East Coast Sustainable Private Limited
6-80/1, Priya Gardens, Near Swamy Kalyana Mandapam
P.O. Simhachalam, Visakhapatnam – 530028
Andhra Pradesh, India
Ph: +91-9705300059, Web: www.eastcoast.net.in

Date: 22-04-2022

CERTIFICATE

M/s East Coast Sustainable Private Ltd (Accredited Energy Auditing firm by Bureau of Energy Efficiency, Government of India) has conducted Energy Audit for AY 2021-2022 during April 2022 for M/s GMR Institute of Technology, Rajam, Srikakulam District, Andhra Pradesh – 532127.

Name: **G Srinivasa Rao**

Designation: **Accredited Energy Auditor**

SEAL:

G. Srinivasa Rao, MIE
Accredited Energy Auditor (BEE)
CEA-1574, AEA-0251

East Coast Sustainable Pvt. Ltd.

REPORT

ON

DETAILED ENERGY AUDIT

Conducted at

M/s GMR INSTITUE OF TECHNOLOGY

Rajam, Srikakulam District,
Andhra Pradesh 532127

Conducted by

Energy Auditing Firm

EAST COAST SUSTAINABLE PRIVATE LIMITED

6-80/1, PRIYA GARDENS P.O SIMHACHALAM, VISAKHAPATNAM
ANDHRA PRADESH – 530028
CIN: U74999AP2018PTC108807

www.eastcoast.net.in

April-2022

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I. ACKNOWLEDGEMENT

THE ENERGY AUDIT TEAM appreciates the keen interest shown by the management of **GMR INSTITUTE OF TECHNOLOGY, RAJAM** in getting Energy Audit done for conservation of energy.

THE ENERGY AUDIT TEAM expresses its sincere thanks to the management of **"GMR INSTITUTE OF TECHNOLOGY, RAJAM''** for their trust and entrusting the assignment of Energy Audit of **GMR INSTITUTE OF TECHNOLOGY, RAJAM.**

THE ENERGY AUDIT TEAM is grateful to Dr.CLVRSV PRASAD, Principal of college, for his initiative and confidence in **THE ENERGY AUDIT TEAM** in awarding the mandatory energy audit study.

We are thankful to the GMR Varalakshmi Foundation, GMRIT management for giving us the opportunity to be involved in this interesting and challenging project.

We are also extremely thankful to the below management team for their hospitality, support and guidance and co-operation in undertaking this energy audit assignment.

Dr T. S . L .V AYYARAO- Department of EEE

Mr S. RAMESH BABU – Estates Department

and all other supporting staff who have given full co-operation and support. They took keen interest and gave valuable inputs during the course of study. We would be happy to provide any further clarifications, if required, to facilitate implementation of the recommendations.

The arrangements and support during the energy audit were excellent. We deeply appreciate the interest, enthusiasm, and commitment of GMR INSTITUTE OF TECHNOLOGY, RAJAM. towards the energy conservation.

For

The Energy Audit Team

II. ENERGY AUDIT TEAM

Name of the Member	Role in the Project
Mr. G Srinivasa Rao	Team Leader - Accredited Energy Auditor
Mr. Azmal Basha	Team Member - Energy Auditor

The report is made as per the Bureau of Energy Efficiency (BEE), Ministry of Power, and Govt. of India format.

III. EXECUTIVE SUMMARY

East Coast sustainable (P). Ltd has been entrusted with carrying out "Detailed Energy Audit" in Head- Office of M/s GMR Institute of Technology, Rajam. optimize the energy consumption and to identify the energy saving opportunities in the facility. In this connection, East Coast has conducted field measurements at the facility during August 2021 for collection of data and measuring various energy consumption parameters to analyse and find energy saving opportunities.

The major energy inputs for the facility are Electricity, Diesel, and Water. Electricity is used for Package Air Conditioners, Severs, PCs, ACs, Fans, lighting appliances and other loads. Diesel oil is being used in the DG set to generate electricity during power failure. A detailed study was carried out with an objective to identify and prioritize the cost-effective energy conservation recommendations to decrease the energy consumption and energy costs in the facility.

GMR Institute of Technology Installed 700 kW grid-connected solar PV system available for the benefit of campus.

Grid-connected solar PV systems feed solar energy directly into the building loads without battery storage. Surplus energy, if any, is exported to the APEPDCL grid and shortfall, if any, is imported from the grid.

IV. LIST OF ENERGY CONSERVATION RECOMMENDATIONS

The following are the energy conservation recommendations identified in the facility.

Table 1: List of Energy Saving Recommendations

S. No	Name of the recommendation	Savings (kWh/year)	Monetary Savings (Rs./year)	Investment (Rs.)	Payback period (Months)	Remarks
1	Retrofit SVs to LED	1976	45052	19000	5	
2	Retrifit Ceiling Fan to BLDC Fan	67904	516070	6366000	148	

V. IMPORTANT INFORMATION

a) Name and Address of the plant **:** M/s GMR Institue of Technology
Rajam, Srikakulam District,
Andhra Pradesh 532127
India

b) Line of Activity **:** Educational Institutional

c) Contact Person and Details **:** Dr.T.S.L.V. Ayya Rao
Phone: +91- 8074821496
E-mail: ayyarao.tslv@gmrit.edu.in

d) Period of Audit **:** April-2022

e) Contracted Maximum Demand (CMD) **:** 600 kVA

f) Maximum Recorded Demand (M.D) **:** 499 kVA (Oct-2021)

g) Minimum Recorded Demand (M.D) **:** 166 kVA (Jan-2022)

h) Power factor (PF) **:** 0.99 (Avg.)

i) Energy Consumption & their cost details **:**

Table 2: List of Electricity Consumption details

Electricity Consumption details for April 2021- March 2022			
Cost of Electricity : Rs. 7.65/Unit Kvah			
Demand Charges : Rs. 475/kVA			
S. No	**Particulars**	**Unit**	**Value**
1	Monthly Avg. Consumption of Electricity	kvah/Month	138589
2	Monthly Avg. Bill of Electricity	Rs./ Month	1272494
3	Yearly Consumption of Electricity	Kvah/Year	1524486
4	Yearly Bill of Electricity	Rs./ Year	13997445
5	Maximum Electricity Consumption (Aug-2021)	kvah/Month	186930
6	Minimum Electricity Consumption (May- 2022)	kvah/Month	91228

Table 3: Diesel Consumption details

Diesel Consumption Details for April 2021 – March 2022 DG Set (180 +380 + 500) kVA				
Month	**Unit Generated kWH**	**Diesel Consumption L**	**Diesel Expenses /Month**	**Average power fail Hours /Month**
04-04-2021	28400	2,200	2,06,800	71
04-05-2021	8048	1,500	1,41,000	20
04-06-2021	3800	850	79,900	10
04-07-2021	14064	2,500	2,67,500	35
04-08-2021	6480	1,600	1,71,200	16
04-09-2021	9680	2,000	2,14,000	24
04-10-2021	13732	2,400	2,56,800	34
04-11-2021	5200	1,000	96,250	13
04-12-2021	10600	1,850	1,78,063	27
04-01-2022	4524	650	62,563	11
04-02-2022	14400	2,100	2,02,125	36
04-03-2022	0	0	0	0
Total	**1,18,928**	**18,650**	**18,76,200**	**297.32**

Table 4: Water Consumption details

Water Consumption Details for April 2021 – March 2022			
S. No	**Particulars**	**Unit**	**Value**
			Water
1	Yearly Water. Consumption	KL/year	9500
2	Monthly Water. Consumption	KL/Day	791
3	Daily Water Consumption	KL/Day	31

Table 5: Electrical & Solar Consumption details

Solar & Electrical Consumption details for April 2020- March 2021				
Month	**EB Power Bill Energy**	**Solar Power Bill Energy**	**Solar Export to EB**	**Consumed Units**
Apr-21	62738	75737	30779	107696
May-21	55374	83486	47632	91228
Jun-21	52510	76591	34664	94437
Jul-21	98160	73220	13521	157859
Aug-21	120399	75917	9386	186930
Sep-21	117969	71603	11160	178412
Oct-21	97863	79057	17882	159038
Nov-21	103546	64846	16650	151742
Dec-21	87420	79400	31482	135338
Jan-22	73879	94424	45200	123103
Feb-22	79507	93036	33840	138703
Mar-21				
Total	**949365**	**867317**	**261417**	**1524486**

1 INTRODUCTION

1.1 GENERAL DETAILS

GMR Institute of Technology (GMRIT) was established in the year 1997 by GMR Varalakshmi Foundation – the corporate social responsibility arm of GMR Group. Located in Rajam, Srikakulam district of Andhra Pradesh, GMRIT provides its learning community state-of-the-art facilities, infrastructure and a competent faculty. The Institute encourages collaborative learning between industry and academia as a means of reinforcing its curriculum with practical and real world experiences.

