Power Quality Audit

Energy Audit

Implementation EnergyConservation

Thermal Audit

Electrical System Audit

Electrical Safety

Water Audit

Reliability Of Equipment

Maintenance & Operation Audit

Engineering Audit House

June-July 2023

Report on Energy Audit at Regent Education & Research Foundation Group of Institutions Telinipara

Prepared for

REGENT EDUCATION & RESEARCH FOUNDATION
GROUP OF INSTITUTIONS.
BARA KANTHALIA (BARRACKPORE)
PO- Sewli Telinipara,
PS- TITAGARH, KOLKATA- 700121
WEST BENGAL

Prepared by

Energytech Management Consultant

City Off. Flat No. S3, 4 Purbachal South Canal Road, Kolkata 700078. Ph.9836926681
Main Off. 35 Kaibarta Para, PO Bhatpara, Pin 741323. Ph. No. 033-25818083

Acknowledgement

Energytech Management Consultant *would like to express their thanks to* ***Regent Education & Research Foundation Group of Institutions, Barrackpore*** *for providing them an opportunity to conduct Energy Audit of RERFGI,* ***Bara Kanthalia, Sweli, Telinipara, Barrackpore, Kolkata- 700121 in West Bengal – India*** *for the period 2022 to 2023 were held on* ***26th June to 29th June 2023.***

We are thankful to the Energy Management Department of RERFGI Barrackpore for organizing this Energy Audit.

Our sincere thanks also go to all the staff members of RERFGI Barrackpore for showing keen interest in the study and for the help and co-operation extended to the Energy Auditors during survey period.

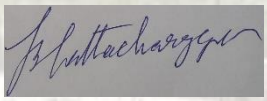
They are full concerned about their energy consumption during their productive time and non-productive time.

We do hope that they will find more recommendations in this report useful in saving energy.

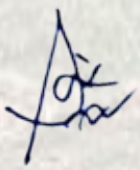
We would welcome any suggestions from your side as to how we can improve further.

Please email to: nrgtec@yahoo.com (S. Bhattacharya, BEE Certified Energy Auditor,).

Prabir Kumar Ghosh
BEE Certified Energy Auditor



S. Bhattacharyya
BEE Certified Energy Auditor



Principal
Regent Education & Research Foundation
Bara Kanthalia, P.O.-Sewli Telinipara
Barrackpore, Kolkata- 700121

Contents

i. Introduction

Energy Audit involves a systematic study of any energy consuming sectors /system with a view to identify input, usage and wastages of energy including recommendation of possible means for energy savings. Energy Audit also helps in energy cost optimization and safety aspects and suggests the method to improve the operating & maintenance practice of the system.

The conduct of Energy Audit as mandated under EC Act and implementation of its recommendation on cost benefit basis through Energy Auditors will improve the energy intensities in Institute including hostels.

It would give a positive orientation to the energy cost reduction, preventive maintenance and quality control programs which are vital for production and utility activities.

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 period. We would like to emphasize that an energy audit is a continuous process.

We do hope that they will find more recommendations in this report useful in saving energy.

ii. Assignment

M/s. **Regent Education & Research Foundation Group of Institutions, Barrackpore** has placed Order on M/s. Energytech Management Consultant for carrying out the Detailed Energy Audit of the Organization (Academic Building) at above address.

iii. Officials of RERFGI Related to Energy Audit Job

Energy management related activities & functions of Institution are being supervised and coordinated by Energy Management Department of the organization - RERFGI Barrackpore.

Table 1

Sl No	Name	Designation
1	Dr. Samik Chakraborty	Principal, RERFGI
2	Dr. Rajorshi Bandyopadhyay	Dean of Student Affairs, RERFGI
3	Mr. Subhankar Ghosh	Registrar, RERFGI
4	Mr. Raju Kumar Shaw	Senior Administration Officer, RERFGI
5	Dr. Suman Kumar Dey	HOD, EEE DEPT., RERFGI
6	Mr. Sanjib Pal	HOD, EE DEPT., RERFGI
7	Mr. Mrinmoy Das	Assistant Professor, EE DEPT., RERFGI
8	Ms. C. Rajalakshmi	Assistant Professor, EEE DEPT., RERFGI

iv. Energy Audit Team of Energytech Management Consultant

Collection & measurement of miscellaneous data/ information, processing & analyzing, investigation of problems in connection with this Energy Audit Report has been performed by a team of followings

Mr. P. K. Ghosh	Certified Energy Auditor
Mr. S. Bhattacharya	Certified Energy Auditor
Manas Bag.	Certified Energy Manager

v. Methodology

a) Historical data are collected from the logbook, energy bill and technical papers related to different equipment.

b) All data verified by the energy audit team physically and interaction with the concerned persons.

c) Operational data is collected by direct observation and operational logbook.

d) Measurement of different energy parameters from panel meter or installing different type of meter, analyzer at proper accessible point for testing and data generation.

e) Data collected by above method are analyzed to identify energy consumption pattern. After identifying the energy savings potential, the proposals for the same are given in the report.

I. Executive Summary

Project	ENERGY AUDIT
Client	**Regent Education & Research Foundation** **Group of Institutions.** **Bara Kanthalia, Barrackpore** **PO- Sewli Telinipara,** **PS- Titagarh, Kolkata 700 121** **West Bengal**
Site	Regent Education & Research Foundation. Bara Kanthalia (Barrackpore) PO- Sewli Telinipara, PS- Titagarh, Kolkata 700 121 West Bengal
Segment	Academic Institute.
Consultants	S. Bhattacharya (BEE Certified Energy Auditor) P.K Ghosh (BEE Certified Energy Auditor)
Project Reference	W.O. No.: RERFGI/SAO/JUN-23/0212 dtd. 26.06.2023
Site Details	Regent Education & Research Foundation Group of Institution started their academic institute in the year 2009 at the Barrackpore area of Kolkata. RERFGI is getting power supply from WBSEDCL at 11.0 kV with a sanctioned demand of 55 KVA. RERFGI campus comprises of four academic buildings. Only one building is under this project. The consumption of this building is 40% of the total supply load.
Project Notes	Energy Audit of the facility of RERFGI **The suggestions / alternatives in the audit report are based on the present operating conditions of equipment's/systems and to the best of our knowledge.** ***It is recommended to obtain vendor quotations before implementation.***

II. Summary of Energy Saving Measures

Table 2

Sl. No	Energy Conservation Measures	Annual Savings	Annual Savings	Investment	Payback
		kWh	Rs. Lacs	Rs. Lacs	Months
ESM 1	**Replace existing 36W tube with 20W energy efficient LED tube**	8640	1.98	0.90	5
ESM 2	**Replacement of existing old conventional ceiling fan by energy efficient fan**	19440	2.41	8.13	40
	TOTAL	**28080**	**4.39**	**9.03**	**5-40**

1.0 Regent Education & Research Foundation Group of Institutions, Barrackpore

RERFGI - Regent Education and Research Foundation Group of Institutions is a premier Institute, established in **2009**. It is located in Kolkata, West Bengal. RERFGI - Regent Education and Research Foundation Group of Institutions offers 14 diverse courses for Degree and Diploma in Full Time mode. Institute present diversified 6 UG programs & 2 PG programs, which are designed to meet the learning aspirations of students from various backgrounds. RERFGI - Regent Education and Research Foundation Group of Institutions has been accredited with **Grade B** by NAAC. Its a private institute. When it comes to choosing a good Institute for higher learning, RERFGI - Regent Education and Research Foundation Group of Institutions comes to mind. Student has the option to choose courses like MBA/PGDM, B.E. / B.Tech, MCA, After 10th Diploma with stream of Business & Management Studies, Engineering and IT & Software Institute provides opportunity to students to gain proficiency & expertise in the specialization of Mechanical Engineering, Civil Engineering, Electrical Engineering, Electrical & Electronics Engineering, Computer Science Engineering, Electronics & Communication Engineering. Course offered by RERFGI - Regent Education and Research Foundation Group of Institutions is well recognized by approving body like AICTE. Most importantly, these courses with 840 seats are imparted at affordable fees, which increase accessibility and allow students to gain knowledge and skills in their chosen field. College provides good facilities and infrastructure like Cafeteria, Hospital / Medical Facilities, Labs, Library, Sports Complex, Others - Conference Hall, Computer Centre and Common Room to the students.

2.0 Energy Scenario

Table 3

Particulars	**RERFGI**			**Details**
Supply Utility				WBSEDCL
Consumer No.				941541800
Meter No				SH5D0998
Type				Educational Institute
Tariff Type				E (C=EI)
Year	**2021**	**2022**	**2023 up to June**	**UNIT**
Contract Demand 4 buildings	55	55	55	kVA
Connected Load	368			kW
Avg. Energy Charges (Seasonal)	8.08/7.87/7.85/8.12			Rs. Per kWh
Landed Price of electricity	12.07	12.27	12.40	Rs Per kWh
Installed Solar Panel	1. (10+5) Watt peak – Connected with 15W lamp 2. 50-Watt peak – Connected with 50W lamp – 2 nos.			Remark. Energy generated or consumed not accessible as there is there is no kWh meter installed
Total built up area	40000			Sqr. ft
Energy Consumption of the Institution for the year from WBSEDCL	58281.5	145983.7	97054.6	kWh
Energy Consumption of the Institution for the year from DG in terms of Diesel	825	646	223	kWh
Cost of Energy received from WBSEDCL	7.071	17.92	12.03	Rs.(lakh)
Total Covered area of RERFGI Barrackpore	40000			Sqr. ft.
Specific Energy Consumption for the year	0.1214	0.304	0.404	kWh/sqr. Ft/month

Note: Due to pandemic condition during the year 2021 off line classes of the institute were suspended.

