

ENERGY AUDIT REPORT



Shri Shikshayatan College

11 Lord Sinha Road, Kolkata - 700071

November, 2021

Auditor :

ADAS India

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ACKNOWLEDGEMENT

We, ADAS India , express our sincere gratitude to the Principal and all IQAC team members of Shri Shikshayatan College , 11 Lord Sinha Road , Kolkata - 700071 for awarding us the assignment of **Energy Audit of the College Building.**

We are thankful to all house members for rendering co-operation and assistance to ADAS team during the entire period of the Audit.

ADAS India

November 2021

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CHAPTER # 1 ABBREVIATION

CFL - Compact Fluorescent Lamp

LED - Light Emitting Diode

CESC - Calcutta Electric Supply Corporation Limited

V - Voltage

I - Current

kW - Kilo-Watt

kVA - Active Power

kVAr - Reactive Power

P F - Power Factor

CHAPTER # 2 ABOUT THE COLLEGE



Shri Shikshayatan College was conceived by its founding father, Late Sitaram Seksaria as extension of Gandhiji's nationwide Constructive Programme, embracing the welfare of the Women. It began its journey with the blessings of Pandit Vidhu Shekhar Shastri, the internationally famed scholar of Indian thought and culture. Since then, it has traversed a long path keeping pace with the growing needs of a fast changing society

Shri Shikshayatan College was founded on 8th July, 1955 for girls under affiliation of the University of Calcutta. Established by the Marwaris, a linguistic minority, it is administered and managed by Shikshayatan Foundation – (Formerly known as Marwari Balika Vidyalaya Society -registered under the Societies Registration Act) which runs it solely for educational and not for commercial purposes.

As a linguistic minority, it enjoys protection under Article 30(1) of the Constitution of India. Originally meant for imparting and promoting education among the girls of the Marwari community, it has over the years, opened its doors in response to pressures for admission, to all eligible girl students of caste creed, religion or language.

The College aims at imparting liberal education which helps in developing the total personality of students and in bringing about all-round growth of their personality and making them self reliant. The college is committed to maintain a good academic standard in a non politicized environment.

The outstanding feature of the college is the harmonious and integrated co-existence of girls hailing from different parts of the country, speaking different languages and having different cultural backgrounds. The spirit of tolerance and understanding creates an ambience of cultural blending between diverse groups.

CHAPTER # 3 INTRODUCTION

3.1 Introduction

Energy Audit can be considered as the first step towards understanding how energy is being used in a given facility. It indicates the ways in which different forms of energy are being used and quantifies energy-use according to discrete functions. Energy Audit does not provide the final answer to the problem. It identifies where the potential of improvement lies and, therefore, where energy management efforts must be concentrated. In a preliminary Audit , the entire audit exercise can be divided into three steps. Step-1 identifies the quantity and cost of the various energy forms used in the plant. Step-2 identifies energy consumption at the department / process level. Step-3 relates energy input to production, thereby highlighting energy wastage in major equipment / processes. The Detailed Energy Audit goes much beyond the quantitative estimate of cost & savings. The study involves detail mass & energy balance of major energy consuming equipment. The system efficiencies are evaluated and measures are identified for improving the end- use energy- efficiency. The study proposes specific projects / feasibility studies for major retrofitting / replacement proposals, providing a cost benefit analysis of the recommended measure.

ADAS India was contracted by **Shri Shikshayatan College , 11 Lord Sinha Road , Kolkata – 700071** to conduct an electrical energy audit of the college.

3.2 Study Team

Dr. Shivaji Biswas - Accredited Energy Auditor(BEE)
Atanu Guha - Certified Energy Auditor(BEE)

3.3 Building details

The Audited building is located at **11 Lord Sinha Road , Kolkata – 700071**. This is College Building constructed with a very decent and attractive decor. Approximate area is 3000 m2..

FIG 3.1 Shri Shikshayatan College Building



3.4 Consumer details

The building is having G+3 Structure with 4 Sets of 3 phase meters. Energy Consuming items are mainly Split ACs, Pumps, Lighting , computers etc .

Power Supply is received from CESC.
The meter details are tabulated below:

Table 3.1 Meter Details

SI No	Meter Tag No	Meter No	Sanctioned Load (KVA)
1.	MTR-1	4385839 10,4385836 09,4159892 08	123.2
2.	MTR-2	4159896 01	52.9
3.	MTR-3	4159888 01	56.4
4.	MTR-4	3819495 01	53



Fig 3.2 Meter in the Panel Room

3.5 Scope of work

ADAS India was contracted by **Shri Shikshayatan College , 11 Lord Sinha Road , Kolkata – 700071** to conduct an Electrical energy audit vide their PO no **SSC/WO/Energyaudit/050/2021** dated **24 Sep 2021..**

The objective of the exercise was to :

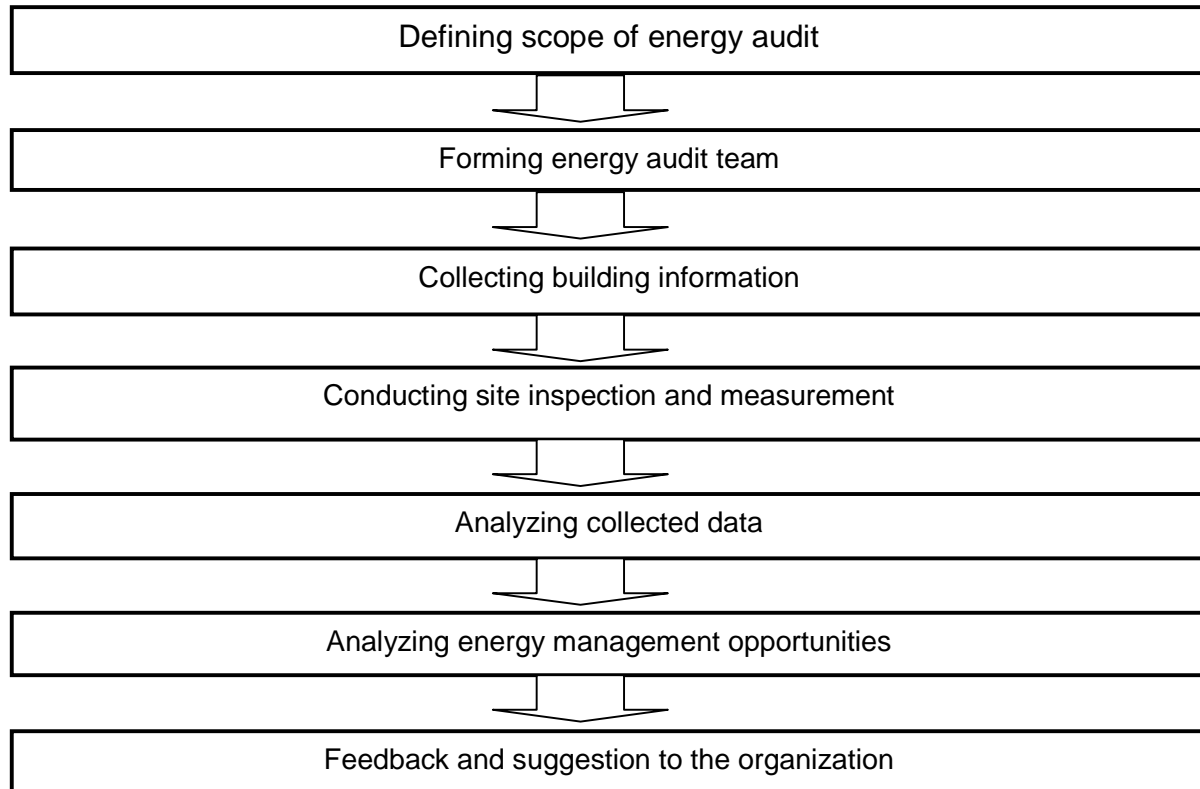
- Determine the energy conservation potential for the Building based on technological interventions
- Determine the electrical energy cost reduction potential based on operational process changes
- Establish the comparative financial feasibility of proposed alternatives.

3.6 Methodology

The detailed audit methodology is as follows and the building audit has been carried out accordingly:

- a. Initiating the audit
 - Understanding client needs and expectation
 - Gathering main data prior to site visit
 - Defining audit criteria and scope of audit
- b. Preparing the audit
 - Planning resources for Audit
 - Preparing audit checklist
- c. Executing the audit
 - Walk- through audit
 - Interviewing key facility personnel
 - Gathering on-site data
 - Conducting on-site measurement
 - Analyzing use of energy
 - Identifying, developing and refining ECON opportunities
- d. Reporting the audit
 - Preparing a draft working report for presentation to client
 - Submission of final report

AUDIT FLOW



Post audit implementation is out of the preview of this audit

The field measurement methodology adopted included the following equipments:

1. **Clamp-On Meter** : for measuring electrical parameters
2. **Luxmeter** : for measuring lux levels on the human occupancy areas.
3. **Anemometer** : for measuring flow rate (velocity) of cooling air to determine the heat rejected by the individual HVAC equipment .
4. **Psychrometer** : for measuring the dry bulb temperature (DBT) and wet bulb temperature (WBT) of the ambient and cooling air to establish the enthalpy change..
5. **Measuring Tape**: to measure the dimensions of various units.
6. **3phase power analyzer** : To measure Voltage, current, power factor, and KW etc.