The institute was approved by AICTE and got the status of Autonomous college under JNTU and has got accreditation by NAAC of UGC with " A " grade, NBA accreditation for all the UG courses being offered. The institute is offering 07 UG courses and 07 PG courses. It has a total teaching staff strength of 113 and student strength of around 3600. It has a very good library which has around 65000 volumes and 17000 books. Recently the institute was awarded the "Most Clean Campus in India in 'AICTE Clean Campus Award 2017'.

GMRIT's research potential spans over diverse disciplines like CAD/CAM, Signal Processing, Time Frequency Transform application to Non-Stationary signal Analysis, System modeling and Identification, Adaptive Filtering, Machine Intelligence, Manufacturing, Product Design, Energy, Information Technology and Structural Engineering. It encourages its researchers to participate in a wide range of research collaborations in the premier Institutes of India. GMRIT organizes various International/ National conferences and Workshops in different thrust areas to discuss and disseminate latest research findings in many burning issues to enable technology for mankind.

GMR group is very active in promoting renewable energy and energy conservation. Solar PV power plant of 700 kWp was installed at the facility. Every week on Thursday, the institute follows Zero pollution day as a social responsibility towards the environment.

The audit covered an in study of the distribution transformers, pumps, Blowers, Air conditioning system, DG set and lighting system. The energy audit covered study of all the major energy consuming equipment.

1.2 SCOPE OF THE STUDY:

The major energy consuming loads of the facility are

- HVAC (Package AC units, Split AC units, Window AC units)
- Lights and Fans
- Water Pumps and Fire Water pumps
- PCs, Servers (UPS load)

2 DESCRIPTION OF ENERGY SYSTEMS

2.1 ENERGY SYSTEMS DESCRIPTION

The major inputs for the facility are

i. Electricity from APEPDCL,
ii. Diesel oil for DG sets as a backup for power and
iii. Water for domestic use and fire fighting

- Electricity is the major input energy and used for HVAC, Lighting, Pumping and running the office equipment like Servers, Computers, Printers, etc.
- Diesel oil is used in DG sets to generate power in case of power failure.
- Water is being used for drinking, cooking, washrooms, and firefighting.

2.2 ELECTRICAL ENERGY ANALYSIS

The electricity is sourced from APEPDCL. The following are the details of the electrical supply.

- The facility has a Maximum Contract Demand (CMD) of 600 kVA.
- The facility has installed 3 No of Transformer of capacity 2x 480 kVA
- The plant has 3 DG sets of 1x500 kVA, 1x 380 kVA & 1x 500 kVA each capacity and is used in the event of power failure.
- Grid supply is available at 11 kV and is stepped down to 415 Volts. The average power factor is maintained at 0.99 (avg.)
- The annual electricity consumption of plant is 1524486 kvah (Units) from Apr-2021 to March-2022. The electricity consumption is varied from 91228 kvah to 186930 kvah and the average monthly electricity consumption is 138589 kvah

Table 6: Month wise electricity consumption April 2021 – March 2022

Electericity Bill									
Month & Year	**Consumed Units (Kvah)**	**Billed Units (kvah)**	**Demand Charges Rs.475/- per kva**	**Energy Charges Rs.7.65 per unit**	**Electricity Duty Re.0.06 per unit**	**Customer Charges**	**Surcharges if any**	**Total amount paid so far**	**PF**
Apr-21	62738	31959	228000	244486	3764	1406	16930	494586.63	0.99
May-21	55374	12000	228000	64463	3322	1406	16771	313962.44	0.99
Jun-21	52510	17846	228000	136522	3150	1406	16072	385149.90	1.00
Jul-21	98160	84640	228000	647496	5890	1406	24946.41	907738.07	0.99
Aug-21	120399	110563	228000	845807	7224	1406	76860.72	1159297.61	0.99
Sep-21	117969	106809	228000	817089	7078	1406	72570.01	1126143.00	0.99
Oct-21	97863	79981	237386	611855	5872	1406	24428	880946.43	0.98
Nov-21	103546	86896	228000	664754	6213	1406	22827	923200.16	0.99
Dec-21	87420	55939	228000	427933	5245	1406	21279	684547.61	0.99
Jan-22	73879	28679	228000	219394	4433	1406	19122	472355.09	0.99
Feb-22	79507	45668	228000	349360	4770	1406	20287	603823.68	0.98
Total	**949365**	**660980**	**2517386**	**5029160**	**56961.5**	**15466**	**332093**	**7951750.6**	**0.99**
Maximum	**120399**	**110563**	**237386**	**845807**	**7224**	**1406**	**76861**	**1159298**	**1.00**
Minimum	**52510**	**12000**	**228000**	**64463**	**3150**	**1406**	**16072**	**313962**	**0.97**

2.2.1 RECORDED MAXIMUM DEMAND PATTERN

The below is the recorded demand pattern of the facility from April- 2021 to March -2022.

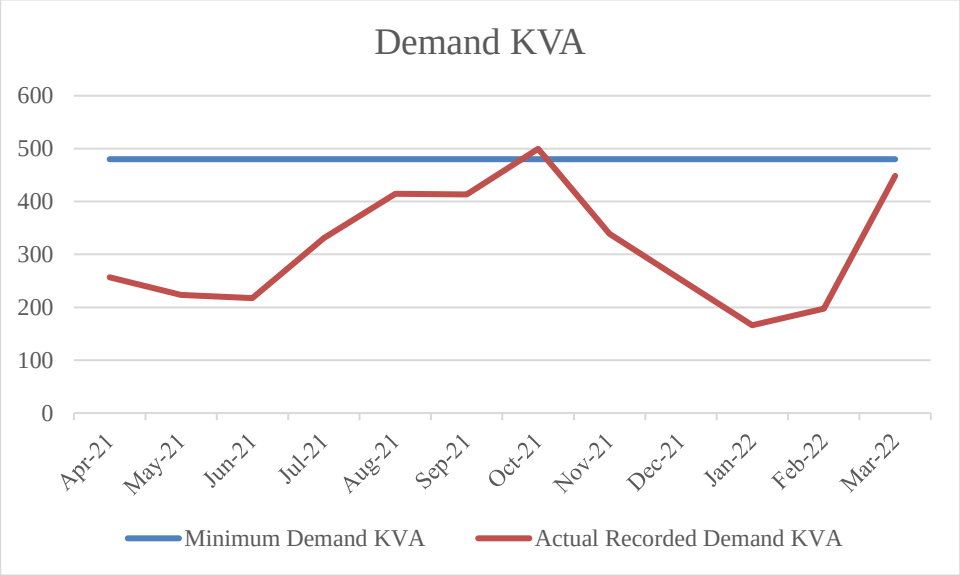

Figure 1:Recorded Maximum Demand Pattern

2.2.2 ELECTRICITY CONSUMPTION PATTERN

The following is the electricity consumption pattern for the facility from April-2021 to March-2022. The electricity consumption is high during the August- 2021 and consumption is low in the month of May-2021.