3.0 Electrical Distribution and Load Utilization

3.1 Regent institute received 3 phase 4 wire 440V power from university substation at main gate by one 400 mm^2 3 & 1/2 core cable. Then the power is distributed in different floor by respective lighting and AC bus bur on both north and south side riser. There are also two nos. of DG set for emergency power supply of lighting and laboratory at the time of power cut off. It has also a few source of power. A simplified electrical single line diagram for power distribution is given below:

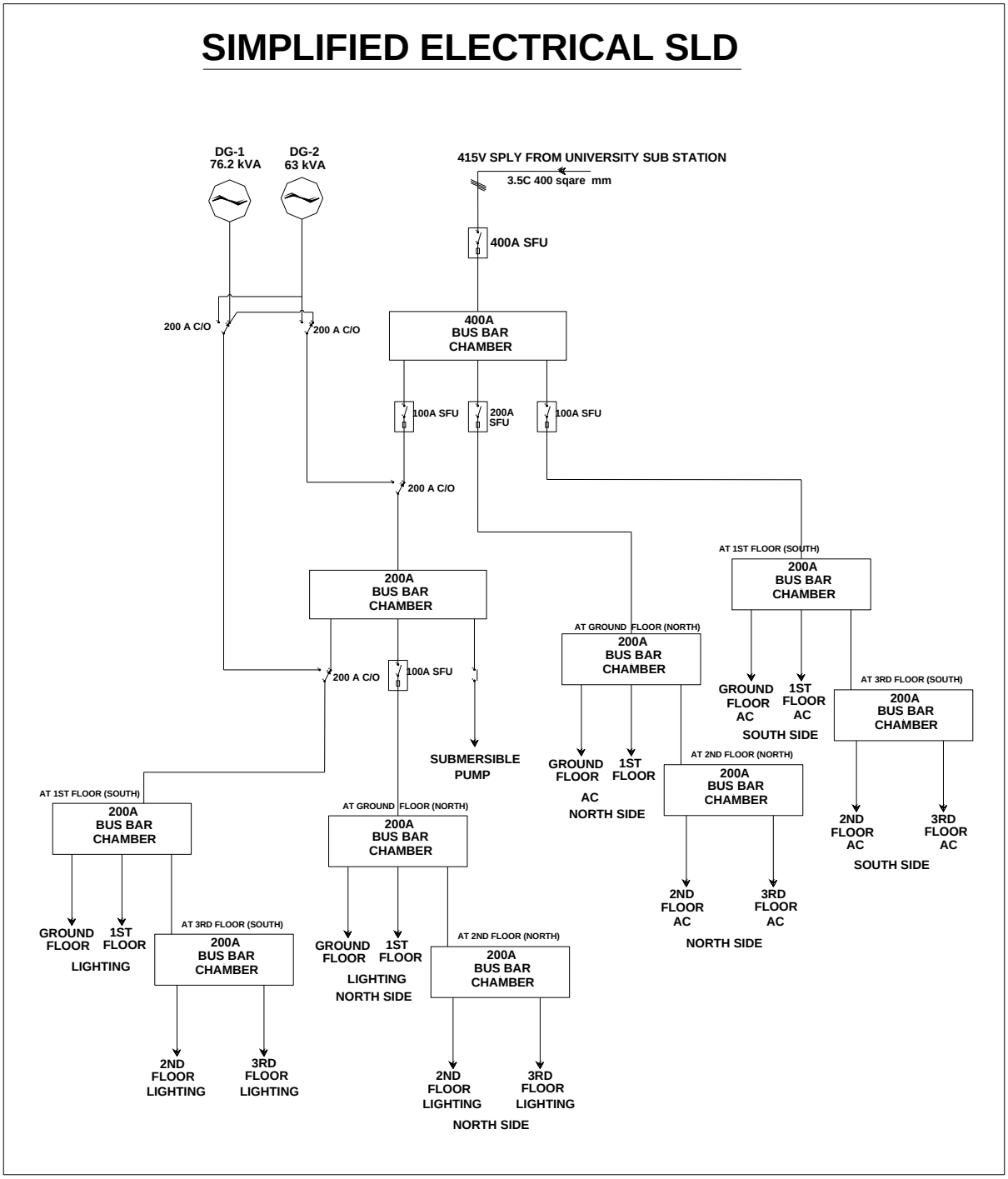


Figure 1

Installed Solar Panel (10+5) Watt peak – Connected with 15W lamp
Installed Solar Panel 50-Watt peak – Connected with 50W lamp – 2 nos.

3.2 2 nos. DG details are given bellow-

i. **Diesel Generator Details**

Table 4

DG	1	2
Make Location	**New**	**Old**
Eng. Sr.No.	ES3A014F187030	4R1040T
Rated kva	63	76
Rated Load current	87.6	139
Rated voltage Current	415	415
Rated frequency	50	50
Rated RPM	1500	1500
EXC. Amp	3.3	-
EXC. Voltage	3	-
Make	Kirloskar	Kirloskar

3.3 Connected Load Distribution of RERFGI (Barrackpore)

Table 5

SL. NO.	LOCATION	FLT 36W	LED 20/40W	9W LED	OTHER LIGHTING	LIGHTING TOTAL	Ceiling Fan No.	WALL FAN/STAN No.	FAN Watt	COMPUTER LOAD Watt	Other Watt	LAB EQUIPMENT LOAD	EQUIPMENT Watt	TOTAL Kw
Ground Floor														
1	Mechanical Workshop	8	18	4		748	19		1520			Machine Load Separate	24080	
2	Room No. 010	4				176	7		560			Equipment Load 100W	100	
3	Room No. 011	4				176	7		560					
4	Room No. 009A Power System Lab	5		1		229	8		640					
5	Room No. 009 Electrical Lab	3				132	2		160					
6	Room No. 008 Chemistry Lab	2		8		160	5	1	485					
7	Room No. 006 Electrical Measurement Lab	5				220	7		560			Equipment Load5000W	5000	
8	Room No. 007 Power Electronics Lab	3				132	6		480			Equipment Load900W	900	
9	Room No. 005 Power System Lab	4				176	7		560			Equipment Load5000W	5000	
10	Room No. 003 Electrical Machine Lab-II	5	2			260	7		560			Equipment Load 6345W	4345	
11	Room No. 002 Electrical Machine Lab-I	3	2			172	6		480			Equipment Load 6000W	6000	
12	Room No. 004	5	1			240	7		560			Equipment Load 600W	600	
13	Mechanical Engineering Lab (Thermal-1) Heat Transfer	7	1			328	7		560			Equipment Load 21600W	21600	
14	Room No. 012A	2				88	1		80					
15	Room No. 013 Environmental Engg. Lab		4			80	7		560			Equipment Load	7150	
16	Room No. 014 Basic Electrical Engg. Lab		13			260	21		1680			Equipment Load	10130	
17	Room No. 015	7	7	1		457	23		1840					

SL. NO.	LOCATION	FLT 36W	LED 20/40W	9W LED	OTHER LIGHTING	LIGHTING TOTAL	Ceiling Fan No.	WALL FAN/STAN No.	FAN Watt	COMPUTER LOAD Watt	Other Watt	LAB EQUIPMENT LOAD	EQUIPMENT Watt	TOTAL Kw
18	Room No. 016A	4				176	7		560					
19	Room No. 016B	4				176	7		560			Equipment Loa 1000W	1000	
20	Common Room	3	1	1		161	6		480					
21	Room No. 020 High Way Lab	2		1		97	8		640			Equipment Loa 7000W	7000	
22	Common Room	4				176	6		480					
23	Concrete Technology Lab	3	3			192	4		320			Equipment Loa 7250W	7250	
24	Canteen		12			240	18	1	1590		1835			
25	Corridor Ground Floor		6	18										
1St Floor														
26	Room No. 129 Board Room	4				176	8		640					
27	Room No. 127 Class Room-12	4	2			216	7		560					
28	Room No. 126	3	1			152	7		560					
29	Room No. 125	3	1			152	7		560					
30	Room No. 124	4	1	1		205	7		560					
31	Room No. 128 Principal Room	2	1			108	2		160	160				
32	Room No. 130A	1	1			64	2		160	80				
33	Room No. 131 Sick Room		2			40	2		160					
34	Room No.130	1	3			104	3	1	340					
35	Room No. 123 Store Room	2	1			108	2	1	260					
36	Room No. 122	3	1			152	8		640					
37	Room No. 122 (A&B)	6				264	8		640			Lab. Equip. 500W	500	
38	Room No. 121A	2				88	5		400					
39	Room No. 120	2	2			128	7		560					
40	Room No. 119	5				220	7		560					
41	Room No. 118	4				176	7		560					
42	Room No. 117	4				176	7		560					

SL. NO.	LOCATION	FLT 36W	LED 20/40W	9W LED	OTHER LIGHTING	LIGHTING TOTAL	Ceiling Fan No.	WALL FAN/STAN No.	FAN Watt	COMPUTER LOAD Watt	Other Watt	LAB EQUIPMENT LOAD	EQUIPMENT Watt	TOTAL Kw
43	Room No. 121 Digital Library	2	2			128	7		560	840				
44	Central Library	4	7			316	11		880					
45	Room No. 101 Principal	1	2			84	4		320	80				
46	Room No. 102	3				132	3	1	265	680				
47	Room No. 104 Exam Central Room	2	3			148	4		320	600				
48	Room No. 103 Cash Office & Chief Admn. Officer	1	6			164	6		480	1240				
49	Room No. 105	1	5			144	7	1	625	1000				
50	Room No. 106	4				176	6		480	880				
51	Room No. 107	6	2		1+2+6+1	304	6		980	240				
52	Room No. 113	3	1			152	7		560	60				
53	Room No. 114	4				176	7		560					
54	Room No. 115	5	7			360			0					
55	Room No. 112 Computer Lab-3 1St Floor	7				308	8		640	2560				
56	Room No. 110 Computer Lab-1	5				220	8		640	1280				
57	Room No. 111 Computer Lab-4	2	4			168	7		560	2560				
58	Room No. 112A Computer Lab-2	4	3			236	8		640	2560				
59	Store Room	3				132	3		240		1500			
60	Room No. 108A	3	5			232			0					
61	Room No. 109 Office 1St Floor	2	2			128	3		240	960				
62	Room No. 108		3			60	8		640	1920				
63	Pantry- 1st Floor		1			20		1	65		3000			
64	Corridor		16	23		527	3		240					
2Nd Floor														
65	Room No. 228	4				176	7		560	60				
66	Room No. 227	2				88	4		320	480				

SL. NO.	LOCATION	FLT 36W	LED 20/40W	9W LED	OTHER LIGHTING	LIGHTING TOTAL	Ceiling Fan No.	WALL FAN/STAN No.	FAN Watt	COMPUTER LOAD Watt	Other Watt	LAB EQUIPMENT LOAD	EQUIPMENT Watt	TOTAL Kw
67	Room No. 225	2	4			168	8		640					
68	Room No. 226	6	1			284	9		720	2560				
69	Room No. 224	4				176	7		560					
70	Room No. 223	3	1			152			0	60				
71	Room No. 221	3	2			172			0	2560				
72	Room No. 222	2				88	3		240	200				
73	Room No. 220B	4				176	7		560	0				
74	Room No. 220A Analog & Digital Lab	4				176	7		560					
75	Room No. 220 Languatge Lab		4		54	350	8		640	2400				
76	Room No. 219A	2				88	4		320	640				
77	Room No. 219 Faculty Electrical & Carriculum	8	2			392	11		880	960				
78	Room No. 218 Lribrary	6	2			304	12		960					
79	Room No. 217	4				176	6		480	1310				
80	Room No. 215	2				88	4		320	120				
81	Room No. 216 MBA	2				88	4		320	200				
82	Room No. 214	3				132	6		480	30				
83	Room No. 213 MCA	2				88	2		160	440				
84	Room No. 209A Antena Lab	7				308	9		720	1000		Lab Equip. 1200W	1200	
85	Room No. 212	4				176	7		560					
86	Room No. 207B	3				132	7		560					
87	Room No. 210 Com Lab-7	11				484	12		960	400				
88	Room No. 211 Architechral Lab	4				176	7		560					
89	Room No. 207A	2	2			128	7		560					
90	Room No. 207	6	2			304	7		560	60				
91	Room No. 205	7				308	7		560					
92	Room No. 203 Comp Lab-5	8				352	8		640	3200		Equipment-200W	2000	