CHAPTER # 4 EXECUTIVE SUMMARY

4.1 Summary of observations

We have carried out **Energy Audit** during the month of **October – November , 2021**.

Our main observations are summarized below:

4.1.1 Energy is supplied by CESC and the category of metering is “ Specified Institution P(M),Type P”

4.1.2 Phase Voltage found within specified limit.

4.1.3 Annual energy consumed were 2,39 Lac, 2.42 Lac, 2.36 Lac, 2.20 Lac Units in FY 2016-17, 2017-18, 2018-19 , 2019-20 amounting a sum total of Rs 18.15 Lac , 18.33 Lac, 17.94 and 16 Lac Respectively

4.1.4 Average energy cost is maintained at 7.6 Rs Per Unit in FY 2016-17, 2017-18, 2018-19 , 2019-20 for MTR 1, 3 & 4. For MTR 2 , it increase to Rs 9 per unit during 2018-2019 and 2019-2020.

4.1.5 Energy performance index is 48-52 KWh/Sqmtr/Year.

4.1.6 A comparison of unit consumption Meter wise reveals that meter M1 consumes max energy .

4.1.7 A study of energy consumption for 5 years energy bill reveals that while meter M1,M3 and M4 maintains a steady consumption , meter M2 has a decreasing trend.

4.1.8 The air conditioning has been provided with 1.5 and 2 TR Carrier & Daikin make split AC. Sample performance test has been carried out and the Energy efficiency of most of the units found less. Phase wise replacement of units with star rated AC is recommended.

4.1.9 Most of the Places , the set point of the AC has been kept below 24 deg C . It is recommended to maintain a set point of 24 deg C as per dept of power guideline.

4.1.10 Though in some places replacement of LED lamps has been done , there are many luminaries which are CFL. These need to be replaced by LED fittings to save further energy

4.1.11 Fans are consuming around 73 to 91 watt . Modern energy efficient fans consumes less power . The replacement of fans may be taken up in phased manner.

4.1.12 Each room is provided with Single on / off MCB outside the Door for switching off all loads while not in use which is a good initiative .

4.1.13 Unbalance load was detected at main panel .

4.1.14 Solar plant has been installed which serves lighting Load . This has given a substantial energy saving to the college

Type of Panel : 300 W Polycrystalline Module

Area of Panel Installed : 144 sqm



General Recommendations

- All Class Rooms and labs to have Display Messages regarding optimum use of electrical appliances in the room like, lights, fans, computers and projectors. Save electricity. Display the stickers of save electricity, save nature everywhere in the campus. So that all stakeholders encouraged to save the electricity.
- Most of the time, all the tube lights in a class room are kept ON, even though, there is sufficient light level near the window opening. In such cases, the light row near the window may be kept OFF
- All projectors to be kept OFF or in idle mode if there will be no presentation slides.
- All computers to have power saving settings to turn off monitors and hard discs, say after 10 minutes/30 minutes.

4.2 Summary of energy saving recommendations

We are highlighting here with only areas where further more Energy can be saved. Proposals are being summarized in table 4.1 for the quick reference. For details, the respective Chapters may be referred.

For ADAS India

(Atanu Guha)
Certified Energy Auditor (BEE)

(Dr. Shivaji Biswas)
Accredited Energy Auditor (BEE)

**SUMMARY of VARIOUS OPTIONS for
ENERGY SAVINGS**

Performance of the various machinery has been worked out based upon the measurement data. Performance as well as effective utilization of Electricity has been observed. The energy saving options are summarized below:

Table 4.1 Options for Energy Savings

SI No	Proposal for energy Saving	Expected annual saving (Rs)	Ref
1	Replacement of CFL Lamps with LED	1,09,000/-	Page 41
2	Replacement of AC Units Room no 112 (1.5 TR AC one no) *	23,788	Page 38
3	Replacement of AC Units Room no 309 (2 TR AC one no) *	10097	Page 38
4	Replacement of AC Units Room no 406 (2 TR AC one no) *	12681	Page 38
5	Replacement of Old ceiling Fans	88,000/-	Page 29

- **Sample test carried out**

CHAPTER # 5 ELECTRICITY BILLING

5.1 Applicable Tariff

Tariff and associated terms and condition vide order no 04/07/2018 of Hon'ble West Bengal Electricity Regulatory Commission

Supply Agency : CESC

Supply Voltage : 3 Phase , 415 V , 50 HZ

Type of consumer: **Specified Institution , Municipal / non municipal**

Consumer Category – **Rate P**

Name of the Tariff Scheme – **Normal**

Table 5.1 Applicable Tariff Scheme

Monthly Consumption in KWh	Energy Charge in Rs/KWh
For All units	6.34

Fixed Charge / Demand Charge (Rs/ KVA) ; 28 Rs

5.2 Study of Monthly billing for the year 2016-2021

Monthly electricity bill for the period of 2016 to 2021 has been studied and results are as per following tables :



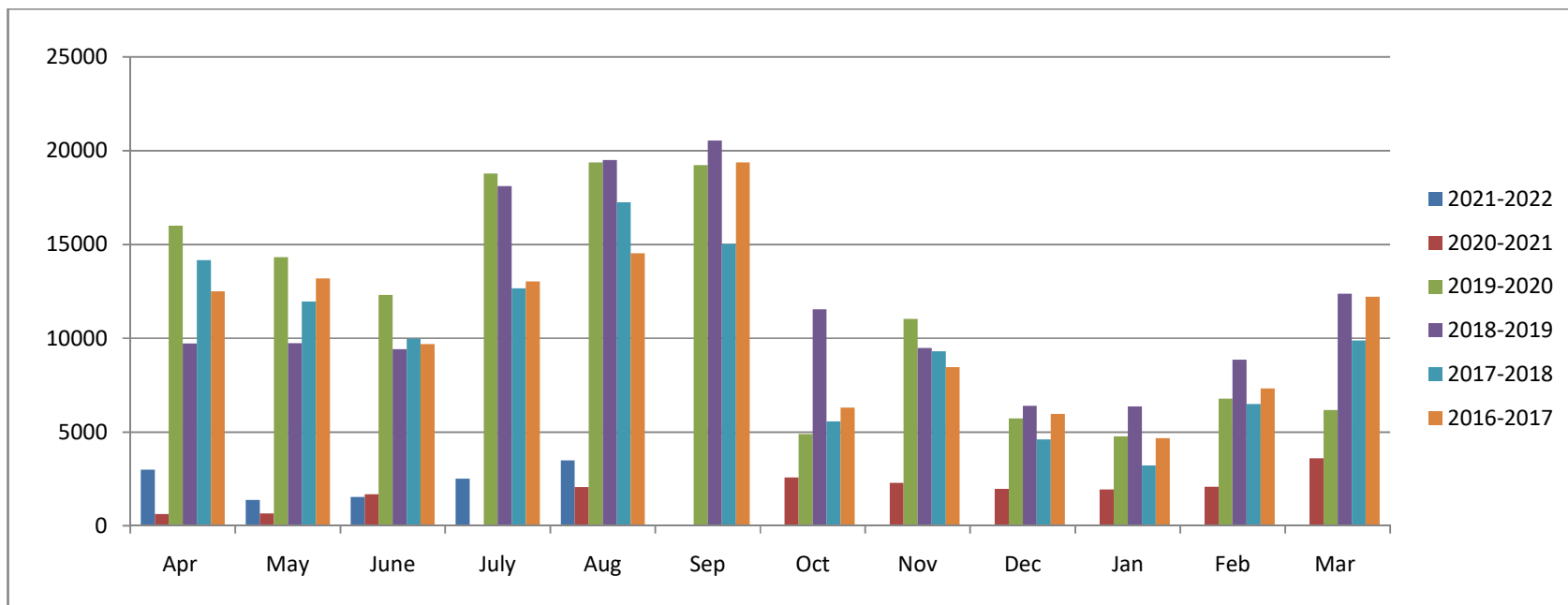
Fig 5.1 Class Room

5.2.1 Energy Bill for MTR-1

Table 5.2 Energy Bill for the year 2016-2021 – KWh Consumption MTR 1

Year/Month	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total	Average
2021-2022	2992	1386	1540	2520	3482								11920	2384
2020-2021	628	647.95	1680		2064		2580	2294	1980	1940	2092	3606	19512	1951
2019-2020	16008	14326	12308	18790	19388	19222	4900	11032	5728	4780	6786	6174	139442	11620
2018-2019	9722	9742	9406	18102	19508	20538	11536	9486	6394	6360	8874	12386	142054	11838
2017-2018	14166	11956	9966	12666	17254	15028	5570	9302	4606	3228	6494	9874	120110	10009
2016-2017	12506.0	13200.0	9694.0	13042.0	14528.0	19384.0	6302.0	8456.0	5980.0	4674.0	7322.0	12216.0	127304	10609