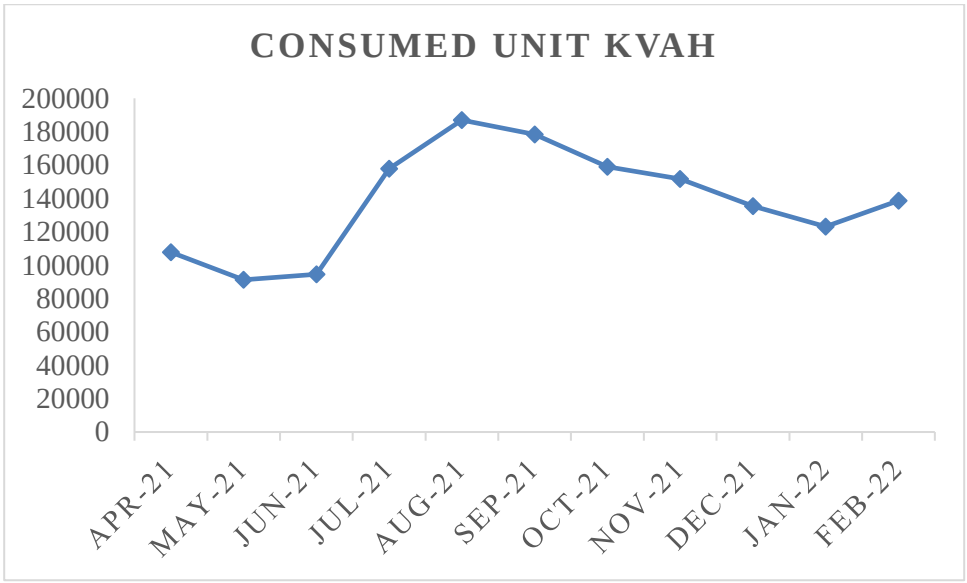

Figure 2: Month wise electrical consumption pattern

2.3 WATER SYSTEM

Majority of water source for GMRIT campus facility is met with from their internal open wells and borewells. Apart from that, management has also made arrangement for tankers and municipal water supply board for meeting the deficit demand of entire campus. Multiple pumps of various types and capacities have installed across the different location of campus for water transportation. Facility has two bulk water storage reservoir one at underground level sump (UGLSR) of 2,50,000 litres capacity and other overhead tank (OHT) of 2,00,000 liters capacity. Further from the overhead tank, water pipe lines of different size (1.5", 2" and 3") are drawn for gravity distribution to different blocks of hostels, quarters, Degree College, etc. Several tanks are installed at individual building blocks of campus for water storage and regulated utilization. Location of the GMRIT pumps along with their sources are given.

Table 7: Water Storage Details

Pump Identification	Type
GCSR College	Open well
GMR Care Back Side	Open well
CSE Block	Open well
OHT sump pump -1	Submersible
OHT sump pump -2	Submersible
Principle	Open well
RASA quarters	Open well
Boys Hostel sump	Sump
STP treared water sump	Sump

2.4 CAPACTOR DETAILS

The plant has installed a total capacitor banks of 210 KVAr mainly to reduce the kVA demand of the facility. The capacity breakup details are provided below:

- SS-1 : 2 x 25 + 2 x 20 + 3 x 10 = 120 kVAr
- SS-2 : 2 x 20 + 1 x 30 = 70 kVAr
- STP : 1 x 20 = 20 kVAr

2.5 TRANSFORMER LOAD MANAGEMENT

Based on the loading pattern of the main transformers, the following parameters like percentage loading, Best efficiency point and all day efficiency are calculated and the details are given in the table 4.13. Table 4.13 Transformer performance parameters Parameters Transformer-1 Transformer-2 Transformer rating (kVA) 480 500 No load losses (kW) 1.15 1.25 Full load losses (kW) 7.15 7.45 Average load (kVA) 89.0 151.2 Maximum load (kVA) 155.6 200.1 Best Efficiency point (%) 40.1 41.0 Loading (%) 32.4 40.0 Annual No load losses (kWh) 10074 10950 Annual full load losses (kWh) 4601 7309 Annual Total losses(kWh) 14675 18263 Combined transformer losses/year 32938 From the above transformer load analysis, it is seen that the load on the transformer is operating less than its 'Best operating point' or 'Optimal loading point' and transformer operating losses are on minimum side. The annual transformer losses accounts to 1.5% of the total facility annual energy consumption.

2.6 ENERGY DISTRIBUTION

The distribution of electricity is presented in the following pie-chart.

The % of energy share pattern is as given below:

Table 8: Energy share pattern

SI.No	Block Name	Power (KW)	% of Energy Share
1	Block -1	395	16%
2	Block -2	205	8%
3	Block -3	278	11%
4	Block -4	271	11%
5	Block -5	169	7%
6	Block -6	73	3%
7	SGCSRC	53	2%
8	Work Shop	113	5%
9	Siemens Work Shop	46	2%
10	Staff Qarters	460	18%
11	Girls Hostel	132	5%
12	Boys Hostel	240	10%
13	Estate Complex	20	1%
14	CSW	19	1%
15	Street Light	20	1%
16	Total	2494	100%

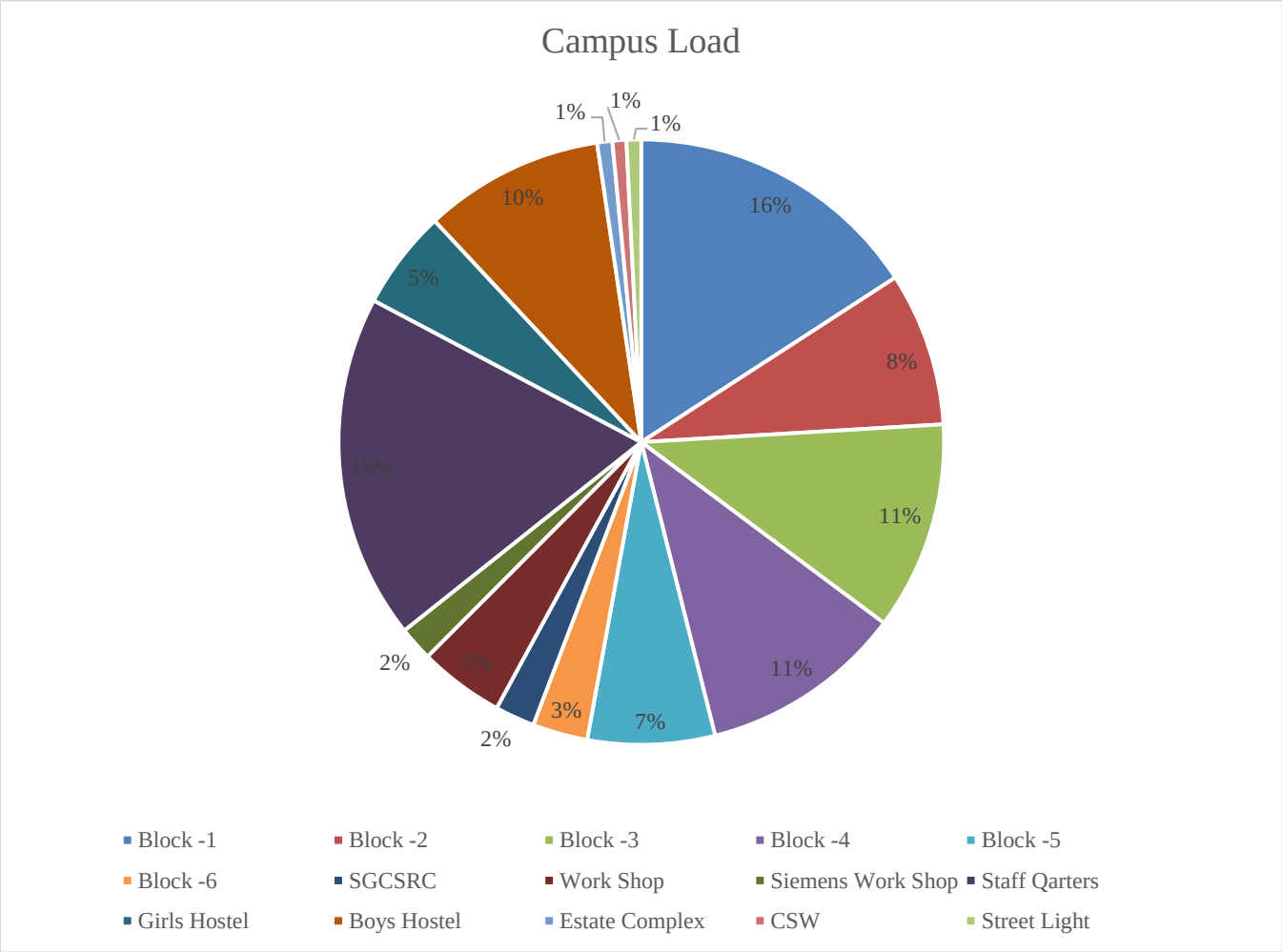

Figure 3: % of Energy share pattern

2.7 ENERGY DISTRIBUTION OF DIFFERENT BLOCKS

The distribution of electricity is presented in the following pie-chart.