SL. NO.	LOCATION	FLT 36W	LED 20/40W	9W LED	OTHER LIGHTING	LIGHTING TOTAL	Ceiling Fan No.	WALL FAN/STAN No.	FAN Watt	COMPUTER LOAD Watt	Other Watt	LAB EQUIPMENT LOAD	EQUIPMENT Watt	TOTAL Kw
93	Room No. 201	6				264	2		160					
94	Room No. 202 Comp Lab-6	8				352	12		960	4160				
95	Room No. 204	4	2			216	12		960	3520				
96	Room No. 206	3				132	4		320					
97	Corridor		15	13		417			0					
3rd Floor														
98	Room No. 321	4	0			176	5		400					
99	Room No. 322	2	2			128	3		240					
100	Room No. 323A	3				132	4		320					
101	Room No. 320	3	1			152	7		560					
102	Room No. 319	3	1			152	7		560					
103	Room No. 318A	2	1			108	5		400					
104	Room No. 318B	1				44	1		80					
105	Toilet	3		2		150			0					
106	Corridor	3		2		150			0					
107	Room No. 317	3	1			152	7		560					
108	Room No. 316	4				176	7		560					
109	Room No. 315	4				176	7		560					
110	Room No. 313	4				176	7		560					
111	Room No. 314 Civil Engg.	8				352	10		800					
112	Room No. 314A Civil Engg. Faculty	5	2			260	7	2	760	240				
113	Room No. 318					0	2		160	0				
114	Godown					0			0	0				
115	Room No. 312	2				88	3		240	0				
116	Room No. 311	2	2			128	7		560	0				
117	Room No. 309	1	3			104	7		560	0				
118	Room No. 308B	2	1			108	7		560	0				
119	Room No. 310	3	1			152	7		560	0				
120	Room No. 307	6				264	11		880	0				
121	Room No. 308A	5				220	7		560	0				
122	Room No. 306	4				176	7		560	0				

SL. NO.	LOCATION	FLT 36W	LED 20/40W	9W LED	OTHER LIGHTING	LIGHTING TOTAL	Ceiling Fan No.	WALL FAN/STAN No.	FAN Watt	COMPUTER LOAD Watt	Other Watt	LAB EQUIPMENT LOAD	EQUIPMENT Watt	TOTAL Kw
123	3rd Floor Toilet		3			60			0	0				
124	Room No. 305B	4				176	7		560	2720				
125	Room No. 305A	4				176	7		560	2320				
126	Room No. 304	11				484	6		480	0				
127	Room No. 300	2	1			108	4		320	0				
128	Room No. 303 Computer Lab	7	1			328	11		880	3040				
129	Room No. 302	4				176	8		640	0				
130	Room No. 301	4				176	3		240	640	600			
131	Room No. 300 Seminer Hall		24			480			0					
132	3rd Floor Corridor	4	8	2		354			0					
	Boundary Lighting													
133	100W LED 3 Nos					300								
134	50W LED 2 Nos					50								
135	400W Metal Halide 3 Nos					1200								
	Total					**26999**			**65770**	**51020**	**6935**		**103855**	**227.580**

3.4 A C Load Distribution of RERFGI (Barrackpore)

Table 6

Sl. No.	Floor	Reference of AC	Type	Rated Capacity (TR)	wattage	kW
1	3rd	323A	Window	1.5	1700	1.7
2	3rd	320	Window	1.5	1700	1.7
3	3rd	319	Window	1.5	1700	1.7
4	3rd	317	Window	1.5	1700	1.7
5	3rd	316	Window	1.5	1700	1.7
6	3rd	315	Window	1.5	1700	1.7
7	3rd	313	Window	1.5	1700	1.7
8	3rd	311	Window	1.5	1700	1.7
9	3rd	310	Window	1.5	1700	1.7
10	3rd	309	Window	1.5	1700	1.7
11	3rd	309	Window	1.5	1700	1.7
12	3rd	308B	Window	1.5	1700	1.7
13	3rd	300	Window	1.5	1700	1.7
14	3rd	303	Window	1.5	1700	1.7
15	3rd	303	Window	1.5	1700	1.7
16	3rd	302	Window	1.5	1700	1.7
17	3rd	302	Split	2	1700	1.7
18	3rd	301	Window	1.5	1700	1.7
19	2nd	228	Window	1.5	1700	1.7
20	2nd	227	Window	1.5	1700	1.7
21	2nd	226	Window	1.5	1700	1.7
22	2nd	223	Window	1.5	1700	1.7
23	2nd	221	Window	1.5	1700	1.7
24	2nd	220B	Window	1.5	1700	1.7
25	2nd	220	Window	1.5	1700	1.7
26	2nd	219A	Window	1.5	1700	1.7
27	2nd	217	Window	1.5	1700	1.7
28	2nd	214	Window	1.5	1700	1.7
29	2nd	209A	Split	1.5	1700	1.7
30	2nd	212	Split	1.2	1700	1.7
31	2nd	207A	Window	1.5	1700	1.7
32	2nd	205	Window	1.5	1700	1.7
33	1st	129	Window	1.5	1700	1.7
34	1st	120	Window	1.5	1700	1.7
35	1st	119	Window	1.5	1700	1.7
36	1st	118	Window	1.5	1700	1.7
37	1st	101	Split	1.5	1700	1.7
38	1st	102	Split	1.2	1100	1.1
39	1st	104	Window	1.5	1700	1.7
40	1st	103	Window	1.5	1700	1.7
41	1st	105	Window	1.5	1700	1.7
42	1st	107	Window	1.5	1700	1.7
43	1st	113	Window	1.5	1700	1.7
44	1st	114	Window	1.5	1700	1.7

Sl. No.	Floor	Reference of AC	Type	Rated Capacity (TR)	wattage	kW
45	1st	115	Window	1.5	1700	1.7
46	1st	112	Window	1.5	1700	1.7
47	1st	110	Window	1.5	1700	1.7
48	1st	111	Window	1.5	1700	1.7
49	1st	112A	Window	1.5	1700	1.7
50	1st	109	Window	1.5	1700	1.7
51	1st	108	Window	1.5	1700	1.7
52	1st	128	Split	1.2	1700	1.7
53	1st	120	Window	1.5	1700	1.7
54	1st	119	Window	1.5	1700	1.7
55	1st	118	Window	1.5	1700	1.7
56	1st	101	Split	1.2	1100	1.1
57	1st	102	Split	1.2	1100	1.1
58	1st	104	Window	1.5	1700	1.7
59	1st	107	Window	1.5	1700	1.7
60	1st	113	Window	1.5	1700	1.7
61	1st	114	Window	1.5	1700	1.7
62	1st	115	Window	1.5	1700	1.7

3.5 Distribution of connected load of RERFGI (Barrackpore)

Table 7

LOAD SUMMARY

	Particulars	Load kW	%
A	Lighting	26.999	7.3%
B	Fan	65.77	17.9%
C	Computer, Printer, Scanner	51.3	13.9%
D	Misc. load	12.335	3.3%
E	AC Load	103.6	28.1%
F	Lab Equipment	103.855	28.2%
G	Lift	1.5	0.4%
H	Pump	3	0.8%
	Total	**368.359**	**100.0%**

Pie Chart of load Distribution

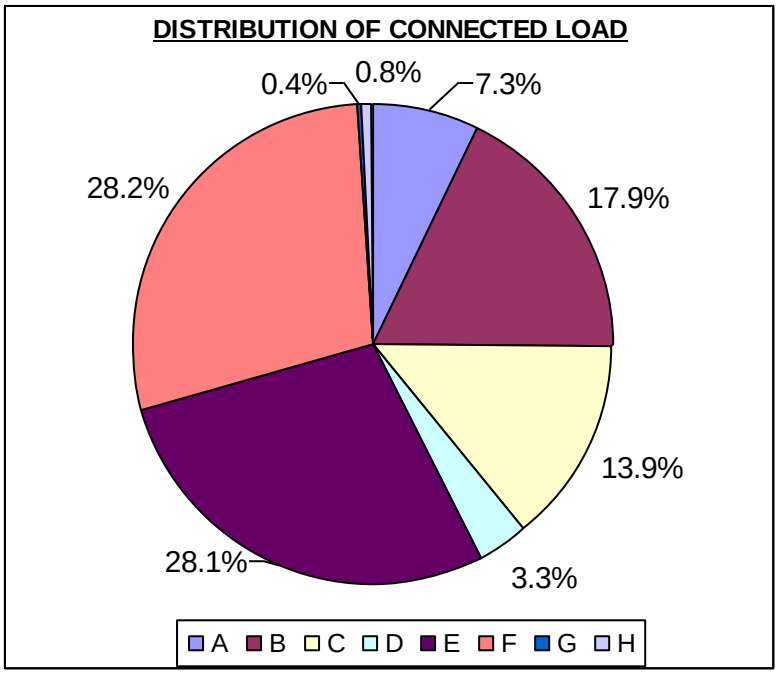


Figure 2

4.0 Energy Consumption Pattern of RERFGI, Barrackpore

4.1 Supply and Supplier's Details

Table 8

Supplier	**WBSEDCL**	**Unit**
Contract Demand	**55**	kW
Supply Voltage	**11**	kV
Supply Current	**-**	A
Tariff code	**Institute**	**Normal**

4.2 Summary of electrical energy Consumption 2021

Table 9

Month	Total Unit	40% of total Unit	Total Bill Value	40% of Bill Value
2021	kWh	kWh	Rs.	Rs.
Jan.	9097	3638.8	103955	41582
Feb.	9133	3653.2	105035	42014
Mar	14799	5919.6	190035	76014
Apr	12941.5	5176.6	165598	66239.2
May	5652.25	2260.9	77536	31014.4
Jun	6625.5	2650.2	84537	33814.8
Jul	13163.75	5265.5	172048	68819.2
Aug	17649.25	7059.7	211756	84702.4
Sep	16917.75	6767.1	197206	78882.4
Oct	13622.25	5448.9	169084	67633.6
Nov	12014.5	4805.8	136169	54467.6
Dec	14088	5635.2	154927	61970.8
Total	145703.8	58281.5	1767886	707154.4
Avg.	12141.98	4856.792	147323.8	58929.53