Fig 5.2 Year Wise Comparison of Energy Consumption – MTR 1

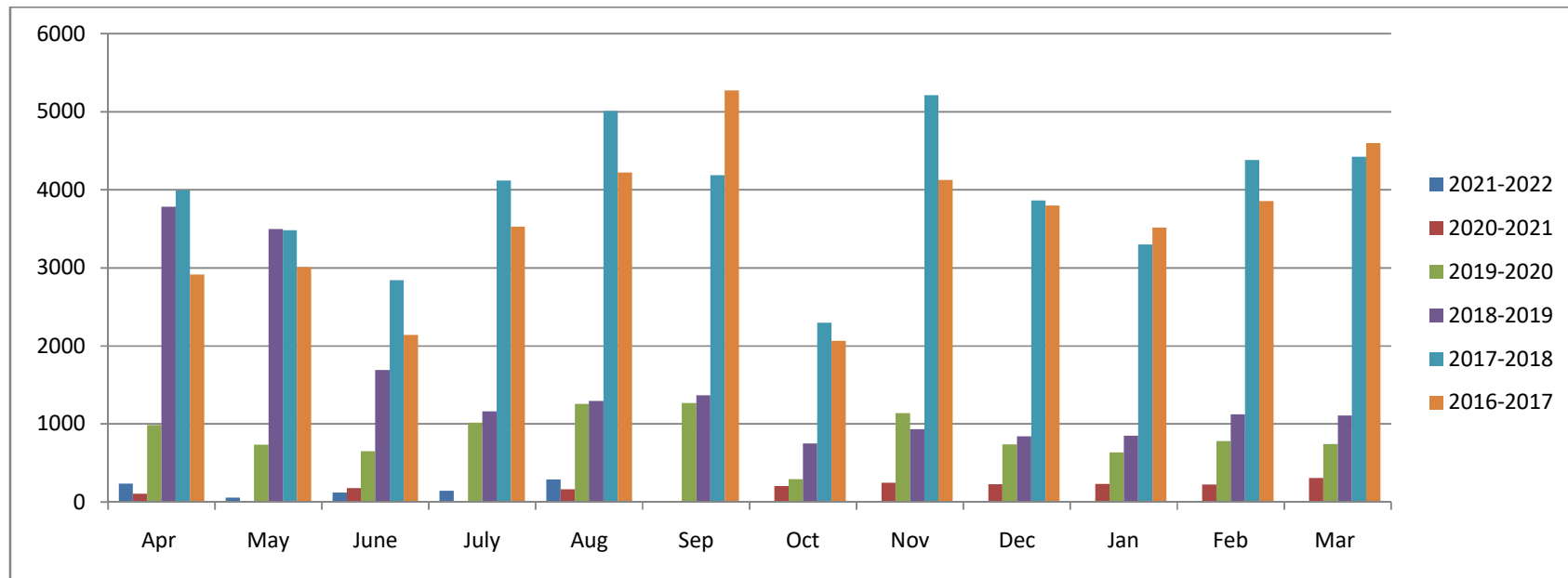


5.2.2 Energy Bill for MTR-2

Table 5.3 Energy Bill for the year 2016-2021 – KWh Consumption MTR 2

Year/Month	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total	Average
2021-2022	236	58	122	144	288								848	169.6
2020-2021	106	0	180		162		208	250	230	234	228	308	1906	190.6
2019-2020	986	734	654	1016	1258	1270	294	1138	740	636	784	746	10256	854.667
2018-2019	3782	3498	1690	1166	1296	1370	752	936	840	848	1124	1110	18412	1534.33
2017-2018	3994	3482	2844	4120	5010	4186	2298	5214	3864	3300	4384	4424	47120	3926.67
2016-2017	2914	3012	2142	3530	4224	5272	2066	4126	3798	3516	3856	4600	43056	3588

Fig 5.3 Year Wise Comparison of Energy Consumption – MTR 2

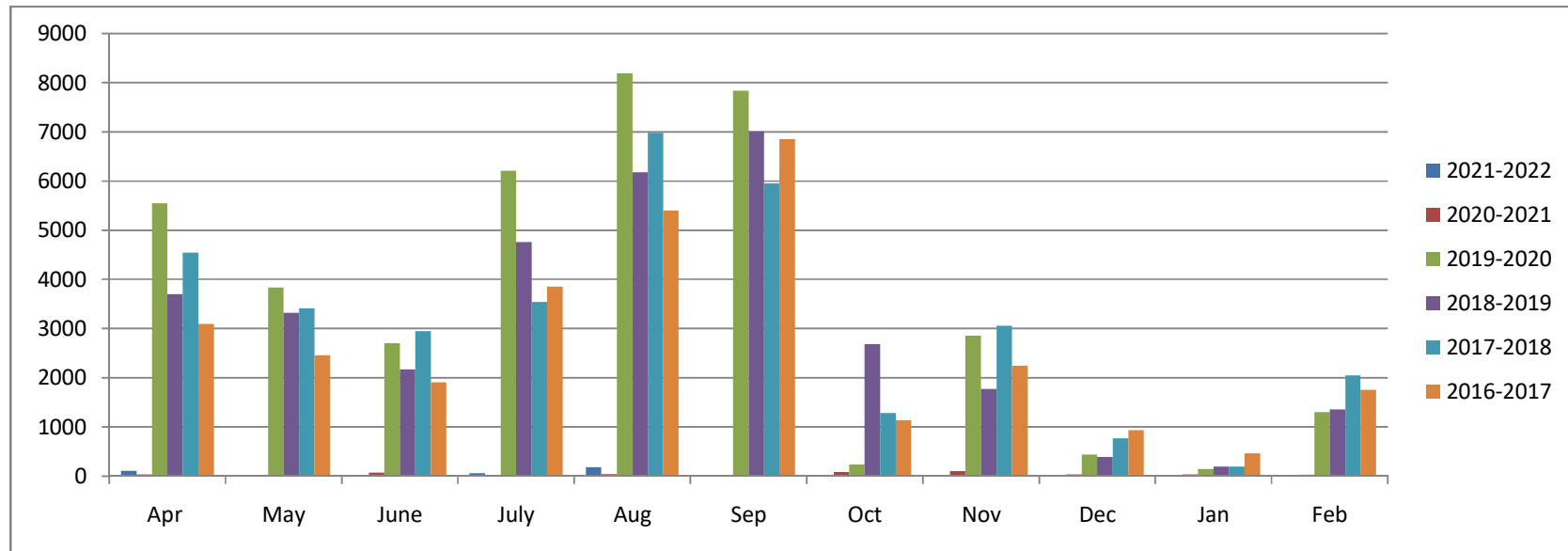


5.2.3 Energy Bill for – MTR-3

Table 5.4 Energy Bill for the year 2016-2021 – KWh Consumption MTR 3

Year/Month	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total	Average
2021-2022	110	8	8	58	180								364	72.8
2020-2021	38	0	72		44		82	102	38	34	30	112	552	55.2
2019-2020	5546	3834	2702	6206	8190	7840	236	2852	438	140	1302	1726	41012	3418
2018-2019	3700	3324	2170	4760	6178	7010	2688	1776	388	198	1356	3590	37138	3095
2017-2018	4546	3412	2946	3536	6980	5952	1282	3058	770	194	2046	4084	38806	3234
2016-2017	3090	2458	1904	3856	5400	6852	1138	2244	936	464	1760	3366	33468	2789