The % of energy share pattern is as given below:

Table 9: Block-1 Energy share pattern

SI.No	Applience	Power (KW)	% Sharing of Power
1	Tensile.M	1	0.25%
2	C Fans	6.525	1.65%
3	AC 2 T	76	19.24%
4	CFL 36 W	3.6	0.91%
5	Computers	115.5	29.24%
6	Ex Fans	0.715	0.18%
7	UPS	83	21.01%
8	W Fan	4.095	1.04%
9	P. Point	1.3	0.33%
10	Cooler	1	0.25%
11	Freezer	0.5	0.13%
12	2x2 LED	0.38	0.10%
13	T Lights	11.66	2.95%
14	TV	0.3	0.08%
15	2x2 Lights	0.36	0.09%
16	LED	0.228	0.06%
17	LED	0.014	0.00%
18	AC 1.5 T	1.5	0.38%
19	AC 7.5 T	6	1.52%
20	SV Lamp	0.15	0.04%
21	CFL 11 W	0.198	0.05%
22	EPABX	0.3	0.08%
23	Fax	0.1	0.03%
24	Heater	2	0.51%
25	MH 70	0.07	0.02%
26	Printer	0.7	0.18%
27	Xerox	0.5	0.13%
	Total	**395**	**100%**

Figure 4: Block-1 % of Energy share pattern

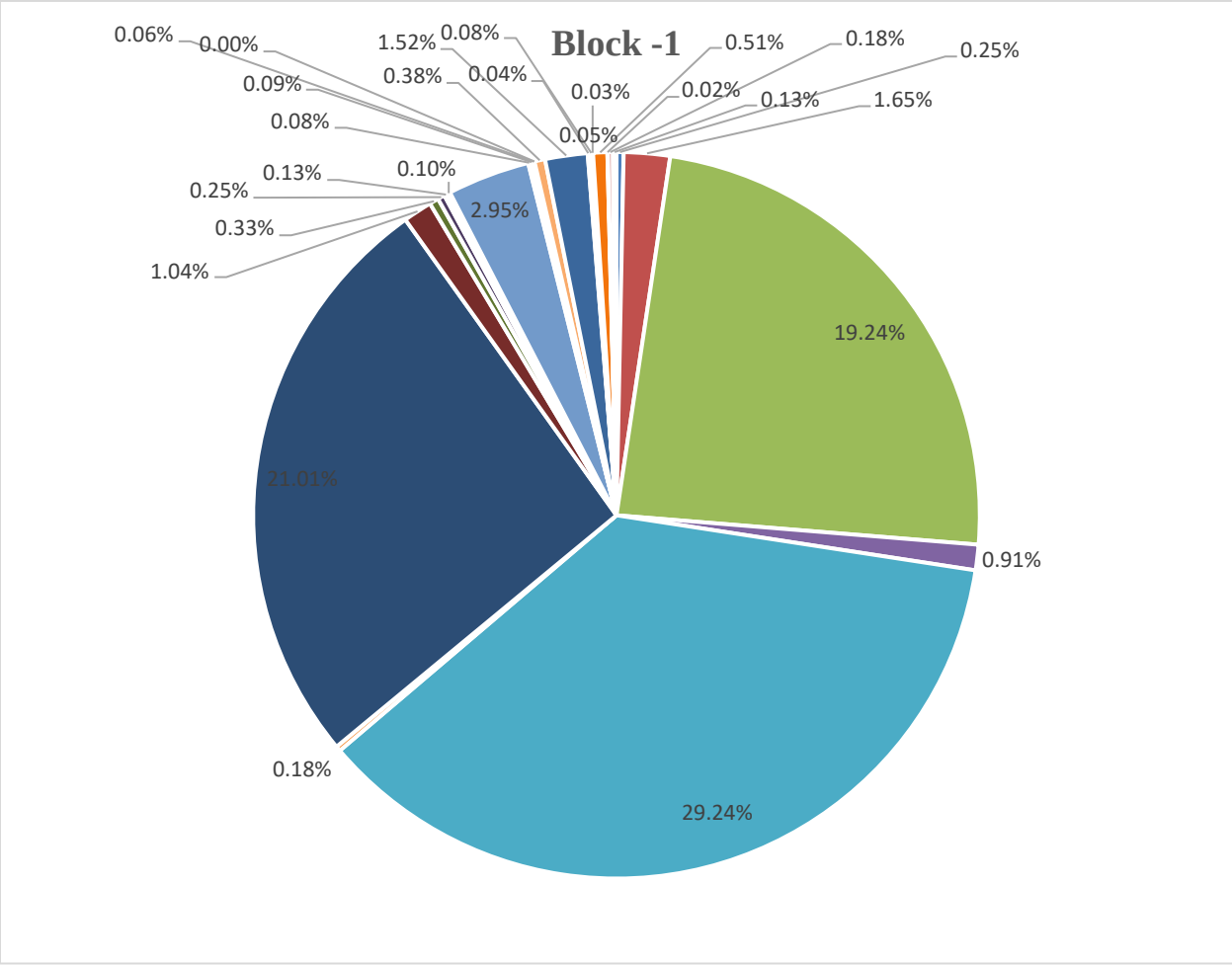

Table 10: Block-2 Energy share pattern

SI.No	Applience	Power (KW)	% Sharing of Power
1	T.Lights	9.405	4.61%
2	UPS-10KVA	9	4.41%
3	UPS-15KVA	13.5	6.61%
4	UPS-5KVA	13.5	6.61%
5	W.F-12"	2.21	1.08%
6	5A.P.Point	1.86	0.91%
7	AC-1.5T	6	2.94%
8	AC-1T	1	0.49%
9	AC-2T	22	10.77%
10	All Geared lahte	11	5.39%
11	Bench Grinder	0.37	0.18%
12	Benelious.apa	0.37	0.18%
13	C.Fans	9.675	4.74%
14	Calibrating-N	0.735	0.36%
15	Capstan Lahte	0.735	0.36%
16	Centrifugal.p	5.5	2.69%
17	CFL-11w	0.176	0.09%
18	CFL-18W	0.0018	0.00%
19	CFL-36W	1.08	0.53%
20	CNC lath	1.5	0.73%
21	CNC-Mill	1.5	0.73%
22	Compressor	0.56	0.27%
23	Computers	36.3	17.77%
24	Corist action shacker	0.017	0.01%
25	Printers	0.3	0.15%
26	PLC-1	0.3	0.15%
27	PLC-2	0.3	0.15%
28	Induction-M	0.18	0.09%
29	Muf.Furnace	3.5	1.71%
30	Jammy test	0.735	0.36%
31	Metolograpy	0.37	0.18%
32	Disk polish-1	0.74	0.36%
33	Disk polish-2	0.74	0.36%
34	Pitot tube	0.37	0.18%
35	Helical coil	0.37	0.18%
36	Reciprocating	0.735	0.36%
37	Mouth piece	0.735	0.36%
38	Friction in pipe	0.735	0.36%
39	Orifice.Meter	0.735	0.36%
40	Packed bed	0.37	0.18%
41	Input.j.vane	0.735	0.36%
42	Fluidised bed	0.37	0.18%
43	Rota meter	0.75	0.37%
44	Francis Turbine	5.5	2.69%
45	Non circular.pipes	0.37	0.18%