4.3 Summary of electrical energy Consumption 2022

Table 10

Month	Total Unit	40% of total Unit	Total Bill Value	40% of Bill Value
2022	kWh	kWh	Rs.	Rs.
Jan.	6427.75	2571.1	82355	32942
Feb.	17391.25	6956.5	191771	76708.4
Mar	29153.5	11661.4	386041	154416.4
Apr	37812	15124.8	466536	186614.4
May	32736.75	13094.7	369476	147790.4
Jun	36969.5	14787.8	437168	174867.2
Jul	42075.25	16830.1	505662	202264.8
Aug	43995.25	17598.1	535750	214300
Sep	43199.5	17279.8	535779	214311.6
Oct	25483	10193.2	363891	145556.4
Nov	30505.5	12202.2	387229	154891.6
Dec	19210	7684	217693	87077.2
Total	364959.3	145983.7	4479351	1791740
Avg.	30413.27	12165.31	373279.3	149311.7

4.4 Summary of electrical energy Consumption Jan to June 2023

Table 11

Month	Total Unit	40% of total Unit	Total Bill Value	40% of Bill Value
2023	kWh	kWh	Rs.	Rs.
Jan.	21779.75	8711.9	242713	97085.2
Feb.	24267.75	9707.1	313872	125548.8
Mar	38419.25	15367.7	481584	192633.6
Apr	42100.25	16840.1	545707	218282.8
May	55557	22222.8	676651	270660.4
Jun	60512.5	24205	747454	298981.6
Total	242636.5	97054.6	3007981	1203192
Avg.	40439.42	16175.77	501330.2	200532.1

Our Observation and remarks

a. The electric bill obtained for total 4 nos. of building of the campus and the contribution under our scope of audit is only 40% of the total consumption and hence considered at the time of electricity bill tabulation.
b. The academic campus is Administrative Building.
c. Here Energy consumption pattern is likely same. It depends on the number of students, staff (both teaching and non-teaching). Variable loads are also of AC but it depends on the seasons. Here the air temperature is not very soothing and that is why need of AC is also very more according to seasons.
d. They have solar panel also but do not have any metering system.
e. DG generation was not noted. We are suggesting to note down.

4.5 Month Wise Energy Consumption (kWh) 2021.2022.2023 (up to June) Comparison

Table 12

Month 21	WBSEDCL	Month 22	WBSEDCL	Month 23	WBSEDCL
Jan.	3638.8	Jan.	2571.1	Jan.	8711.9
Feb.	3653.2	Feb.	6956.5	Feb.	9707.1
Mar	5919.6	Mar	11661.4	Mar	15367.7
Apr	5176.6	Apr	15124.8	Apr	16840.1
May	2260.9	May	13094.7	May	22222.8
Jun	2650.2	Jun	14787.8	Jun	24205.0
Jul	5265.5	Jul	16830.1	Jul	-
Aug	7059.7	Aug	17598.1	Aug	-
Sep	6767.1	Sep	17279.8	Sep	-
Oct	5448.9	Oct	10193.2	Oct	-
Nov	4805.8	Nov	12202.2	Nov	-
Dec	5635.2	Dec	7684	Dec	-

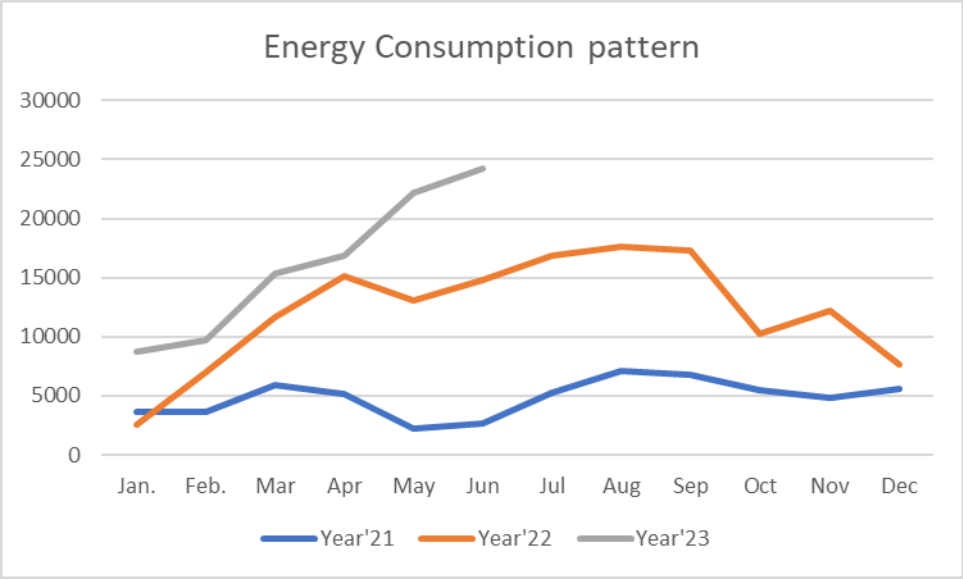


Figure 2

Our Observation and remarks

In the year 2021, due pandemic condition energy consumption was less. Energy consumption pattern for the period is variable in every month. Actually, month June & July are the end of session and start up. Maximum students are homebound at that time. Energy consumption is less. April is the hot season. Energy consumption is more in this season.

ii. **Feeder, DB Running Load Study**

The loading pattern of the different **Feeder, DB** of the installation has been measured for their redundency and over loading and following results were obtained-

4.6 FEEDER LOAD STUDY

Table 13

Sl. No.	Feeder ID	Voltage (Avg.)	IR	IY	IB	Current (Avg.)	R	y	B	P.F	Running kW
MAIN POWER DB AT GROUND FLOOR NORTH DISTRIBUTION PANEL28.06.23											
1	North & South Bus Bar Lighting 200A	404.3065	65.5	58.9	72.5	65.6	0.996	0.999	0.998	1.00	45.9
2	AC North 200A Switch	404.7107	61.1	42.2	51.7	51.7	0.97	0.98	0.99	0.98	35.5
3	AC South 100A Switch	402.69	13.2	11	16.5	13.6	0.98	0.99	0.98	0.98	9.3
4	100A SFU Lighting North	403.556	34.9	41.6	54.7	43.7	0.98	0.99	0.97	0.98	30.0
5	South Lighting from Change Over	344.9567	36.4	22.8	20.9	26.7	0.99	0.97	0.98	0.98	15.6
RISER BUS BAR AT DIFFERENT FLOOR											
6	North Lighting Riser Bus at Ground Floor (All floor lighting)	402.7477	33.7	44.4	49.1	42.4	0.99	0.98	0.99	0.99	29.2

Sl. No.	Feeder ID	Voltage (Avg.)	IR	IY	IB	Current (Avg.)	R	y	B	P.F	Running kW
7	North Lighting Riser Bus at 2nd Floor (2nd and 3rd floor lighting)	401.5353	24.9	32.2	52.1	36.4	0.978	0.999	0.997	0.99	25.1
8	North AC Riser Bus at Ground floor (All floor AC)	402.1704	72.5	40.4	81.3	64.733333	0.98	0.99	0.97	0.98	44.2
9	North AC Riser Bus at 2nd floor (2nd & 3rd Floor AC)	402.7477	74.6	38.5	52.3	55.133333	1	0.993	0.981	0.99	38.1
10	South Lighting Riser Bus at 1st Floor (All floor lighting)	400.958	23.7	26.5	13	21.066667	0.98	0.99	0.97	0.98	14.3
11	South Lighting Riser Bus at 3rd Floor (2nd and 3rd floor lighting)	401.9395	17.9	17	7.4	14.1	0.99	0.98	0.97	0.98	9.6
12	South AC Riser Bus at 1St floor (All floor AC)	402.2281	16.2	15.8	13.2	15.066667	0.97	0.99	0.99	0.98	10.3
13	South AC Riser Bus at 3rd floor (2nd & 3rd floor AC)	400.4961	14.9	10.9	5.4	10.4	0.742	0.809	0.815	0.79	5.7

Table 14

DISTRIBUTION OF RUNNING LOAD		
Particulars	**Load kW**	**%**
Lighting an Lab North	34.9	24.0%
Lighting and Lab South	36.4	25.0%
AC North	61.1	42.0%
AC South	13.2	9.1%
TOTAL	**145.6**	100.0%

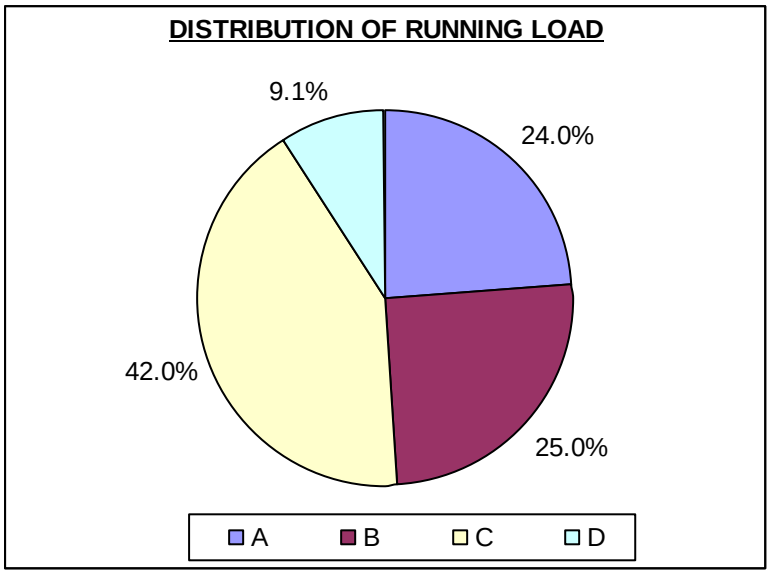


Figure 3

4.7 Daily Electrical Parameter Profile

a. Daily Load Profile

The energy consumption profile for 24 hours at the main incomer as on 28.06.23 is as follows.