Fig 5.4 Year Wise Comparison of Energy Consumption – MTR 3

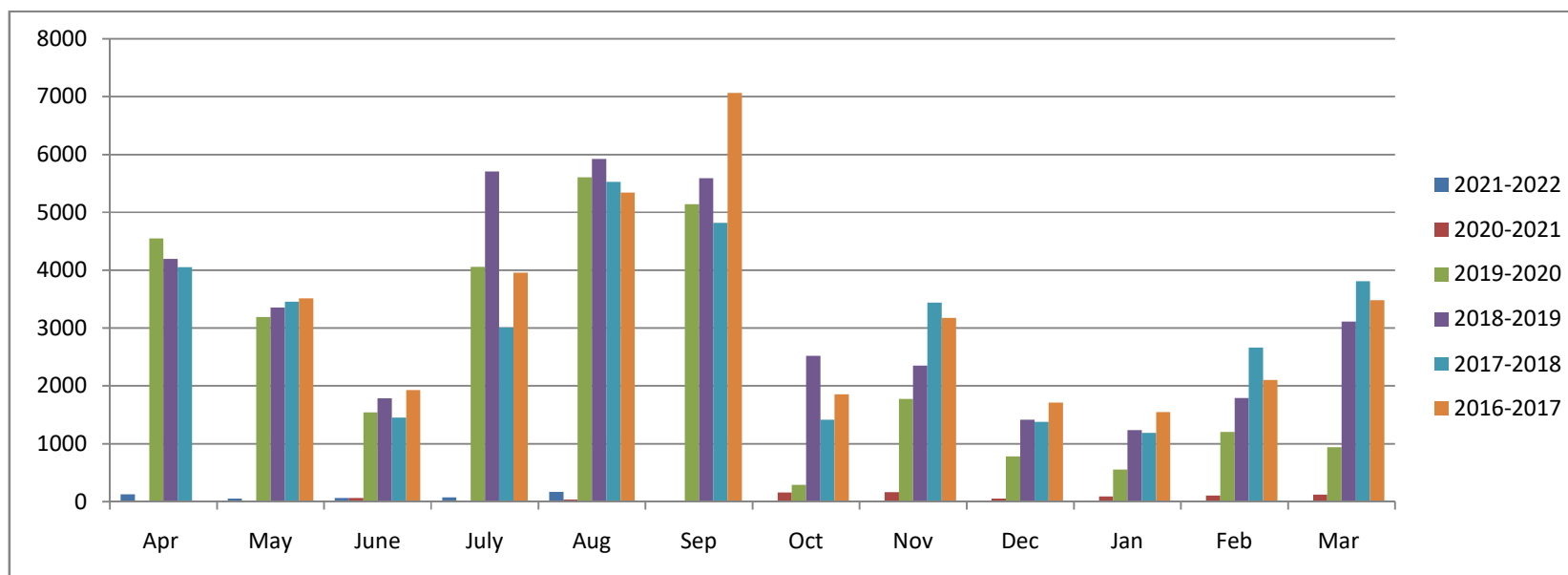


5.2.4 Energy Bill for – MTR-4

Table 5.5 Energy Bill for the year 2016-2021 – KWh Consumption MTR 4

Year/Month	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total	Average
2021-2022	124	52	60	72	172								480	96
2020-2021	0	0	64		36		152	158	50	88	102	120	770	77
2019-2020	4548	3188	1542	4058	5610	5140	288	1776	780	558	1206	938	29632	2469
2018-2019	4194	3354	1784	5704	5922	5590	2520	2350	1416	1234	1788	3114	38970	3248
2017-2018	4052	3452	1452	3006	5526	4822	1416	3438	1378	1186	2658	3806	36192	3016
2016-2017		3514	1930	3958	5338	7062	1850	3176	1708	1546	2098	3484	35664	2972

Fig 5.5 Year Wise Comparison of Energy Consumption – MTR 4

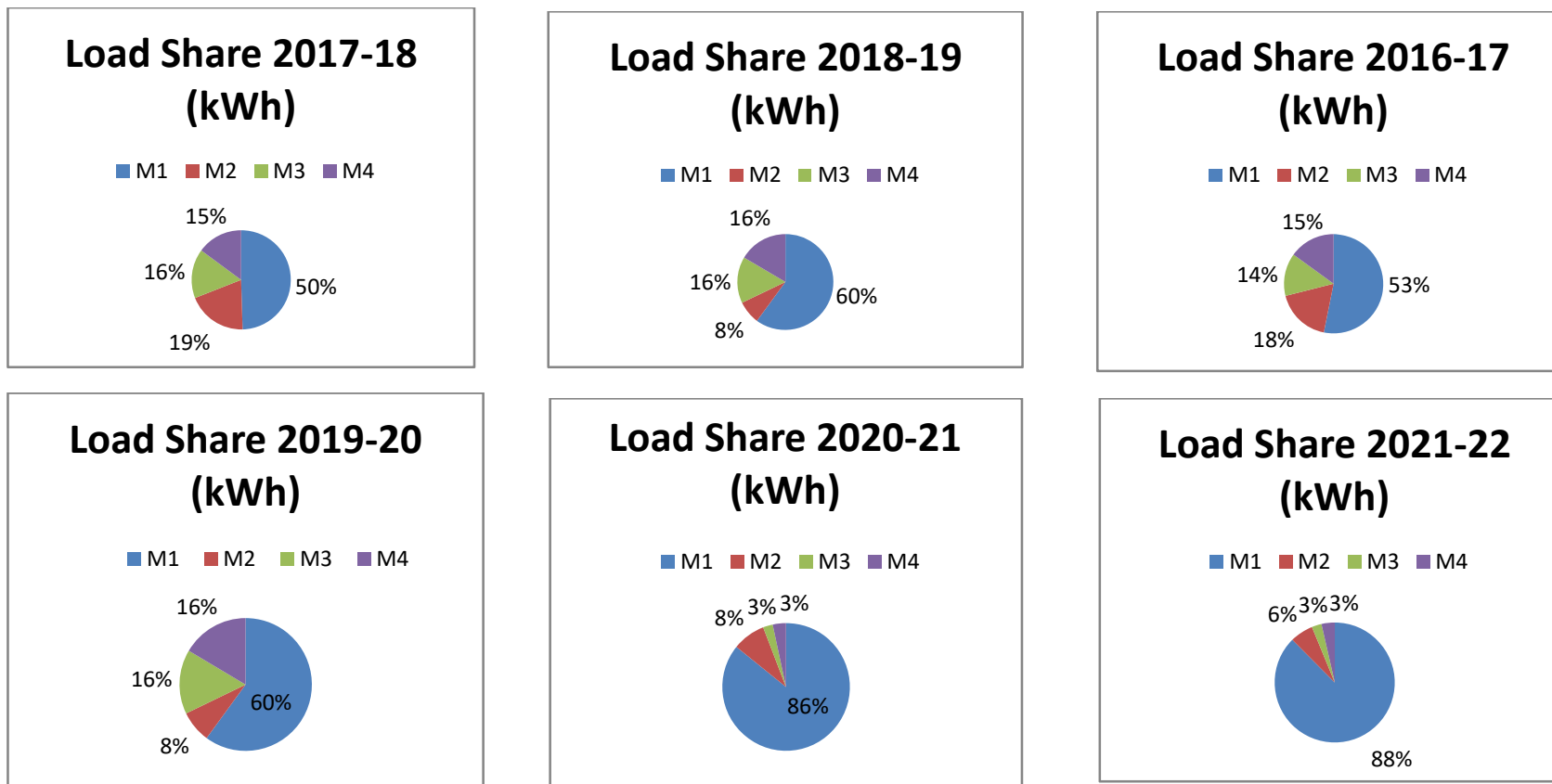


5.3 Meter Wise wise Load share for year 2016-2021

Table 5.6 Meter wise Load share for the year 2016 – 2021

Meter / Year	2021-22	2020-21	2019-20	2018-19	2017-18	2016-17
M1	11920	19511.95	139452	142054	120110	127308
M2	848	1906	10256	18412	47120	43056
M3	364	552	41012	37138	38806	33468
M4	480	770	29632	38970	36192	35900

Fig 5.6 Meter wise Load share for the year 2016-2021



5.4 Year wise Energy Cost and average unit cost 2016-2021

Table 5.7 Meter wise yearly energy cost and per unit cost

Meter	Item / Year	2021-22	2020-21	2019-20	2018-19	2017-18	2016-17
M1	Total Consumption	11920	19511.95	139452	142054	120110	127308
	Gross Amount	103716	175896	1056495	1075527	915635	968053
	Unit Cost	8.7	9.01	7.5	7.6	7.6	7.6
M2	Total Consumption	848	1906	10256	18412	47120	43056
	Gross Amount	12167	29451	91933	151361	360538	330926
	Unit Cost	14.3	15.5	9.0	8.2	7.7	7.7
M3	Total Consumption	364	552	41012	37138	38806	33468
	Gross Amount	10232	19537	290674	264989	276048	240657
	Unit Cost	28.1	35.4	7.1	7.1	7.1	7.2
M4	Total Consumption	480	770	29632	38970	36192	35900
	Gross Amount	9739	18277	230997	301185	280944	275660
	Unit Cost	20.29	23.7	7.8	7.7	7.8	7.7
Grrand Total Energy		13612	22739.95	220352	236574	242228	239732
Grrand Total Cost Of energy		135854	243160	1670099	1793062	1833165	1815296
Grand Average energy cost/unit		10.0	10.7	7.6	7.6	7.6	7.6