46	Pin fin apparatus	0.37	0.18%
47	Stefer Boltz	1	0.49%
48	Detormination	1	0.49%
49	Critical Heat flux	1	0.49%
50	Heat pipe aparatus	1	0.49%
51	Fridge	0.45	0.22%
52	Drop and Film	0.125	0.06%
53	Heat Transfer through Coils	2	0.98%
54	Double pipe Heat Exchanger	2	0.98%
55	Legged pipe apparatus	1	0.49%
56	Heat Transfer to Composit wall	1	0.49%
57	Forced convection apparatus	0.37	0.18%
58	PL-4 Lathe	0.735	0.36%
59	Shaping Machine	2.2	1.08%
60	Shaping Machine	1.47	0.72%
61	Surphase grinder	0.735	0.36%
62	Power Hack saw	2.94	1.44%
63	Pilla Drilling machine	0.37	0.18%
64	Radial Drilling machine	4.4	2.15%
65	Motor	0.18	0.09%
66	Heaters	8	3.92%
67	Mixed Flow reactor	0.051	0.02%
68	Solid liquid with chemical reaction	0.517	0.25%
69	CSTR	0.017	0.01%
70	Stirrer	0.017	0.01%
71	Forced draft drain	0.37	0.18%
72	Surface evaparation	0.117	0.06%
73	Steam distillation	0.5	0.24%
74	Diffution	0.017	0.01%
75	Thermal Conductivity	0.5	0.24%
76	Thermal Conductivity of Metal Rod	1	0.49%
77	Universal milling	1.47	0.72%
78	Tool &Cutter Grinder	0.37	0.18%
	Total	**204.2258**	**100%**

Figure 5: Block-2 % of Energy share pattern

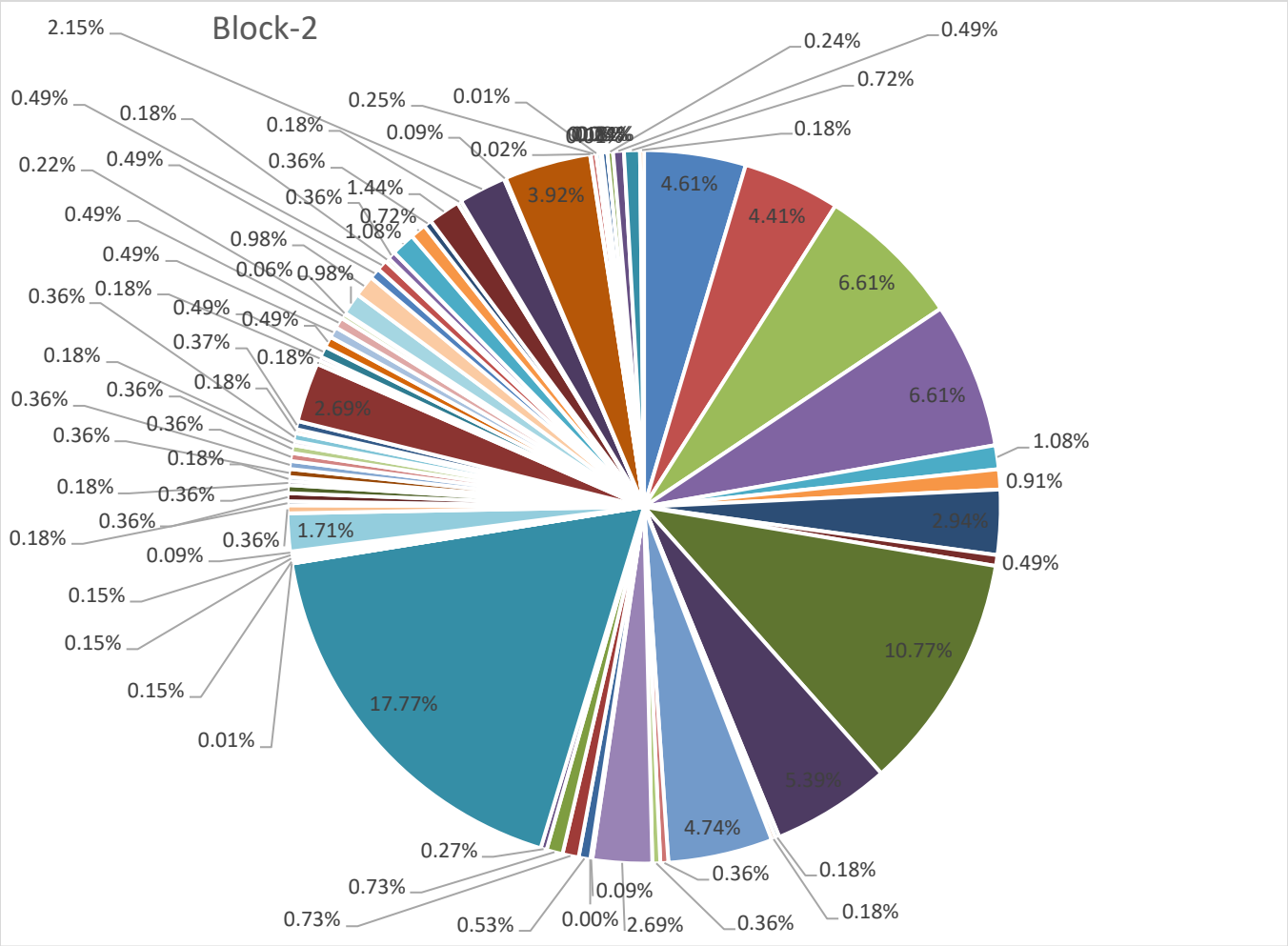

Table 11: Block-3 Energy share pattern

SI.No	Applience	Power (KW)	% Sharing of Power
1	CFL	0.432	0.15%
2	CFL-11W	0.066	0.02%
3	CFL2x36W	1.296	0.46%
4	CFL-18W	0.072	0.03%
5	CFL-11W	0.22	0.08%
6	C.Fans	11.625	4.16%
7	AC-1T	2	0.72%
8	AC-1.5T	7.5	2.68%
9	AC-2T	28	10.01%
10	5A.P.Point	4.74	1.70%
11	15A.P.Point	0.5	0.18%
12	Stabilizer	9	3.22%
13	Synchronous motor-5hp	3.73	1.33%
14	Slop Induction Motor	3.73	1.33%
15	Squirel cage Induction Motor	3.73	1.33%
16	Case cad Induction Motor	3.73	1.33%
17	DC Compound Motor	7.5	2.68%
18	DC Shunt Motor 2	7.5	2.68%
19	DC.Series Motor	3	1.07%
20	DC.Shunt Motor-1	2.238	0.80%
21	DC.Shunt Motor-2	2.238	0.80%
22	DC.Shunt Motor-Generator Set	2	0.72%
23	DC.Shunt Motor-Series Gen set	2.238	0.80%
24	DC Compound Motor-Genset	1.5	0.54%
25	1Phase induction Motor	0.75	0.27%
26	DC.Shunt Motor -Genset	2.238	0.80%
27	DC.Compound Motor	2.238	0.80%
28	Tranformers-2KVA	1.8	0.64%
29	Tranformers-1KVA	5.4	1.93%
30	Tranformer-3KVA	13.5	4.83%
31	Transformer-2.5KVA	9	3.22%
32	1Phase induction Motor	1.5	0.54%
33	Case cad Induction Motor	7.46	2.67%
34	UPS-20KVA	36	12.87%
35	UPS-20KVA	54	19.31%
36	UPS-7.5KVA	13.5	4.83%
37	UPS-7.5KVA	13.5	4.83%
38	W.F-12"	2.275	0.81%
39	Computers	7.878	2.82%
	Total	**279.624**	**100%**