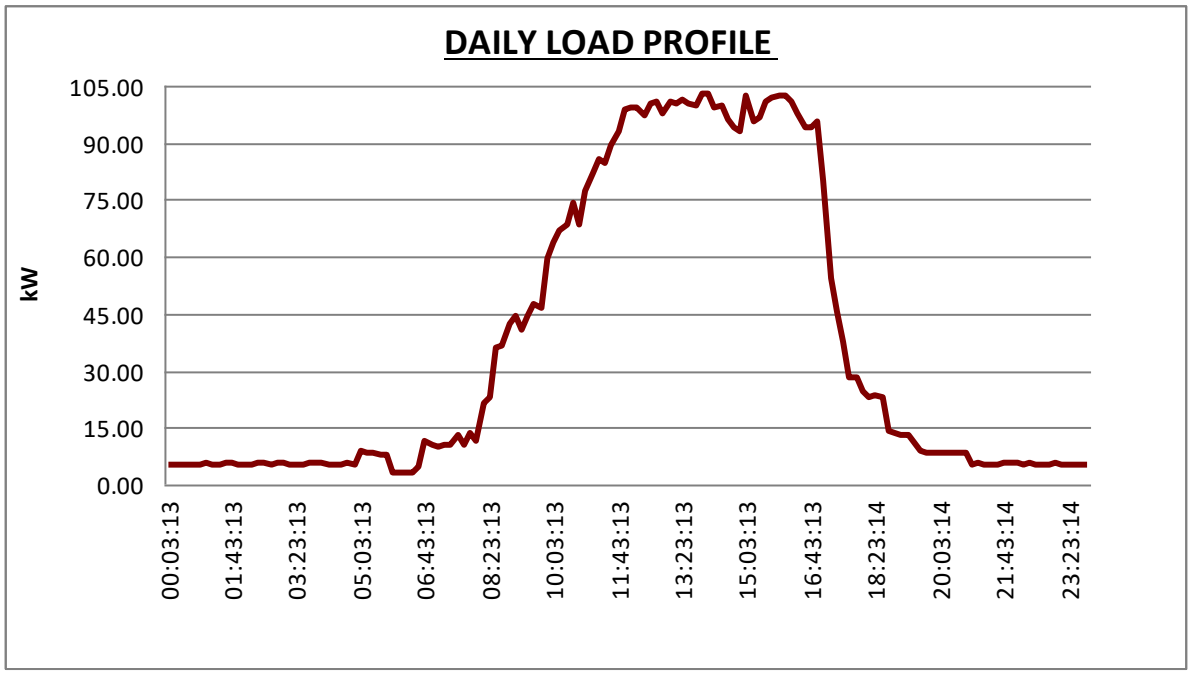


Figure 4

Table 15

MAXIMUM kW	MINIMUM kW	AVERAGE kW
102.87	5.11	36.70

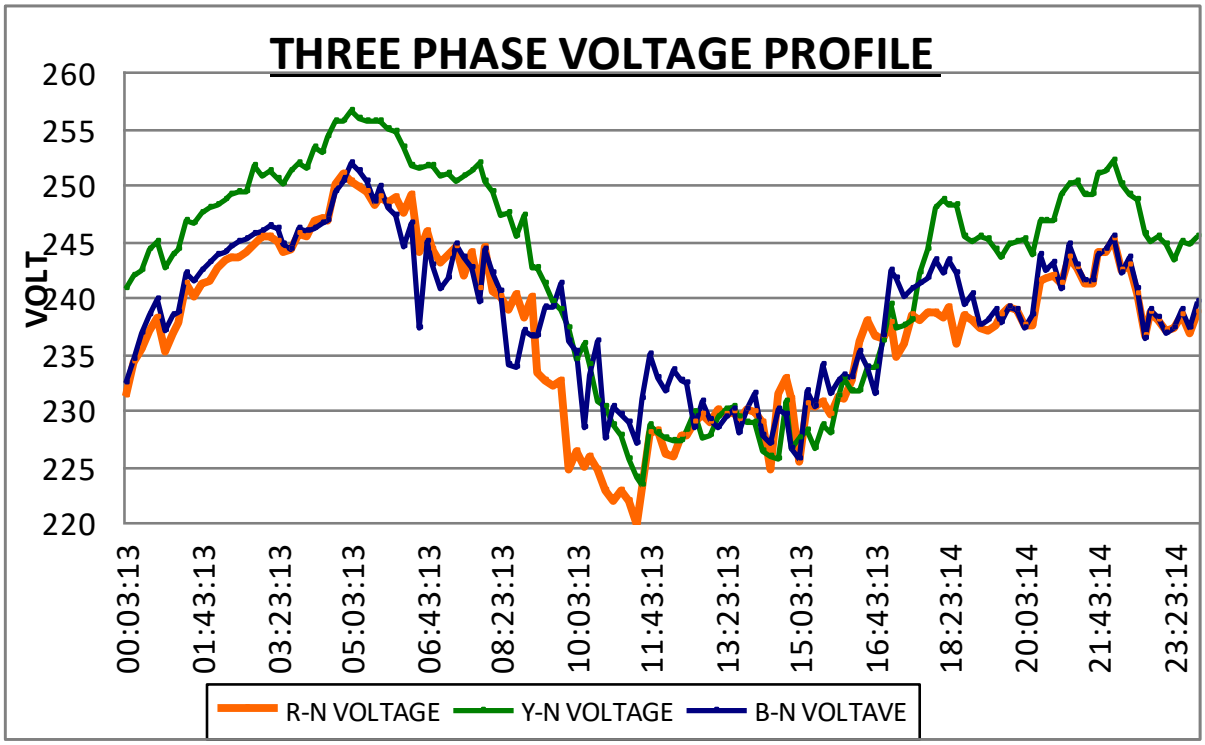


Table 16

MAXIMUM V	MINIMUM V	AVERAGE V
256.4	219.6	239.4

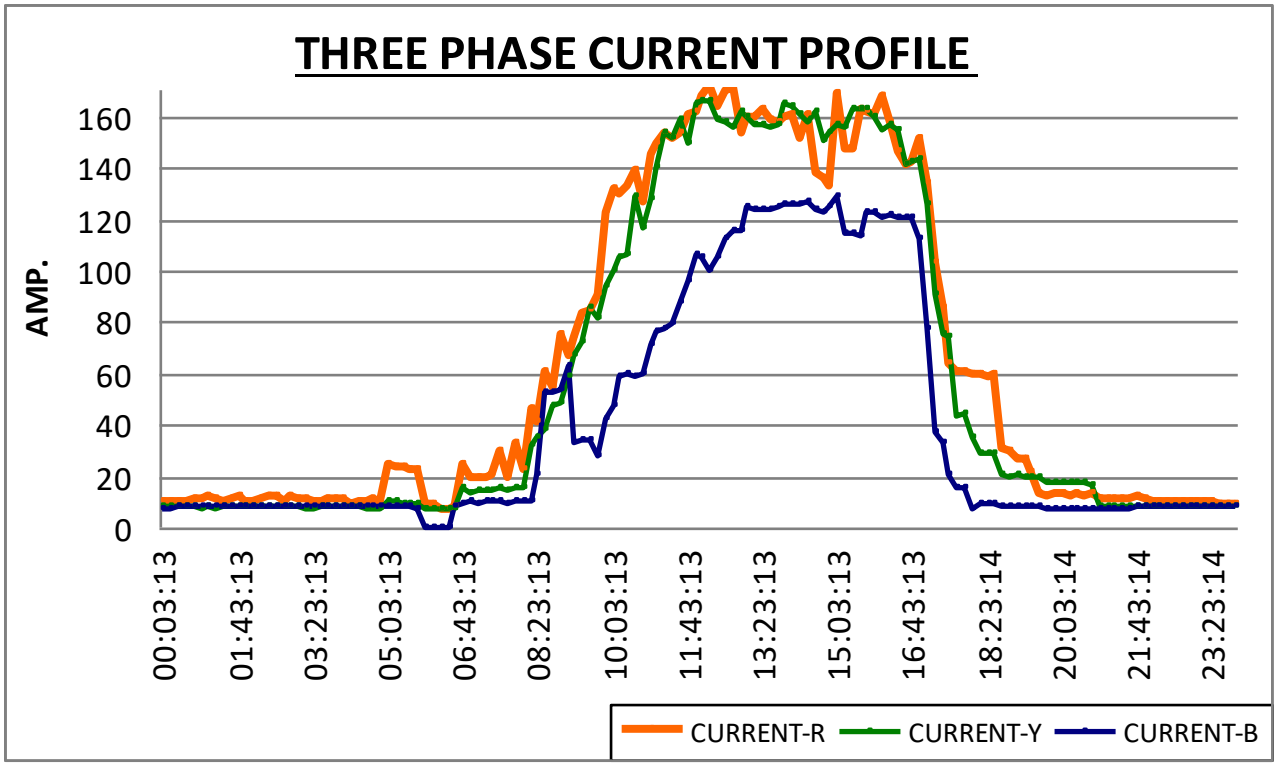


Table 17

MAXIMUM Amp.	MINIMUM Amp.	AVERAGE Amp.
172.05	5.0	53.85

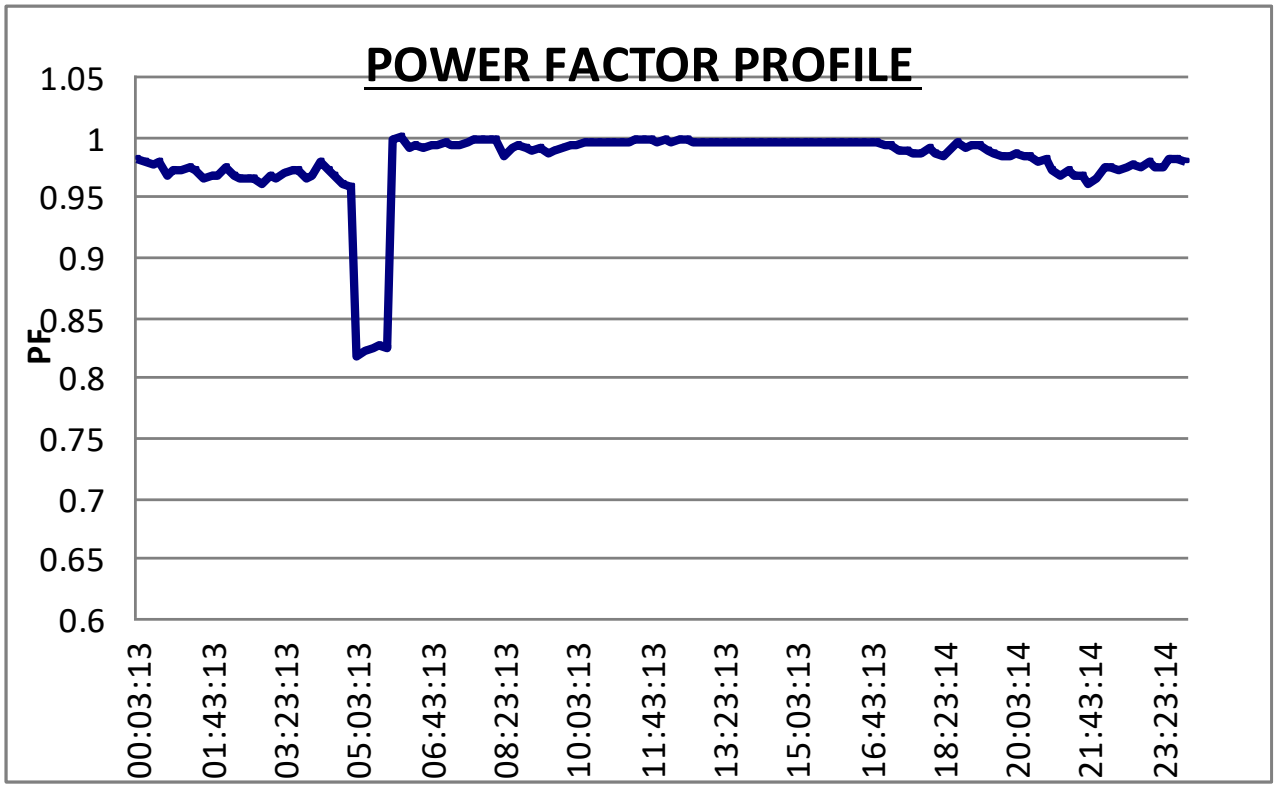


Table 18

MAXIMUM	MINIMUM	AVERAGE
0.99	0.817	0.978

4.8 Performance analysis of Air conditioners in the building-

Table 19

Sl. No.	Floor	Reference of AC	Type	Rated Capacity (TR)	Avg. Flow (m/s)	TR developed	Input power (kW)	Remarks
1	3rd	323A	Window	1.5	6	1.01	1.2	
2	3rd	320	Window	1.5	5.45	0.89	1.18	Moderate
3	3rd	319	Window	1.5	5.1	0.76	1.05	Moderate
4	3rd	317	Window	1.5	3.2	0.67	0.96	Moderate
5	3rd	316	Window	1.5	4.75	0.87	1.16	Old AC, Window Leakage
6	3rd	315	Window	1.5	5.2	0.94	1.23	Old
7	3rd	313	Window	1.5				Out of order
8	3rd	311	Window	1.5	4	0.76	1.05	Medium
9	3rd	309	Window	1.5	6.95	1.32	1.61	running
10	3rd	309	Window	1.5	4.8	0.88	1.17	old
11	3rd	308B	Window	1.5				Out of order

Sl. No.	Floor	**Reference of AC**	**Type**	**Rated Capacity (TR)**	**Avg. Flow (m/s)**	**TR developed**	**Input power (kW)**	Remarks
12	3rd	300	Window	1.5				Out of order
13	3rd	303	Window	1.5	4.25	0.89	1.18	OK
14	3rd	303	Window	1.5	5.1	0.92	1.21	OK
15	3rd	302	Window	1.5	5.05	0.98	1.27	2 Star
16	3rd	302	Split	2	2.5	0.49	0.78	3 Star
17	3rd	301	Window	1.5	4.4	0.88	1.17	Old
18	1st	129	Window	1.5	4.3	0.79	1.08	OLD
19	2nd	228	Window	1.5				Load Shading
20	2nd	227	Window	1.5				Load Shading
21	2nd	226	Window	1.5				Load Shading
22	2nd	118	Split	1.2				Moderate
23	2nd	120	Window	1.5	2.5	0.55	0.84	Moderate
24	2nd	119	Window	1.5	2.1	0.46	0.75	Moderate
25	2nd	118	Window	1.5	3	0.59	0.88	Moderate
26	2nd	101	Split	1.5	1.7	0.42	0.71	Moderate
27	2nd	102	Split	1.2				good
28	2nd	104	Window	1.5				good
29	2nd	103	Window	1.5	3.1	0.51	0.80	good
30	2nd	105	Window	1.5				good
31	2nd	107	Window	1.5	3.2	0.69	0.98	good
32	2nd	113	Window	1.5	5.2	0.98	1.27	good
33	2nd	114	Window	1.5	4.5	0.83	1.12	gas amount is less
34	2nd	115	Window	1.5				Not working
35	2nd	112	Window	1.5	4.2	0.78	1.07	good
36	2nd	110	Window	1.5	4.85	0.98	1.27	-
37	2nd	111	Window	1.5	4.4	0.85	1.14	good
38	2nd	112A	Window	1.5	4.75	0.89	1.18	good
39	2nd	109	Window	1.5	4.7	0.86	1.15	good
40	2nd	108	Window	1.5	3.3	0.86	1.15	Moderate

4.9 Illumination Study

SL. NO.	LOCATION	FLT 36 W	LED 20/40 W	9W LED	TOTAL CIRCUIT WATTS (W)	COVERED FLOOR AREA (m^2)	AVERAGE MEASURED ILLUMINATION (LUX)	RECOMMENDED (MIN-AVG-MAX) ILLUMINATION (LUX)	WATT / M^2	REMARK	RECOMMENDATION
1	**Room No. 321**	4	0		176	63.8	105	100-150-200	2.8	ok	36W tube to be replaced by 20W LED Tube
2	**Room No. 322**	2	2		128	97.9	111	100-150-200	1.3	ok	36W tube to be replaced by 20W LED Tube
3	**Room No. 323A**	3			132	34.8	101	100-150-200	3.8	ok	36W tube to be replaced by 20W LED Tube
4	**Room No. 320**	3	1		152	62.7	115	100-150-200	2.4	ok	36W tube to be replaced by 20W LED Tube
5	**Room No. 319**	3	1		152	68.2	120	100-150-200	2.2	ok	36W tube to be replaced by 20W LED Tube
6	**Room No. 318A**	2	1		108	67.1	105	100-150-200	1.6	ok	36W tube to be replaced by 20W LED Tube
7	**Room No. 317**	3	1		152	66	108	100-150-200	2.3	ok	36W tube to be replaced by 20W LED Tube