Fig 5.7. Energy consumption – year 2016-21 MTR 1

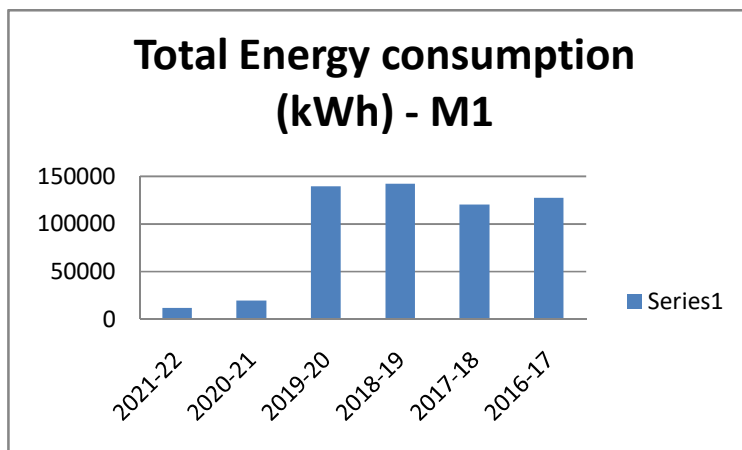


Fig 5.8 Unit Energy cost – year 2016-21 MTR 1

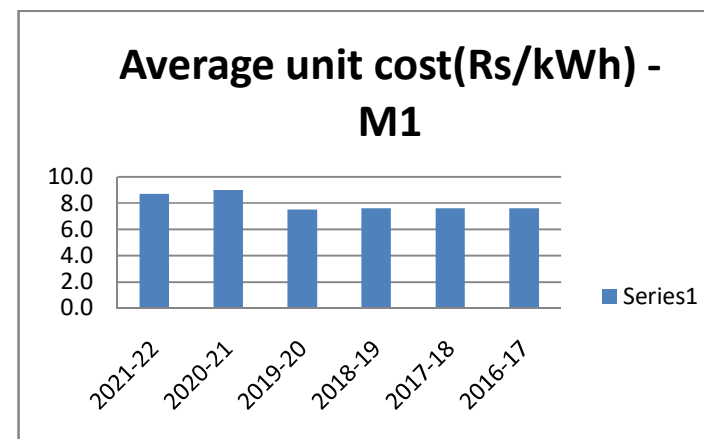


Fig 5.9 Energy consumption – year 2016 – 21 MTR 2

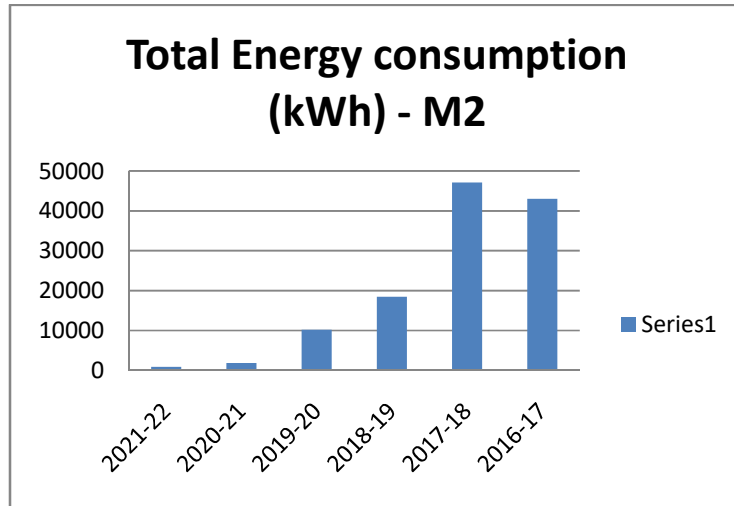


Fig 5.10. unit Energy consumption – year 2016-21 MTR2

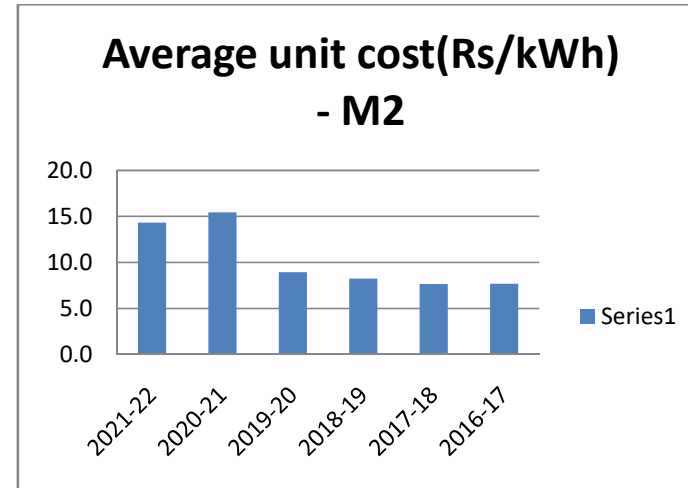


Fig 5.11 Energy consumption – year 2016 – 21 MTR 3

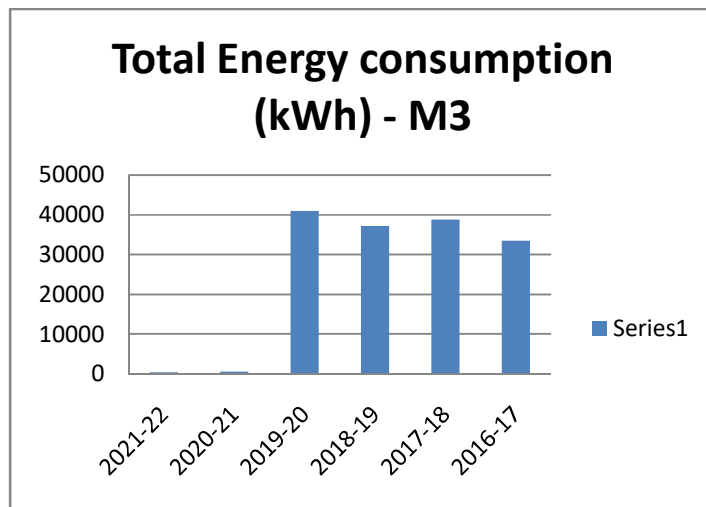


Fig 5.12 Unit Energy consumption – year 2016-21 MTR3

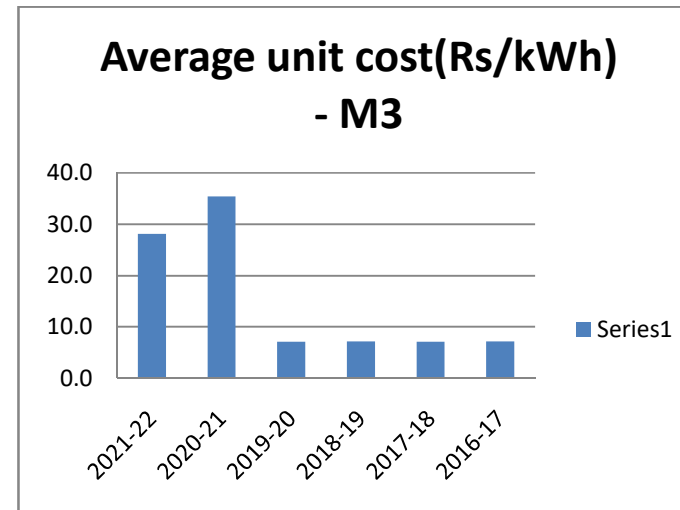


Fig 5.13 Energy consumption – year 2016 – 21 MTR 4

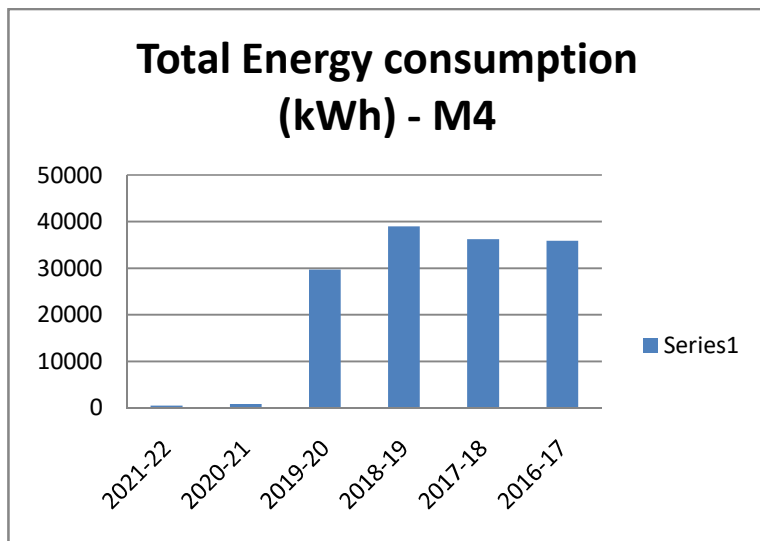
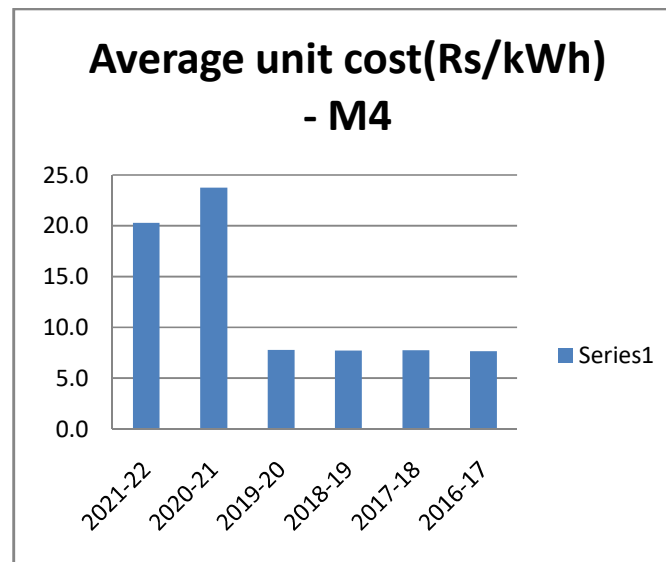