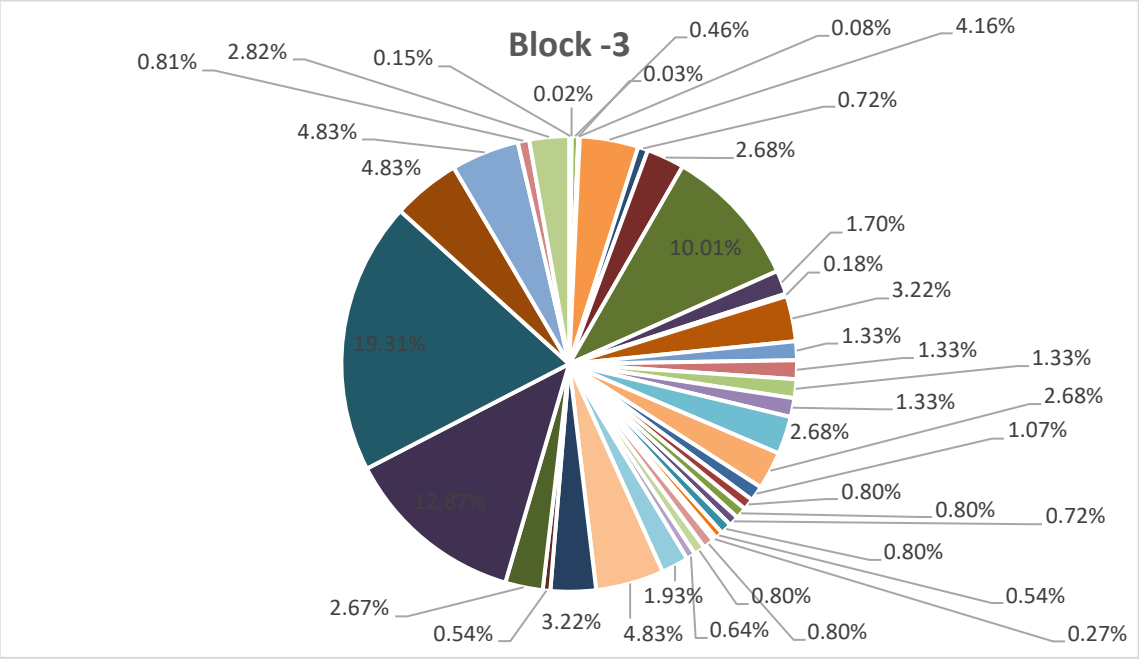

Figure 6: Block-3 % of Energy share pattern

Table 12: Block-4 Energy share pattern

SI.No	Applience	Power (KW)	% Sharing of Power
1	Parkans	7.8	2.88%
2	Hologen	9	3.33%
3	Babycans	2	0.74%
4	Spotlight	2.6	0.96%
5	Hologen	3	1.11%
6	Scanners	1.2	0.44%
7	Projector	0.8	0.30%
8	Water Coller	2	0.74%
9	W.F-12"	2.925	1.08%
10	UPS-7.5KVA	6.75	2.49%
11	UPS-10KVA	18	6.65%
12	UPS-5KVA	4.5	1.66%
13	T.V	0.3	0.11%
14	T.Lights	5.94	2.19%
15	Stabilizer	75	27.71%
16	LED-2x2	0.304	0.11%
17	LED-70watt	0.28	0.10%
18	Ex.Fans	0.65	0.24%
19	Computers	19.2	7.09%
20	Hologen	9	3.33%
21	Hologen	4	1.48%
22	CFL-18W	1.476	0.55%
23	CFL-11W	0.297	0.11%
24	CFL-36W	3.456	1.28%
25	CFL-55W	1.32	0.49%
26	C.Fans	7.125	2.63%
27	Babycans	3	1.11%
28	AC-2T	16	5.91%
29	AC-1T	8	2.96%
31	AC-1.5T	6	2.22%
32	AC-11.5T	34.5	12.75%
33	5A.P.Point	8.4	3.10%
34	15A.P.Point	4	1.48%
35	2x2 led	1.824	0.67%
	Total	**270.647**	**100%**

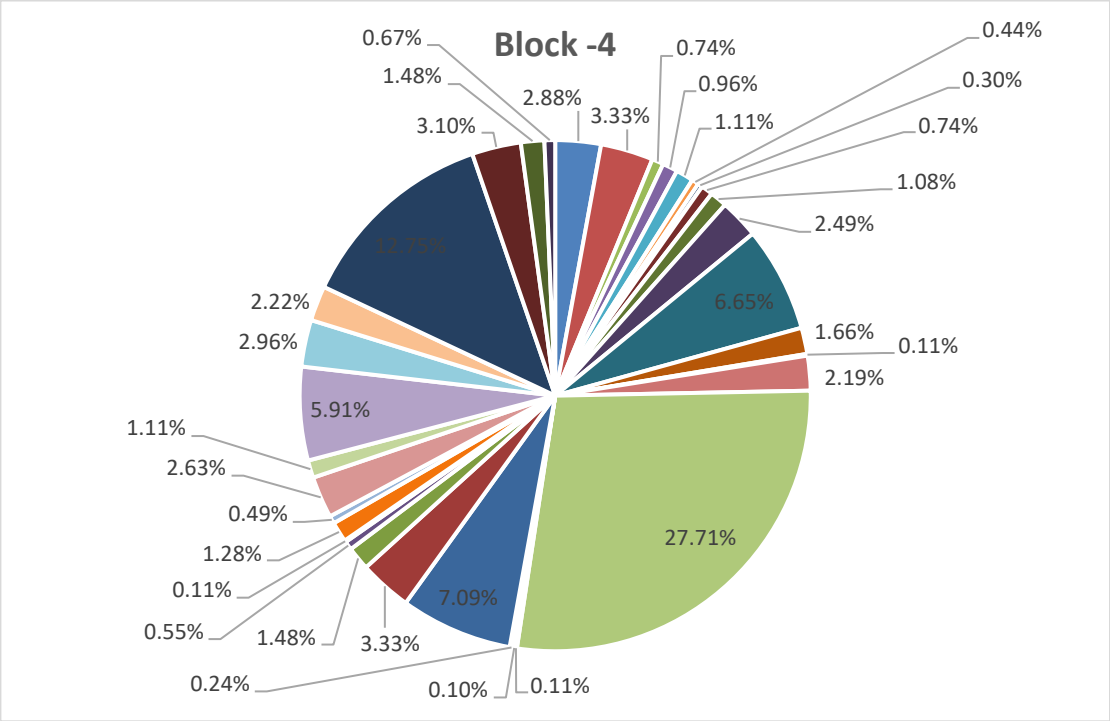

Figure 7: Block-4 % of Energy share pattern

Table 13: Block-5 Energy share pattern

SI.No	Applience	Power (KW)	% Sharing of Power
1	W.Fan-12"	0.13	0.08%
2	W.Fan-16"	0.525	0.31%
3	UPS	13.5	8.02%
4	UPS	18	10.69%
5	T.Lights	10.285	6.11%
6	Submercible	2.2	1.31%
7	S.V.Lamps	0.5	0.30%
8	Ex.Fan-12"	0.325	0.19%
9	Computers	43.5	25.83%
10	CFL	3.384	2.01%
11	C.Fan	13.875	8.24%
12	AC	3	1.78%
13	AC	32	19.00%
14	AC	20	11.87%
15	5A.P.Point	7.2	4.27%
	Total	**168.424**	**100%**