SL. NO.	LOCATION	FLT 36 W	LED 20/40 W	9W LED	TOTAL CIRCUIT WATTS (W)	COVERED FLOOR AREA (m^2)	AVERAGE MEASURED ILLUMINATION (LUX)	RECOMMENDED (MIN-AVG-MAX) ILLUMINATION (LUX)	WATT / M^2	REMARK	RECOMMENDATION
8	**Room No. 316**	4			176	66	121	100-150-200	2.7	ok	36W tube to be replaced by 20W LED Tube
9	**Room No. 315**	4			176	64.9	109	100-150-200	2.7	ok	36W tube to be replaced by 20W LED Tube
10	**Room No. 313**	4			176	66	112	100-150-200	2.7	ok	36W tube to be replaced by 20W LED Tube
11	**Room No. 314**	8			352	140.8	117	100-150-200	2.5	ok	36W tube to be replaced by 20W LED Tube
12	**Room No. 314A**	5	2		260	93.5	102	100-150-200	2.8	ok	36W tube to be replaced by 20W LED Tube
13	**Room No. 312**	2			88	25.68	110	100-150-200	3.4	ok	36W tube to be replaced by 20W LED Tube

SL. NO.	LOCATION	FLT 36 W	LED 20/40 W	9W LED	TOTAL CIRCUIT WATTS (W)	COVERED FLOOR AREA (m^2)	AVERAGE MEASURED ILLUMINATION (LUX)	RECOMMENDED (MIN-AVG-MAX) ILLUMINATION (LUX)	WATT / M^2	REMARK	RECOMMENDATION
14	**Room No. 311**	2	2		128	63.84	115	100-150-200	2.0	ok	36W tube to be replaced by 20W LED Tube
15	**Room No. 309**	1	3		104	65.4	125	100-150-200	1.6	ok	36W tube to be replaced by 20W LED Tube
16	**Room No. 308B**	2	1		108	63.72	116	100-150-200	1.7	ok	36W tube to be replaced by 20W LED Tube
17	**Room No. 310**	3	1		152	77	111	100-150-200	2.0	ok	36W tube to be replaced by 20W LED Tube
18	**Room No. 307**	6			264	68.2	118	100-150-200	3.9	ok	36W tube to be replaced by 20W LED Tube
19	**Room No. 308A**	5			220	72.6	119	100-150-200	3.0	ok	36W tube to be replaced by 20W LED Tube

SL. NO.	LOCATION	FLT 36 W	LED 20/40 W	9W LED	TOTAL CIRCUIT WATTS (W)	COVERED FLOOR AREA (m^2)	AVERAGE MEASURED ILLUMINATION (LUX)	RECOMMENDED (MIN-AVG-MAX) ILLUMINATION (LUX)	WATT / M^2	REMARK	RECOMMENDATION
20	**Room No. 306**	4			176	72.6	118	100-150-200	2.4	ok	36W tube to be replaced by 20W LED Tube
21	**3rd Floor Toilet**		3		60			50-75-100	#DIV/0!	ok	36W tube to be replaced by 20W LED Tube
22	**Room No. 305B**	4			176	72.6	116.5	100-150-200	2.4	ok	36W tube to be replaced by 20W LED Tube
23	**Room No. 305A**	4			176	72.6	116.2	100-150-200	2.4	ok	36W tube to be replaced by 20W LED Tube
24	**Room No. 304**	11			484	93.5	110	100-150-200	5.2	ok	36W tube to be replaced by 20W LED Tube
25	**Room No. 300**	2	1		108	41.04	109	100-150-200	2.6	ok	36W tube to be replaced by 20W LED Tube

SL. NO.	LOCATION	FLT 36 W	LED 20/40 W	9W LED	TOTAL CIRCUIT WATTS (W)	COVERED FLOOR AREA (m^2)	AVERAGE MEASURED ILLUMINATION (LUX)	RECOMMENDED (MIN-AVG-MAX) ILLUMINATION (LUX)	WATT / M^2	REMARK	RECOMMENDATION
26	**Room No. 303 Computer Lab**	7	1		328	141.9	130	100-150-200	2.3	ok	36W tube to be replaced by 20W LED Tube
27	**Room No. 302**	4			176	66	105	100-150-200	2.7	ok	36W tube to be replaced by 20W LED Tube
28	**Room No. 301**	4			176	35.4	115	100-150-200	5.0	ok	36W tube to be replaced by 20W LED Tube
29	**3rd Floor Corridor**	4	8	2	354		101	50-75-100		ok	36W tube to be replaced by 20W LED Tube
30	**Room No. 300 Board Room**		24		480	202.4	115	100-150-200	2.4	ok	
31	**Room No. 228**	4			176	77	119	100-150-200	2.3	ok	36W tube to be replaced by 20W LED Tube
32	**Room No. 227**	2			88	36.6	101	100-150-200	2.4	ok	36W tube to be replaced by 20W LED Tube

