls (i.e. fall from a ladder after receiving a smalls hock).

Current	Effect
0.5 - 3 mA	Tingling sensations
3 – 10 mA	Muscle contractions (painful)
10 – 40 mA	“Can’t Let Go” phenomena
30 – 75 mA	Respiratory paralysis (possibly fatal)
100 – 200 mA	Ventricular fibrillation (likely fatal)
200 – 500 mA	Heart clamps tight
1.5 A	Tissue and organs begin to burn

11.1 Way To Reduce Risks:

- ✔ The installation and maintenance of fixed electrical systems must be performed by competent persons (e.g. registered electrical contractors / electrical workers).
- ✔ Electrical installation and systems must comply with the legislative requirements and relevant standards. They should also be regularly maintained to ensure safety.
- ✔ Provide sufficient sockets so that each socket is inserted with one plug as far as possible. If adaptors are used, do not plug too many electrical appliances into the same socket circuit lest it becomes a fire hazard due to overloading.
- ✔ Electrical installation must be properly earthed.

11.2 Object Of Earthing:

The object of the earthing system is to provide a surface under and around a station, which shall be at a uniform potential (nearly zero or absolute earth potential). This Earth surface should be as nearly as possible to the system. This is in order to ensure that all parts of apparatus other than live parts and attending personnel shall be at earth potential at all times. Due to this there exists no potential difference, which could cause shock or injury to a person, when short circuit or any other type of abnormalities takes place.

11.3 Advantages Of Earthing:

For efficient/effective operation of any power system, it is very much essential to connect the neutral to suitable earth connection. The following are the few advantages:

- ✔ Reduced operation & Maintenance cost.
- ✔ Reduction in magnitude of transient over voltages.
- ✔ Improved lightning protection.
- ✔ Simplification of ground fault location.
- ✔ Improved system and equipment fault protection.
- ✔ Improved service reliability.
- ✔ Greater safety for personnel & equipment.
- ✔ Prompt and consistent operation of protective devices during earth fault.

11.4 Equipment Earthing:

It comprises earthing of all metal work of electrical equipment other than parts which are normally live or current carrying. This is done to ensure effective operation of the protective gear in the event of leakage through such metal work, the potential of which with respect to neighboring objects may attain a value which would cause danger to life or risk of fire.

11.5 System Earthing:

Earthing done to limit the potential of live conductors with respect to earth to values which the insulation of the system is designed to withstand and this to ensure the security of the system.

GENERAL REQUIREMENT FOR EARTHING Earthing shall generally be carried out in accordance with the requirement of I.E. rules, 1956, as amended from time to time and the relevant regulation of the electricity supply. Codes /Standard given below may also be referred : i) IS:3043 - Code of practice for earthing (latest) ii) National Electricity Code - 1985 of BIS iii) IEEE guide for safety in AC substation grounding No. ANSI/IEEE standard, 80-1986.In cases where direct earthing may prove harmful rather than provide safety, relaxation may be obtained from the competent authority. Earth electrodes shall be provided at generating stations, substations and consumer premises in accordance with the requirements. As far as possible all earth connections shall be visible for inspection. All connections shall be carefully made. If they are not properly made or are inadequate for the purpose for which they are intended, loss of life or serious personal injury may result. Each earth system shall be so devised that the testing of individual earth electrodes is possible. It is recommended that the value of any earth system resistance shall not be more than 5 ohms unless otherwise specified. The minimum size of earthing lead used on any installations shall have a nominal cross-section at areas of not less than 3.0 mm2 if of copper and 6.0 mm2 if of galvanized iron or steel. The actual size will depend on the max. fault current which the earthing lead will be required to carry safely. It is recommended drawing showing the main earth connection and earth electrode be prepared for each installation. No addition to the existing load whether temporary or permanent shall be made, which may exceed the assessed earth fault or its duration until it is ascertained that the existing arrangement of earthing is capable of carrying the new value of earth fault current resulting due to such addition. All materials, fittings etc. used in earthing shall conform to Indian Standard specification wherever these exist. In the case of material for which Indian standard specifications do not exist, the material shall be approved by the competent authority.

12. GENERAL ENERGY SAVING TIPS:

1. Change your light bulbs to LEDs.
2. Wash your clothes in cold water if possible it enhance for water energy consumption.
3. Air seal your home. Sealing cracks, gaps and leaks and adding insulation can save up to 10% on home heating and cooling costs.
4. Clean or replace all filters in your home regularly. Dirty filters make your system work harder and run longer than necessary.
5. Defrost your refrigerator and freezer before ice build-up becomes 1/4-inch thick to ensure your appliances are running efficiently.
6. Do not leave the TV, AC with remote off, sometimes we disconnect the mobile phone from mobile charger we forget to switch off the switch it leads to consume some minor power consumption, so break the switch off completely when not in use.
7. Sometimes we switch off the AC with the remote off but the stabilizer is in condition. The stabilizer consumes some power, so switch off the AC completely when not in use.

Water Resources:

1. Recycle water, particularly for uses with less-critical quality requirements.
2. Recycle water, especially if sewer costs are based on water consumption.
3. Balance closed systems to minimize flows and reduce pump power requirements.
4. Eliminate once-through cooling with water.
5. Use the least expensive type of water that will satisfy the requirement.
6. Fix water leaks.
7. Test for underground water leaks. (It's easy to do over a holiday shutdown.)
8. Check water overflow pipes for proper operating level.