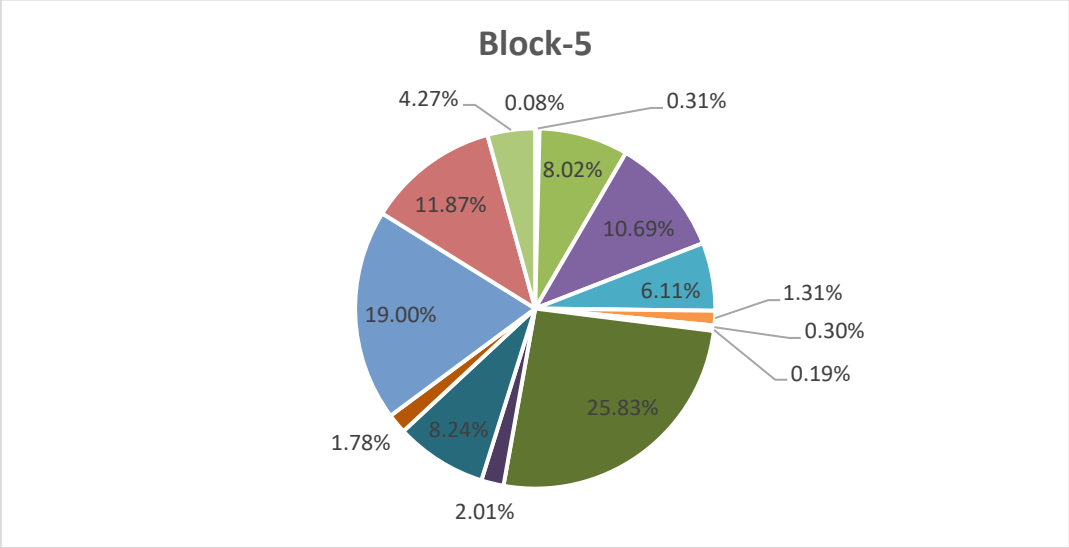

Figure 8: Block-5 % of Energy share pattern

Table 14: Block-6 Energy share pattern

SI.No	Applience	Power (KW)	% Sharing of Power
1	Xerox	0.5	0.69%
2	Water Cooler	0.5	0.69%
3	W.Fan-12"	0.13	0.18%
4	UPS	1.5	2.07%
5	UPS	9	12.43%
6	UPS	5.4	7.46%
7	T.V	0.3	0.41%
8	T.Lights	8.8	12.16%
9	MH	0.5	0.69%
10	Lamps	0.036	0.05%
11	Ex.Fan	0.065	0.09%
12	Computers	17.1	23.62%
13	CFL	0.144	0.20%
14	C.Fans	8.175	11.29%
15	AC	2	2.76%
16	AC	7.5	10.36%
17	5A.P.Point	10.74	14.84%
	Total	**72.39**	**100%**

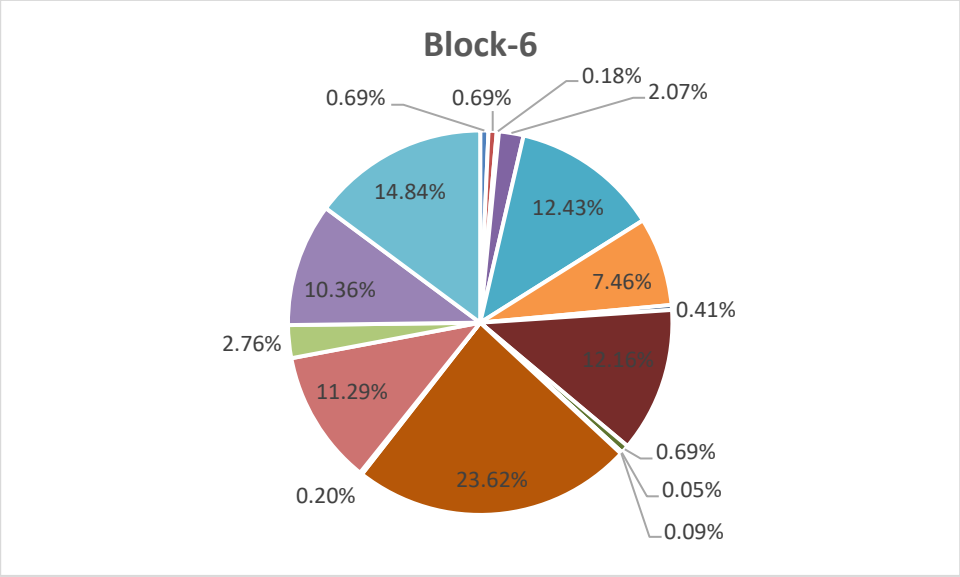

Figure 9: Block-6 % of Energy share pattern

Table 15: Boys Hostel Energy share pattern

SI.No	Applience	Power (KW)	% Sharing of Power
1	C Fans	57.15	23.71%
2	AC	2	0.83%
3	CFL	2.629	1.09%
4	Ex Fans	2.925	1.21%
5	W Fan	0.26	0.11%
6	P. Point	72.24	29.97%
7	Cooler	0.5	0.21%
8	Lamp	8.244	3.42%
9	T Lights	44.055	18.27%
10	TV	0.25	0.10%
11	Cold Storage	2	0.83%
12	Greaser	16	6.64%
13	Grinders	3	1.24%
14	Heating Elements	20	8.30%
15	Pesto	0.165	0.07%
16	Potato Piller	2.25	0.93%
17	Stablizer	5.4	2.24%
18	SV lamps	2	0.83%
	Total	**241**	**100%**

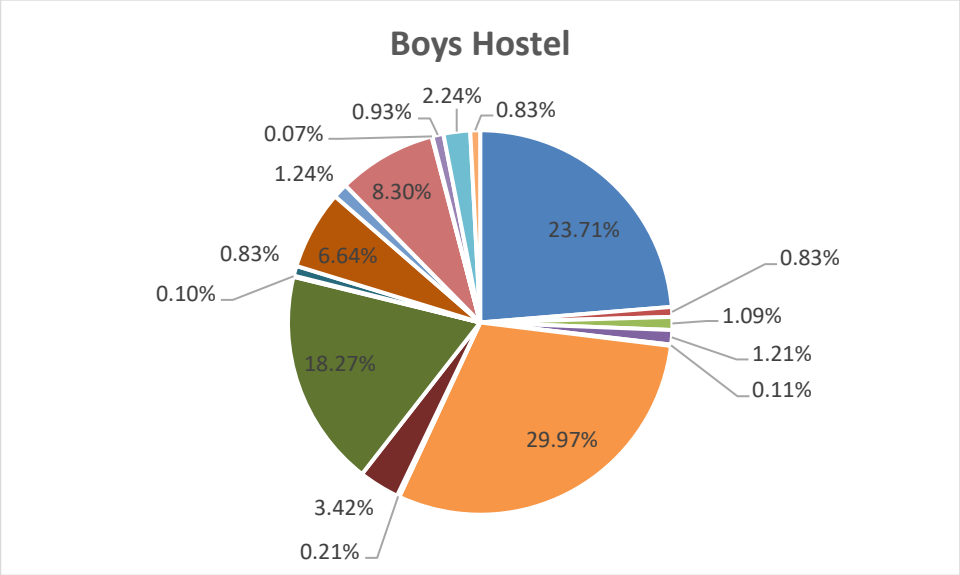

Figure 10: Boys Hostel % of Energy share pattern

Table 16: Girls Hostel Energy share pattern

SI.No	Applience	Power (KW)	% Sharing of Power
1	CFL	0.616	0.46%
2	Ex Fans	1.82	1.37%
3	W Fan	0.52	0.39%
4	P. Point	46.8	35.19%
5	Cooler	0.5	0.38%
6	Lamp	2.7	2.03%
7	T Lights	19.965	15.01%
8	TV	0.25	0.19%
9	Cold Storage	2	1.50%
10	Greaser	6	4.51%
11	Grinders	3	2.26%
12	Heating Elements	20	15.04%
13	Pesto	0.275	0.21%
14	Potato Piller	0.75	0.56%
15	Stablizer	10.8	8.12%
16	SV lamps	2.5	1.88%
17	Oven	0.5	0.38%
18	UPS	1	0.75%
19	UPS	9	6.77%
20	Water Cooler	4	3.01%
	Total	**132.996**	**100%**