SL. NO.	LOCATION	FLT 36 W	LED 20/40 W	9W LED	TOTAL CIRCUIT WATTS (W)	COVERED FLOOR AREA (m^2)	AVERAGE MEASURED ILLUMINATION (LUX)	RECOMMENDED (MIN-AVG-MAX) ILLUMINATION (LUX)	WATT / M^2	REMARK	RECOMMENDATION
33	**Room No. 225**	2	4		168	110	105	100-150-200	1.5	ok	36W tube to be replaced by 20W LED Tube
34	**Room No. 226**	6	1		284	99	112	100-150-200	2.9	ok	36W tube to be replaced by 20W LED Tube
35	**Room No. 224**	4			176	72.6	112	100-150-200	2.4	ok	36W tube to be replaced by 20W LED Tube
36	**Room No. 223**	3	1		152	72.6	118.8	100-150-200	2.1	ok	36W tube to be replaced by 20W LED Tube
37	**Room No. 221**	3	2		172	72.6	101	100-150-200	2.4	ok	36W tube to be replaced by 20W LED Tube
38	**Room No. 222**	2			88	47.52	112	100-150-200	1.9	ok	36W tube to be replaced by 20W LED Tube

SL. NO.	LOCATION	FLT 36 W	LED 20/40 W	9W LED	TOTAL CIRCUIT WATTS (W)	COVERED FLOOR AREA (m^2)	AVERAGE MEASURED ILLUMINATION (LUX)	RECOMMENDED (MIN-AVG-MAX) ILLUMINATION (LUX)	WATT / M^2	REMARK	RECOMMENDATION
39	**Room No. 220B**	4			176	66	117.5	100-150-200	2.7	ok	36W tube to be replaced by 20W LED Tube
40	**Room No. 220A Analog & Digital Lab**	4			176	77	118.5	200-300-500	2.3	ok	36W tube to be replaced by 20W LED Tube
41	**Room No. 220 Language Lab**		4		398	72.6	135	100-150-200	5.5	ok	
42	**Room No. 219A**	2			88	47.52	118.7	100-150-200	1.9	ok	36W tube to be replaced by 20W LED Tube
43	**Room No. 219**	8	2		392	176	122	100-150-200	2.2	ok	36W tube to be replaced by 20W LED Tube
44	**Room No. 218 Lribrary**	6	2		304	132	117.1	100-150-200	2.3	ok	36W tube to be replaced by 20W LED Tube
45	**Room No. 217**	4			176	72.6	119	200-300-500	2.4	ok	36W tube to be replaced by 20W LED Tube

SL. NO.	LOCATION	FLT 36 W	LED 20/40 W	9W LED	TOTAL CIRCUIT WATTS (W)	COVERED FLOOR AREA (m^2)	AVERAGE MEASURED ILLUMINATION (LUX)	RECOMMENDED (MIN-AVG-MAX) ILLUMINATION (LUX)	WATT / M^2	REMARK	RECOMMENDATION
46	**Room No. 215**	2			88	43.56	107	100-150-200	2.0	ok	36W tube to be replaced by 20W LED Tube
47	**Room No. 216**	2			88	43.56	109.2	100-150-200	2.0	ok	36W tube to be replaced by 20W LED Tube
48	**Room No. 214**	3			132	72.6	102	100-150-200	1.8	ok	36W tube to be replaced by 20W LED Tube
49	**Room No. 213**	2			88	19.8	110	100-150-200	4.4	ok	36W tube to be replaced by 20W LED Tube
50	**Room No. 209A Antena Lab**	7			308	252	105	200-300-500	1.2	ok	36W tube to be replaced by 20W LED Tube
51	**Room No. 212**	4			176	72.6	113	100-150-200	2.4	ok	36W tube to be replaced by 20W LED Tube

SL. NO.	LOCATION	FLT 36 W	LED 20/40 W	9W LED	TOTAL CIRCUIT WATTS (W)	COVERED FLOOR AREA (m^2)	AVERAGE MEASURED ILLUMINATION (LUX)	RECOMMENDED (MIN-AVG-MAX) ILLUMINATION (LUX)	WATT / M^2	REMARK	RECOMMENDATION
52	**Room No. 207B**	3			132	72.6	117.8	100-150-200	1.8	ok	36W tube to be replaced by 20W LED Tube
53	**Room No. 210 Com Lab-7**	11			484	165.68	115	100-150-200	2.9	ok	36W tube to be replaced by 20W LED Tube
54	**Room No. 211 Architechral Lab**	4			176	72.6	105	200-300-500	2.4	ok	36W tube to be replaced by 20W LED Tube
55	**Room No. 207A**	2	2		128	69.3	104	100-150-200	1.8	ok	36W tube to be replaced by 20W LED Tube
56	**Room No. 207**	6	2		304	69.3	103	100-150-200	4.4	ok	36W tube to be replaced by 20W LED Tube
57	**Room No. 205**	7			308	64.9	105	100-150-200	4.7	ok	36W tube to be replaced by 20W LED Tube

SL. NO.	LOCATION	FLT 36 W	LED 20/40 W	9W LED	TOTAL CIRCUIT WATTS (W)	COVERED FLOOR AREA (m^2)	AVERAGE MEASURED ILLUMINATION (LUX)	RECOMMENDED (MIN-AVG-MAX) ILLUMINATION (LUX)	WATT / M^2	REMARK	RECOMMENDATION
58	**Room No. 203 Comp Lab-5**	8			352	102.3	118	100-150-200	3.4	ok	36W tube to be replaced by 20W LED Tube
59	**Room No. 201**	6			264	39.69	175	100-150-200	6.7	ok	36W tube to be replaced by 20W LED Tube
60	**Room No. 202 Comp Lab-6**	8			352	138.6	105	100-150-200	2.5	ok	36W tube to be replaced by 20W LED Tube
61	**Room No. 204**	4	2		216	96.8	107	100-150-200	2.2	ok	36W tube to be replaced by 20W LED Tube
62	**Room No. 206**	3			132	22.8	121	100-150-200	5.8	ok	36W tube to be replaced by 20W LED Tube
63	**Corridor 2nd Floor**		15	13	577			50-75-100		ok	
64	**Room No. 129**	4					128	100-150-200		ok	36W tube to be replaced by 20W LED Tube

SL. NO.	LOCATION	FLT 36 W	LED 20/40 W	9W LED	TOTAL CIRCUIT WATTS (W)	COVERED FLOOR AREA (m^2)	AVERAGE MEASURED ILLUMINATION (LUX)	RECOMMENDED (MIN-AVG-MAX) ILLUMINATION (LUX)	WATT / M^2	REMARK	RECOMMENDATION
65	**Room No. 127**	4	2		216	72.6	105	100-150-200	3.0	ok	36W tube to be replaced by 20W LED Tube
66	**1St Floor Corridor**		16	23	527		105	50-75-100	#DIV/0!		36W tube to be replaced by 20W LED Tube
67	**Room No. 126**	3	1		152	66	104	100-150-200	2.3	ok	36W tube to be replaced by 20W LED Tube
68	**Room No. 125**	3	1		152	66	117.4	100-150-200	2.3	ok	36W tube to be replaced by 20W LED Tube
69	**Room No. 124**	4	1	1	205	66	104	100-150-200	3.1	ok	36W tube to be replaced by 20W LED Tube
70	**Room No. 128 Principal Room**	2	1		108	28.42	108.2	100-150-200	3.8	ok	36W tube to be replaced by 20W LED Tube

SL. NO.	LOCATION	FLT 36 W	LED 20/40 W	9W LED	TOTAL CIRCUIT WATTS (W)	COVERED FLOOR AREA (m^2)	AVERAGE MEASURED ILLUMINATION (LUX)	RECOMMENDED (MIN-AVG-MAX) ILLUMINATION (LUX)	WATT / M^2	REMARK	RECOMMENDATION
71	**Room No. 130A**	1	1		64	41.25	105	100-150-200	1.6	ok	36W tube to be replaced by 20W LED Tube
72	**Room No. 131**		2		40	22.5	101	100-150-200	1.8	ok	
73	**Room No.130**	1	3		104	38.5		100-150-200	2.7		36W tube to be replaced by 20W LED Tube
74	**Room No. 123 Store Room**	2	1		108	41.76	107.9	50-75-100	2.6	ok	36W tube to be replaced by 20W LED Tube
75	**Room No. 122**	3	1		152	72.6	125	100-150-200	2.1	ok	36W tube to be replaced by 20W LED Tube
76	**Room No. 122**	6			264	136.4	108.2	100-150-200	1.9	ok	36W tube to be replaced by 20W LED Tube
77	**Room No. 121A**	2			88	66	107.8	100-150-200	1.3	ok	36W tube to be replaced by 20W LED Tube

SL. NO.	LOCATION	FLT 36 W	LED 20/40 W	9W LED	TOTAL CIRCUIT WATTS (W)	COVERED FLOOR AREA (m^2)	AVERAGE MEASURED ILLUMINATION (LUX)	RECOMMENDED (MIN-AVG-MAX) ILLUMINATION (LUX)	WATT / M^2	REMARK	RECOMMENDATION
78	**Room No. 120**	2	2		128	66	117.9	100-150-200	1.9	ok	36W tube to be replaced by 20W LED Tube
79	**Room No. 119**	5			220	66	108.1	100-150-200	3.3	ok	36W tube to be replaced by 20W LED Tube
80	**Room No. 118**	4			176	69.3	108.2	100-150-200	2.5	ok	36W tube to be replaced by 20W LED Tube
81	**Room No. 117**	4			176	69.3	109	100-150-200	2.5	ok	36W tube to be replaced by 20W LED Tube
82	**Room No. 121 Digital Library**	2	2		128	66	107.5	100-150-200	1.9	ok	36W tube to be replaced by 20W LED Tube
83	**Central Library**	4	7		316	150.8	123	100-150-200	2.1	ok	36W tube to be replaced by 20W LED Tube

SL. NO.	LOCATION	FLT 36 W	LED 20/40 W	9W LED	TOTAL CIRCUIT WATTS (W)	COVERED FLOOR AREA (m^2)	AVERAGE MEASURED ILLUMINATION (LUX)	RECOMMENDED (MIN-AVG-MAX) ILLUMINATION (LUX)	WATT / M^2	REMARK	RECOMMENDATION
84	**Room No. 101 Office**	1	2		84	44.25	114	100-150-200	1.9	ok	36W tube to be replaced by 20W LED Tube
85	**Room No. 102**		3		120	22.5	225	100-150-200	5.3	ok	36W tube to be replaced by 20W LED Tube
	Room No. 102 Office		2		80	16	185	100-150-200	5.0	ok	36W tube to be replaced by 20W LED Tube
86	**Room No. 104**	2	3		148	43.66	126	100-150-200	3.4	ok	36W tube to be replaced by 20W LED Tube
87	**Room No. 103 Office**	1	6		164	66	142	100-150-200	2.5	ok	36W tube to be replaced by 20W LED Tube
88	**Room No. 105**	1	5		144	72.6	140	100-150-200	2.0	ok	36W tube to be replaced by 20W LED Tube