Fig 5.14 Unit Energy consumption – year 2016-21 MTR 4

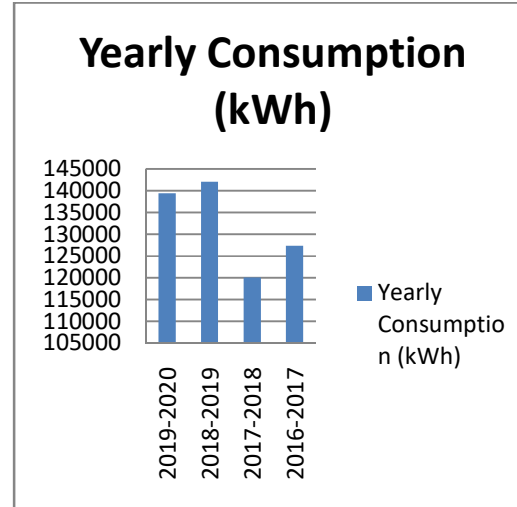


5.5 Yearly Consumption Profile - 2016-2021

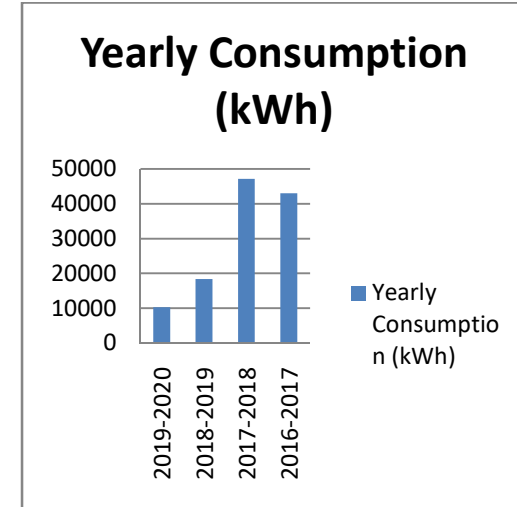
MTR - 1

Year	Yearly Consumption (kWh)
2019-2020	139442
2018-2019	142054
2017-2018	120110
2016-2017	127304

MTR - 1



MTR - 2



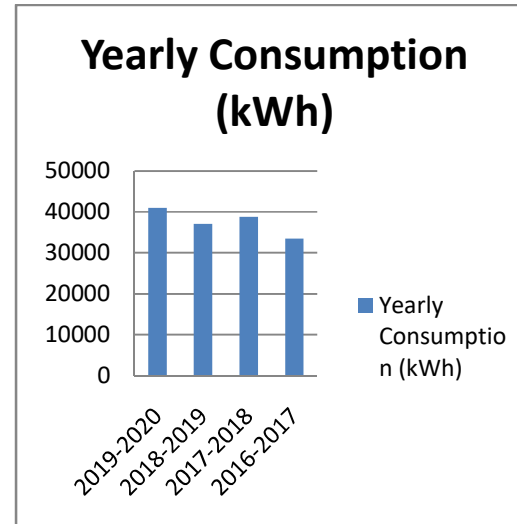
MTR - 2

Year	Yearly Consumption (kWh)
2019-2020	10256
2018-2019	18412
2017-2018	47120
2016-2017	43056

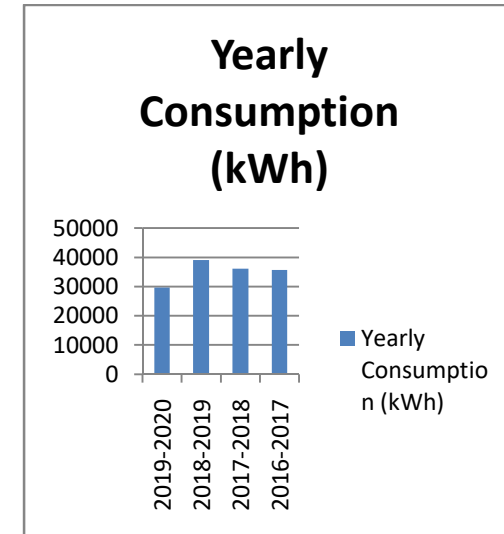
Mtr-3

Year	Yearly Consumption (kWh)
2019-2020	41012
2018-2019	37138
2017-2018	38806
2016-2017	33468

MTR - 3



MTR - 4



MTR-4

Year	Yearly Consumption (kWh)
2019-2020	29632
2018-2019	38970
2017-2018	36192
2016-2017	35664

** Year 2020-2021 data not considered

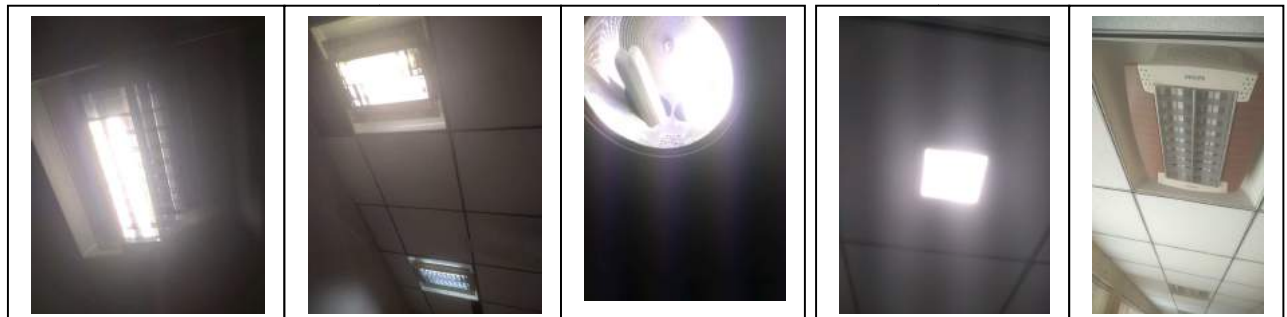
5.6 Observations

- The category of metering P(M) Type P
- Annual energy consumed in year 2016-17 was 2.36 lakh kWh, Gross bill Rs 18.15 Lakh and average cost per unit is Rs 7.6
- Annual energy consumed in year 2017-18 was 2.42 lakh kWh, Gross bill Rs 18.33 Lakh and average cost per unit is Rs 7.6
- Annual energy consumed in year 2018-19 was 2.36 lakh kWh, Gross bill Rs 17.9 Lakh and average cost per unit is Rs 7.6
- Annual energy consumed in year 2019-20 was 2.2 lakh kWh, Gross bill Rs 16.7 Lakh and average cost per unit is Rs 7.6
- The Energy performance index(EPI) is 53 to 58 KWh/sqmtr/Year.
- The year wise consumption reveals that MTR 1 consumption has a steep increase from year 2016 to 2020 whereas MTR 2 has steep decrease in KW reading . MTR 3 & 4 maintained a steady consumption.. Consumption in the year 2020 and 2021 has not been considered in this study.

CHAPTER # 6 POWER SYSTEM

6.1 Load details

415 Volt , 3 phase Power is supplied by CESC through 6 separate meters as mentioned in chapter 3. The power is fed to a distribution panel for further distributed to different floors .Each Floor is connected with Split ACs , Lights of various types, Laptop, Computers etc .. The details of the loads are given in the annexures .



Following Load lists are attached as annexure :

- List Of Light : Annexure – 2
- List Of Fan : Annexure – 3
- List Of Computers : Annexure - 4

6.2 V I Measurement

Table 6.1 Meter wise Power Measurement Data

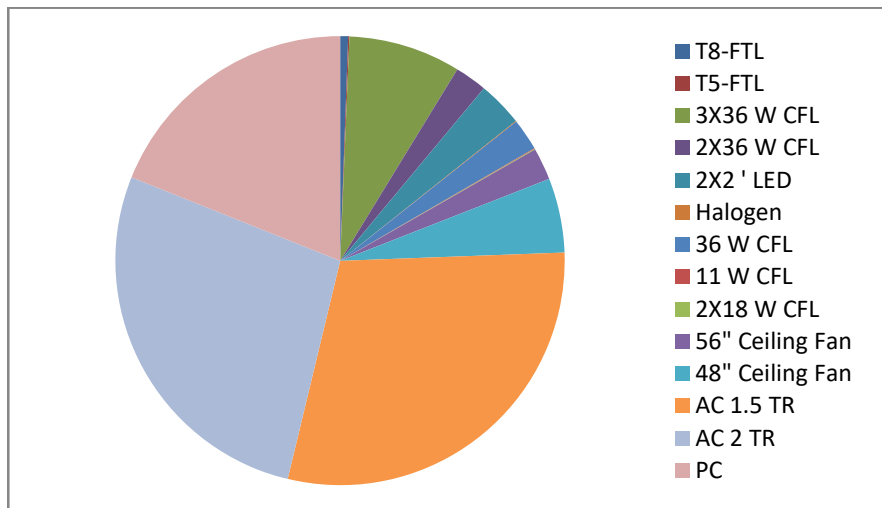
Date: 15.11.2021

Sl No	Particulars	Phase	Voltage	Load Current
1	MTR 1(836)	R	233.5	13.19
		Y	233.7	23.15
		B	236	25.35
2	MTR 1(839)	R	230.6	44.8
		Y	231.3	61.2
		B	236	48.8
3	MTR 2	R	328	1.41
		Y	237	4.33
		B	238	4.04
4	MTR 3	R	242	0.29
		Y	241.4	0.69
		B	241.6	0.06
5	MTR4	R	238	5.56
		Y	238	4.24
		B	237	6.57

6.3 Connected Load

Conencted load and Tentative Load details is furnished below

SI No	Item	Qty	Load / unit (W/Unit)	Total KW
1	T8-FTL	43	40	1.72
2	T5-FTL	14	20	0.28
3	3X36 W CFL	224	108	24.192
4	2X36 W CFL	96	72	6.912
5	2X2 ' LED	270	36	9.72
6	Halogen	3	50	0.15
7	36 W CFL	189	36	6.804
8	11 W CFL	14	11	0.154
9	2X18 W CFL	6	36	0.216
10	56" Ceiling Fan	77	90	6.93
11	48" Ceiling Fan	200	80	16
12	AC 1.5 TR	65	1350	87.75
13	AC 2 TR	43	1900	81.7
14	PC	515	110	56.65
	Total Conncted Load			299.178



6.4 Ceiling Fan performance

Ceiling fan is a devise suspended from ceiling of a room which employs hub mounted rotating paddles to circulate air in order to produce cooling effect. When the fan rerates , the breeze created by the ceiling fan speeds the evaporation of sweat air of human skin which gives cooling .The BEE labeling scheme is for ceiling fan of 1200 mm sweep and energy efficiency is called service value .