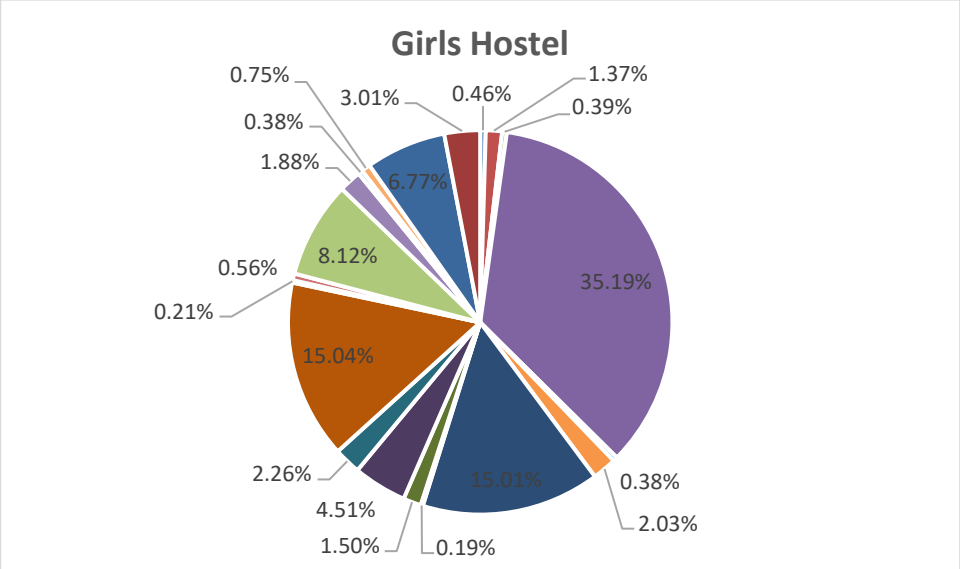

Figure 11: Girls Hostel % of Energy share pattern

2.8 PUMPS

During the audit it was observed that, 9 pumps are installed in the Campus. 7 pumps are centrifugal, and 2 pumps are Submersible is in operation. The details of the pumps are presented below:

Pump Identification	Type	Flow m3/hr	Pressure Mtrs	Power kW
GCSR college	Open well	8	29	5
GMR care back side	Open well	29	14	5
CSE Block	Open well	6	13	2
OHT Sump -1	Submersible	35	18	6.5
OHT Sump -2	Submersible	35	23	8.1
Principle	Open well	16	11	5
RASA Qarters	Open well	9	19	2
Boys Hostel Sump	Sump	12	19	5.3
STP Treated Water Sump	Sump	19	25	4.6

GCSR College open well: One submersible pump (7.5HP) is installed in (30ft dia x 30ft deep) open well. Normally operates continuously 24 hours in a day for supplying water to UGLSR at central locality of GMRIT campus. Estimated efficiency was found to be very low mainly due to ageing of pump and suspected silt accumulation near the foot valves leading restricted flow.

GMR Care: One submersible pump (7.5HP) is installed in (20ft dia x 25ft deep) open well and normally operates 8-12 hours in a day for supplying water to GMR care and Tanker filling operations. Estimated efficiency was found to be low due to higher velocity as the installed pipeline is found to be very small.

CSE Block Open well: One submersible pump (5HP) is installed in (15ft dia x 30ft deep) open well and normally operates 12 hours in a day for supplying water to UGLSR at central locality of GMRIT campus. Estimated efficiency was found to be low due to ageing and performance deterioration after re-wounded motor twice in the past.

Underground sump: Two submersible pumps (7.5HP) is installed in (30ft dia x 12ft deep) closed reservoir. Normally one pump operates continuously 24 hours in a day to fill the overhead tank, while other pump at standby mode. Estimated efficiency of both the pumps was found to be low, it is mainly due to mismatch in design consideration for present operation. Observed physical height of OHT tank is 16m and frictional head of installed 3" pipelines & valves are around 2-3 m. Total head required is around 18-20m, but design specifications (Flow-77 m3 /h, Head-10m, Power-5.5

kW) of pump are leading to operate in efficient zone. This scenario has reduced flow delivery to 50% of design and power consumption of motor to overloading. It was also known from the operating personnel, that one of the pump is designed with additional stage for head development.

Principal quarter's backside: One submersible pump (7.5HP) is installed in (20ft dia x 30 ft deep) open well. Normally pump operation is 8 hours in a day for supplying water to UGLSR at central locality of GMRIT campus. Estimated efficiency was found to be low, mainly due to depleted water levels in the well and mismatch in design and operation.

Rasa quarters: One submersible pump (3HP) is installed in (10ft x 20ft) sump of 30000 liters capacity. Normally pump operates for 8 hours in a day by lifting water from sump to overhead tank located at building's top floor (70 ft). Further water is distributed to individual houses by gravity through connected pipelines. Estimated efficiency was found to be slightly on the lower side, due to throttling of discharge valve at user end for avoiding overflow.

Boys Hostel sump: One submersible pump (5HP) is installed in (10ft x 30 ft) sump of 30000 liters capacity. Normally pump operates for 10-14 hours in a day by lifting water from sump to multiple overhead storage tanks located at different hostel building blocks top floor (40-60 ft). Further water is distributed to individual solar water heaters by gravity through connected pipelines. Estimated efficiency was found to be on the lower side, it is mainly due to mismatch in design consideration and present head variation for different hostel blocks.

Sewage treatment plant pump: One submersible pump (5HP) is installed in (20ft dia x 30 ft deep) open well. Normally pump operates for 12 hours in a day by lifting treated water from sump to direct distribution of gardening purpose for sprinkler system. Estimated efficiency was found to be slightly on the lower side, mainly due to restricted flow and variation in consumption near the user ends.

2.9 10.4 Canteen

During the canteen (boys & girls hostel) study, we came across the following observations

- LPG is the main source of energy for cooking and hot water generation, with consumption of total 10-12 cylinders (Boys – 6/8, Girls -2 and canteen-2) in a day.
- One deep freezer will be continuously operating for cold storage of vegetables at 8oC. whereas the exhaust blower resumes operation during cooking.

- Small capacity boiler (100 LPH and 50 PSI) has installed and operates for 4 hours in weekdays and 7 hours in weekend. Feed water to the boiler was at ambient temperature and generated steam is utilized for cooking of rice.
- Implementation of solar water heater (300 LPH) will preheat the feed water upto 50 – 65oC and also hot water can be used for cleaning the utensils, etc., This will reduce the LPG consumption by 3-5%.
- Apart from that significant organic solid waste generated as mentioned below: ¬ Wet waste - 290 kg / day ¬ Dry (vegetable waste) - 40 kg /day ¬ Cooked Food - 110 kg / day ¬ Garden Waste (Plantation) - 500 kg /day

RECOMMENDATION: 1

A: Title of Recommendation	**:**	**Retrofit Ceiling Fan with BLDC Fans**
B: Description of Existing System and its operation	**:**	Existing luminaries for Office are Ceiling Fans which consumes 80 W
C: Description of Proposed system and its operation	**:**	Retrofit Ceiling Fan with energy efficient BLDC fan to reduce the energy consumption. The BLDC Fan will consume 40 W.
D: Energy Saving Calculations		
Present No. of Ceiling Fans		2122
Present Ceiling Fan Consumption W	**:**	80
Proposed Consumption of BLDC Fan	**:**	40
Achievable power savings(W)	**:**	40
Operating Hours (@ 4 hrs./day & 200 D/Y)	**:**	800
Total Energy Savings kWh/year	**:**	67904
E: Cost Benefits		
Energy Saving Potential / year	=	67,904
Cost Savings / year@ unit cost Rs. 7.60/ unit	=	5,16,070
Investment (@ Rs. 3000/Fan)	=	6366000
Payback Period in months	=	148

RECOMMENDATION: 2

A: Title of Recommendation	**:**	**Retrofit SV with LED Light Lamps**
B: Description of Existing System and its operation	**:**	Existing luminarie lighting are SV Lamps which consumes 250 W
C: Description of Proposed system and its operation	**:**	Retrofit SV Light's with energy efficient LED Lights to reduce the energy consumption. The LED Lights will consume 150 W without compromising on the illumination levels.
D: Energy Saving Calculations		
Present No. of SVs		19
Present Fixture Consumption of SVs(W)	**:**	250
Proposed Consumption of LED Tube Light(W)	**:**	150
Achievable power savings(W)	**:**	100
Operating Hours (@ 12 hrs./day & 260 D/Y)	**:**	1040
Total Energy Savings kWh/year	**:**	1,976
E: Cost Benefits		
Energy Saving Potential / year	**=**	1,976
Cost Savings / year@ unit cost Rs. 7.85/ unit	**=**	45,052
Investment (@ Rs. 500/LED)	=	19000
Payback Period in months	**=**	5