SL. NO.	LOCATION	FLT 36 W	LED 20/40 W	9W LED	TOTAL CIRCUIT WATTS (W)	COVERED FLOOR AREA (m^2)	AVERAGE MEASURED ILLUMINATION (LUX)	RECOMMENDED (MIN-AVG-MAX) ILLUMINATION (LUX)	WATT / M^2	REMARK	RECOMMENDATION
89	**Room No. 106**	4			176	66	205	100-150-200	2.7	ok	36W tube to be replaced by 20W LED Tube
90	**Room No. 107**	6	2		654	66	131	100-150-200	9.9	ok	36W tube to be replaced by 20W LED Tube
91	**Room No. 113**	3	1		152	66	171	100-150-200	2.3	ok	36W tube to be replaced by 20W LED Tube
92	**Room No. 114**	4			176	66	106.5	100-150-200	2.7	ok	36W tube to be replaced by 20W LED Tube
93	**Room No. 115**	5	7		360	66	107	100-150-200	5.5	ok	36W tube to be replaced by 20W LED Tube
94	**Room No. 112 Computer Lab-3 1St Floor**	7			308	66	178	100-150-200	4.7	ok	36W tube to be replaced by 20W LED Tube

SL. NO.	LOCATION	FLT 36 W	LED 20/40 W	9W LED	TOTAL CIRCUIT WATTS (W)	COVERED FLOOR AREA (m^2)	AVERAGE MEASURED ILLUMINATION (LUX)	RECOMMENDED (MIN-AVG-MAX) ILLUMINATION (LUX)	WATT / M^2	REMARK	RECOMMENDATION
95	**Room No. 110 Computer Lab-1**	5			220	66	104	100-150-200	3.3	ok	36W tube to be replaced by 20W LED Tube
96	**Room No. 111 Computer Lab-4**	2	4		168	66	105	100-150-200	2.5	ok	36W tube to be replaced by 20W LED Tube
97	**Room No. 112A Computer Lab-2**	4	3		236	66	105	100-150-200	3.6	ok	36W tube to be replaced by 20W LED Tube
98	**Store Room**	3			132	66		50-75-100	2.0	ok	36W tube to be replaced by 20W LED Tube
99	**Room No. 108A**	3	5		232	66		100-150-200	3.5	ok	36W tube to be replaced by 20W LED Tube
100	**Room No. 109**	2	2		128	40.6	145	100-150-200	3.2	ok	36W tube to be replaced by 20W LED Tube
101	**Room No. 108**		3		60	66	125	100-150-200	0.9	ok	

SL. NO.	LOCATION	FLT 36 W	LED 20/40 W	9W LED	TOTAL CIRCUIT WATTS (W)	COVERED FLOOR AREA (m^2)	AVERAGE MEASURED ILLUMINATION (LUX)	RECOMMENDED (MIN-AVG-MAX) ILLUMINATION (LUX)	WATT / M^2	REMARK	RECOMMENDATION
102	**Pantry- 1st Floor**		1		20	4.4	121	100-150-200	4.5	ok	
103	**Mechanical Workshop**	8	18	4	748	624	205.5	200-300-500	1.2	ok	36W tube to be replaced by 20W LED Tube
104	**Room No. 010**	4			176	66	225	200-300-500	2.7	ok	36W tube to be replaced by 20W LED Tube
105	**Room No. 011**	4			176	66	228	200-300-500	2.7	ok	36W tube to be replaced by 20W LED Tube
106	**Room No. 009A Power System Lab**	5		1	229	104.5	268	200-300-500	2.2	ok	36W tube to be replaced by 20W LED Tube
107	**Room No. 009 Electrical Lab**	3			132	66	229	200-300-500	2.0	ok	36W tube to be replaced by 20W LED Tube
108	**Room No. 008 Chemistry Lab**	2		8	160	66	219	200-300-500	2.4	ok	36W tube to be replaced by 20W LED Tube

SL. NO.	LOCATION	FLT 36 W	LED 20/40 W	9W LED	TOTAL CIRCUIT WATTS (W)	COVERED FLOOR AREA (m^2)	AVERAGE MEASURED ILLUMINATION (LUX)	RECOMMENDED (MIN-AVG-MAX) ILLUMINATION (LUX)	WATT / M^2	REMARK	RECOMMENDATION
109	**Room No. 006 Electrical Measurement Lab**	5			220	60.5	280	200-300-500	3.6	ok	36W tube to be replaced by 20W LED Tube
110	**Room No. 007 Power Electronics Lab**	3			132	60.5	278	200-300-500	2.2	ok	36W tube to be replaced by 20W LED Tube
111	**Room No. 005 Power System Lab**	4			176	66	282	200-300-500	2.7	ok	36W tube to be replaced by 20W LED Tube
112	**Room No. 003 Electrical Machine Lab-II**	5	2		260	66	201	200-300-500	3.9	ok	36W tube to be replaced by 20W LED Tube
113	**Room No. 002 Electrical Machine Lab-I**	3	2		172	66	278	200-300-500	2.6	ok	36W tube to be replaced by 20W LED Tube
114	**Room No. 004**	5	1		240	66	268	100-150-200	3.6	ok	36W tube to be replaced by 20W LED Tube
115	**Mechanical Engineering Lab (Thermal-1) Heat Transfer**	7	1		328	96	215	200-300-500	3.4	ok	36W tube to be replaced by 20W LED Tube

SL. NO.	LOCATION	FLT 36 W	LED 20/40 W	9W LED	TOTAL CIRCUIT WATTS (W)	COVERED FLOOR AREA (m^2)	AVERAGE MEASURED ILLUMINATION (LUX)	RECOMMENDED (MIN-AVG-MAX) ILLUMINATION (LUX)	WATT / M^2	REMARK	RECOMMENDATION
116	**Room No. 012A**	2			88	30	292	200-300-500	2.9	ok	36W tube to be replaced by 20W LED Tube
117	**Room No. 013 Environmental Engg. Lab**		4		80	99	205	200-300-500	0.8	ok	
118	**Room No. 014 Basic Electrical Engg. Lab**		13		260	198	200	200-300-500	1.3	ok	
119	**Room No. 015**	7	7	1	457	198	171	100-150-200	2.3	ok	36W tube to be replaced by 20W LED Tube
120	**Room No. 016A**	4			176	66	168	100-150-200	2.7	ok	36W tube to be replaced by 20W LED Tube
121	**Room No. 016B**	4			176	66	105	100-150-200	2.7	ok	36W tube to be replaced by 20W LED Tube
122	**Common Room**	3	1	1	161	216	138	100-150-200	0.7	ok	36W tube to be replaced by 20W LED Tube

SL. NO.	LOCATION	FLT 36 W	LED 20/40 W	9W LED	TOTAL CIRCUIT WATTS (W)	COVERED FLOOR AREA (m^2)	AVERAGE MEASURED ILLUMINATION (LUX)	RECOMMENDED (MIN-AVG-MAX) ILLUMINATION (LUX)	WATT / M^2	REMARK	RECOMMENDATION
123	**Room No. 020 High Way Lab**	2		1	97	66	265	200-300-500	1.5	ok	36W tube to be replaced by 20W LED Tube
124	**Common Room Table Tennis**	4			176	66	105	100-150-200	2.7	ok	36W tube to be replaced by 20W LED Tube
125	**Concrete Technology Lab**	3	3		192	216	278	200-300-500	0.9	ok	36W tube to be replaced by 20W LED Tube
126	**Canteen**		12		240	191.52	105	100-150-200	1.3	ok	

5.0 Energy Savings Measures (ESM)

ESM -1

Replace existing 36W tube with 20W energy efficient LED tube:
Presently there is 452 nos. of fluorescent tube in the premises and among them 300 nos are suggested to replace when required one by one and the calculation of energy savings is given below:

Table 20

COMPARISION BETWEEN TL-D 30W FL TUBE SYSTEM WITH 20W LED TUBE

Sl. No.	Parameter	**1 x FLT 36W**	**1 x 20W LED TUBE**
1	Lamp Wattage	36	20
2	System Wattage	44	20
3	Ballast Type	Electronic/ Magnetic	Not Required
4	Quantity (Considered for Same Lux Levels)	300	300
6	**Total system load KW**	13.2	6
7	Usage per day	6	6
8	Usage per year (day)	200	200
9	Total energy consumed (Units) Yrly.	15840	7200
10	Energy Cost per unit (Rs)	12.4	12.4
11	Lamp Life (Br. Hrs.)	10000	100000
12	Lamp Unit Price	50	300
13	Total Lamp Replacement Cost Yearly	**1800**	0
14	Total Ballast Replacement Cost	**45000**	0
14	Total Energy Cost (Rs) Yearly	**196416**	45000
15	Savings in Yearly Energy Cost (Rs)		151416
16	Saving in Lamp & Ballast Replacement Cost		46800
17	**TOTAL YEARLY SAVINGS**		198216
18	Cost Per System		300
19	Initial Investment		90000
20	Extra Cost		90000
21	**Pay Back Period**	**Month**	**5**

ESM - 2

Replacement of existing old conventional ceiling fan by energy efficient fan.

At present there is as many as 806 nos of ceiling fan present out of which 250 nos are suggested to be replaced in first phase and a cost benefit analysis with pay back period is given below:

Table 21

Particulars	**Unit**	**Value**
Power Consumption of Existing Fans	Watt	80
Number of Ceiling fan in the Institution	No.	806.00
Number of ceiling fan suggested by Phase wise replacement	NO.	250
Power Consumption of all replaceable fan	kW	20.00
Power Consumption of each energy efficient fan	Watt	26
Power Consumption of all fan after replacement	kW	6.50
Daily Working Hour	Hour	8.0
Annual Working Days	Days	180.0
Energy Consumption before replacement	kWh	28800.0
Energy Consumption after replacement	kWh	9360.0
Savings of Energy	kWh	19440.00
Savings in terms of money @ Rs. 12.40 per Unit	Rs.	241056.0
Investment @ Rs. 3650 per fan	Rs.	912500.0
Less Cost of old fan (by selling) Rs. 400 per fan	Rs.	100000.0
Net Investment	Rs.	812500.0
Pay Back Period	Month	40.4