Air delivery , fan speed and power input are the parameters to be tested for energy efficiency.

Star Rating	Service Value of Ceiling Fan
1 Star	3.2 to 3.4
2 Star	3.4 to 3.6
3 Star	3.6 to 3.8
4 Star	3.8 to 4.0

Service factor is Ratio of air delivery / power input

Air delivery (minimum) is 210 cubic meter / min

Sl No	Room No	Fan Wattage	Velocity (m/s)	Sweep Volume (m ³ / min)	Service Factor
1	202	73.44	1.3	210	2.85
2	112	91.08	1.4	210	2.3
3	111	76.78	1.5	210	2.76
4	301	83.17	1.4	210	2.44

Sample Pay back calculation – Room no 112

1. No of 48” fan – 6
2. Average power drawn : 73 – 91 watt (82 watt average)
3. Power drawing by 6 fans – 492 watt
4. Power drawing by new HAVELS make fan – 50 Watt
5. Power drawing by new 6 nos HAVELS make fan – 300 Watt
6. Watt saving : 192 watt
7. Considering 180 days ./ yr , 10 Hrs/day , saving : 345.6 Kwh / yr
8. Saving in Rs @ 7.6 Rs/ unit : Rs 2626.56 / Yr ie Rs 437 per Fan
9. Investment for 6 fans @ 3065 Rs / Fan : 18390 Rs
10. Pay back – 7 years

Total No of 56” and 48 “ fans is 275 . Considering average annual saving of Rs 400/ unit and 80% diversity factor , total saving per year will be Rs 88,000/-

Specification of HAVEL fan

Model : ES-New-2S fan

Sweep – 1200 mm

Air Delivery : 225 m³/ min

Colour : White

Wattage : 50 watt

Specification of BLDC fan

Wattage : 28 watt

Price – 4343 Rs

Air Delivery : 250 cmm

6.5 Observation

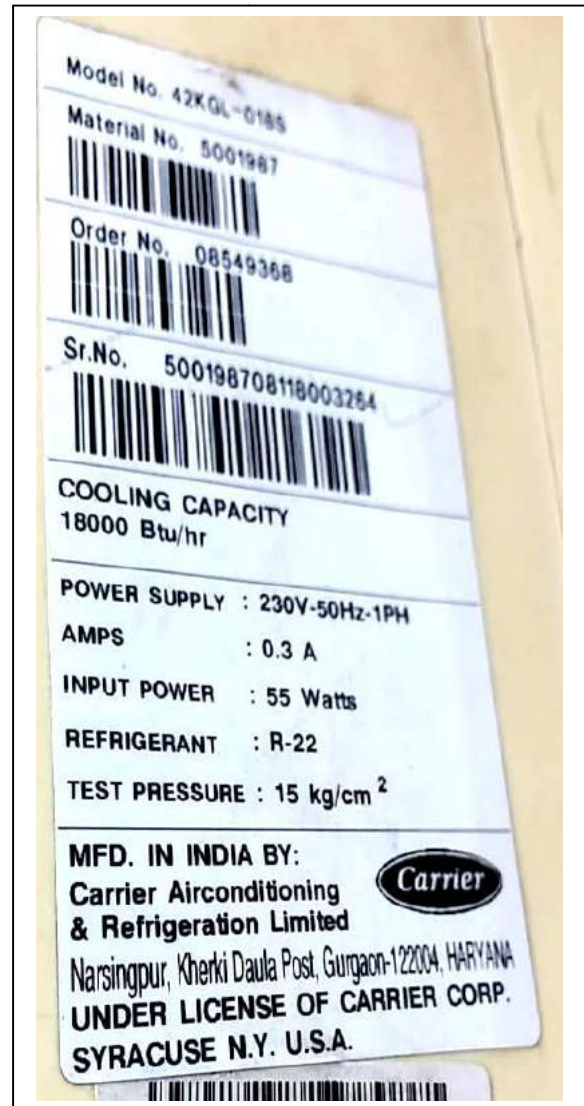
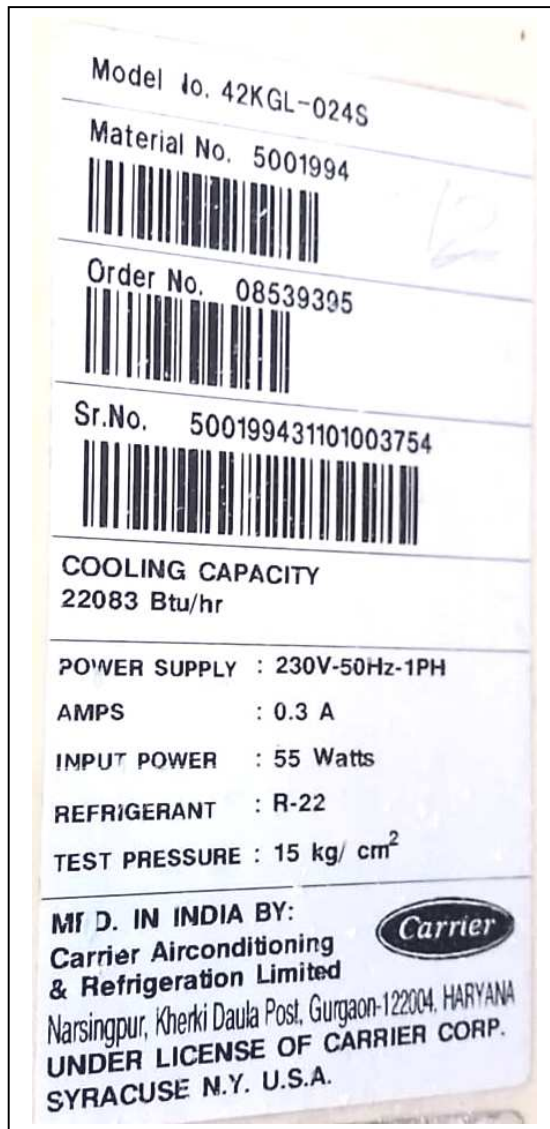
Our observations are as follows:

- Voltage : Within specified limit
- Current : Unbalance current due to random switching-on of loads in different phases observed
- Old Fans can be replaced by high efficiency fans to reduce energy consumption
- Most of the fan studied are drawing wattage from 73 to 91. This is in higher side as a result service factor reduced to 2.44 to 2.85
- Connected load is approximately 300 Kw .
- Each room is connected with single load switch outside the door to switch off all electrical units inside room which is a good initiative.

CHAPTER # 7 AIR CONDITIONING SYSTEM

7.1 AC system and specification

Fig 7.1 Machine details



Specification

1. Make Carrier , Cooling capacity 22083 Btu/Hr or 1.8 TR , Refrigerant R22 , Ams 0.3 A , Model 42KGL-024S
2. Make Carrier , Cooling capacity 18000 Btu/Hr or 1.5 TR , Refrigerant R22 , Am 0.3 A , Model 42KGL-018S

Table7.1 AC System Rating Details

Floor	Room No	Room Name	AC Type	Brand	Qty	Rating (Ton)	Rated EER
GR	5	Class Room	Split Ac	Carrier	2	2	2.9
GR	6	Class Room	Split Ac	Carrier	2	2	2.9
GR	LAB - 1	General Lab	Split Ac	Daikin	2	1.5	2.9
GR	LAB-2	Multimedia Lab	Split Ac	Carrier	1	2	2.9
IST	101	Principal's Room	Split Ac	Carrier	1	2	3.02
IST	102	Conferenece Room	Split Ac	Daikin	1	1.5	2.91
IST	103	PG Room	Split Ac	Carrier	1	1.5	3.17
IST	104	Joint Secretary Room	Split Ac	Daikin	1	1.5	2.91
IST	105	Principal's Office	Split Ac	Carrier	3	1.5	3.17
IST	105	Principal's Office	Split Ac	Daikin	1	1.5	2.9
IST	108	General Staff Room	Split Ac	Carrier	1	2	3.02
IST	108	General Staff Room	Split Ac	Daikin	2	1.5	2.91
IST	110	B. Ed Staff Room	Split Ac	Carrier	1	1.5	3.17
IST	111	B. Ed Activity Room	Split Ac	Carrier	1	1.5	2.9
IST	112	B. Ed Class Room	Split Ac	Carrier	2	2	3.02
IST	113	B. Ed Class Room	Split Ac	Carrier	2	2	3.02
IST	114	B. Ed Library	Split Ac	Carrier	2	2	3.02
IST	115	B. Ed Class Room	Split Ac	Carrier	1	2	3.02
IST	115	B. Ed Class Room	Split Ac	Carrier	1	1.5	3.17
IST		B. Ed Corridor - 1	Split Ac	Carrier	1	1.5	3.17
IST		B. Ed Corridor - 2	Split Ac	Carrier	1	1.5	3.17
IST		B. Ed Corridor - 3	Split Ac	Carrier	1	1.5	3.17
2ND	202	Laptop Lab / Class Room	Split Ac	Carrier	1	1.5	3.17
2ND	203A	Laptop Lab / Class Room	Split Ac	Carrier	1	1.5	3.17
2ND	203B	Laptop Lab / Class Room	Split Ac	Carrier	1	1.5	3.17
2ND	204	Laptop Lab / Class Room	Split Ac	Carrier	1	2	3.02
2ND	205	Class Room	Split Ac	Carrier	3	2	3.02
2ND	206	Server Room	Split Ac	Carrier	1	1.5	3.17
2ND	208	Exam Control Room	Split Ac	Carrier	1	1.5	3.17
2ND	209	Class Room	Split Ac	Carrier	2	2	3.02
2ND	210	Class Room	Split Ac	Carrier	2	1.5	3.17
2ND	211	Class Room	Split Ac	Carrier	1	1.5	3.17
2ND	212	Class Room	Split Ac	Carrier	2	2	2.9
2ND	213A	Class Room	Split Ac	Carrier	1	1.5	3.17
2ND	213B	Class Room	Split Ac	Carrier	1	1.5	3.17
2ND	214	Class Room	Split Ac	Carrier	2	1.5	3.17
2ND	215	Class Room	Split Ac	Carrier	2	2C	3.02

Floor	Room No	Room Name	AC Type	Brand	Qty	Rating (Ton)	Rated EER
2ND	216	Laptop Lab / Class Room	Split Ac	Carrier	2	2C	3.02
2ND	217	Media Lab	Split Ac	Carrier	3	1.5	3.17
2ND		Cafeteria	Split Ac	Carrier	3	2	2.91
2ND	A1	Physics Lab	Split Ac	Carrier	2	2	2.91
2ND	A2	Class Room	Split Ac	Carrier	3	1.5	3.17
2ND	A3	Class Room	Split Ac	Carrier	2	1.5	3.17
2ND	A4	Class Room	Split Ac	Carrier	1	2	2.91
2ND	A5	Class Room	Split Ac	Carrier	1	2	2.91
2ND	A6	Class Room	Split Ac	Carrier	1	2	2.91
2ND	A7	Class Room	Split Ac	Carrier	2	2	2.91
3RD	301	Class Room	Split Ac	Carrier	2	1.5	3.17
3RD	301	Class Room	Split Ac	Daikin	2	1.5	3.17
3RD	302	Class Room	Split Ac	Carrier	4	1.5	3.17
3RD	303	Class Room	Split Ac				
3RD	304	Yoga Room	Split Ac	Carrier	3	1.5	3.17
3RD	307A	Botany Lab	Split Ac				
3RD	307B	Botany Lab	Split Ac				
3RD	307C	Botany Class Room	Split Ac	Carrier	1	1.5	3.17
3RD	308A	Class Room	Split Ac	Carrier	1	1.5	3.17
3RD	308B	Class Room	Split Ac	Carrier	1	1.5	3.17
3RD	309	Class Room	Split Ac		2	2C	
3RD	310	Class Room	Split Ac		1	1C	
3RD	311	Geography Staff Room	Split Ac	Carrier	1	1.5	3.17
3RD	312	Class Room	Split Ac	Carrier	1	1.5	3.17
3RD	313	Class Room	Split Ac	Carrier	2	1.5	3.17
3RD	314	Class Room	Split Ac	Carrier	1	1.5	3.17
3RD	314	Class Room	Split Ac	Daikin	3	1.5	3.17
4TH	403A	Class Room	Split Ac	Carrier	1	1.5	3.17
4TH	403C	Chemistry Lab	Split Ac				
4TH	404A	Class Room	Split Ac	Carrier	1	1.5	3.17
4TH	404C	Zoology Lab	Split Ac				
4TH	405	Class Room	Split Ac	Carrier	2	2	2.91
4TH	406	Class Room	Split Ac	Carrier	2	2	2.91
4TH	407	Class Room	Split Ac	Carrier	2	2	2.91
4TH	409	Class Room	Split Ac	Carrier	2	1.5	3.17
4TH	410	Class Room	Split Ac	Carrier	2	1.5	3.17

Table 7.3 AC PARAMETERS - ROOM NO 112

DATE	15.11.2021
Room No	112
Make	Carrier
Rating	2 TR
Rared EER	3.02

DUCT SIZE (mm)	L	B
	970	110

VELOCITY (m/s)						
1.3	1.4	1.5	1.7	2	2.1	2.2
2.3	2.4	2.2	2.3	2.2	2.1	2.1
2.2	2.3	2.4	2.5	2.4	2.3	1.2
2.1	2	2	1.9	1.8	1.7	1.9
1.8	2.1	2.2	2.4	2.5	2.7	2.3
2.2	2.1	2.2	2.4	2.5	2.7	2.3

Average velocity 2.117 (m/s) 2.1 (m/s)
 Air qty 813.1 m3/hr
 Wt of air 975.7 kg/hr

COLD AIR DRY & WET BULB TEMP

WBT	12
DBT	11

ROOM AIR TEMP

DBT	24
WBT	18

ELECTRICAL POWER

V	I	PF	KW
230	8.17	0.979	1.84

Heat Extracted by AC per hr 4460.5 kcal/hr 1.475 TR
 Input KW 1.84
 Input KCl/hr 1582.09 Kcal /Hr

EER

2.819

Result : THIS AC IS NOT RUNNING EFFICIENTLY

Table 7.4

AC PARAMETERS - ROOM NO 202

DATE	15.11.2021
Room No	202
Make	Carrier
Rating	1.5 TR
Rared EER	3.17

DUCT SIZE (mm)	L	B
	970	110

VELOCITY		(m/s)				
3.2	3.7	3.8	2.9	3.8	3.5	3.6
3.1	3	3	3.2	3.1	3.1	2.9
2.9	2.9	2.6	2.5	2.5	2.5	2.5
2.4	2.3	2.2	2.8	3	3	3.9
2.8	2.7	2.7	1.8	2.2	2.8	3.1
3.1	2.9	2.8	2.8	2.4	2.8	3.1

Average velocity	2.902	(m/s)	2.9	(m/s)
Air qty			1114.9	m ³ /hr
Wt of air			1337.8	kg/hr

COLD AIR DRY & WET BULB TEMP

WBT	15
DBT	16

ROOM AIR TEMP

DBT	22
WBT	17

ELECTRICAL POWER

V	I	PF	KW
230	8.49	0.982	1.92

Heat Extracted by AC per hr	1821.1	kcal/hr	0.602	TR
Input KW	1.92			
Input KCl/hr	1649.09	Kcal /Hr		

EER**1.104****Result : THIS AC IS NOT RUNNING EFFICIENTLY**

Table 7.5 AC PARAMETERS - ROOM NO 309

DATE	15.11.2021
Room No	309
Make	Carrier
Rating	2 TR
Rared EER	2.91

DUCT SIZE (mm)	L	B
	970	110

VELOCITY (m/s)						
2.6	3.1	3.6	3.8	4	4.1	4
3.8	3.4	3.6	3.1	2.9	2.8	2.9
2.9	2.9	2	2.1	2.2	2.1	3.1
3.1	3.1	3.1	3	3	3.1	3.1
3.1	2.2	2.4	2.5	2.4	2.5	2.5
2.5	2.4	2.4	2.3	2.5	2.7	2.6

Average velocity 2.893 (m/s) 2.9 (m/s)
 Air qty 1111.2 m3/hr
 Wt of air 1333.4 kg/hr

COLD AIR DRY & WET BULB TEMP

WBT	13
DBT	14

ROOM AIR TEMP

DBT	23
WBT	17

ELECTRICAL POWER

V	I	PF	KW
230	8.52	0.988	1.94

Heat Extracted by AC per hr 3525.0 kcal/hr 1.166 TR
 Input KW 1.94
 Input KCl/hr 1665.03 Kcal /Hr

EER

2.117

Result : THIS AC IS not RUNNING EFFICIENTLY

Table 7.7 AC PARAMETERS - ROOM NO 406

DATE	15.11.2021
Room No	406
Make	Carrier
Rating	2 TR
Rared EER	2.91

DUCT SIZE (mm)	L	B
	840	110

VELOCITY (m/s)						
2.2	2.6	2.7	2.6	2.5	2.3	2.2
2.1	1.9	1.9	2	2	2	1.9
1.9	1.8	1.7	1.7	1.6	1.6	1.5
2.5	1.5	1.4	1.4	1.8	1.6	1.5
1.5	1.6	1.7	1.6	1.6	1.5	1.5
1.5	1.6	1.8	1.9	2	2.2	2.3

Average velocity 1.874 (m/s) 1.874 (m/s)
 Air qty 623.304 m3/hr
 Wt of air 747.965 kg/hr

COLD AIR DRY & WET BULB TEMP

WBT	16
DBT	18

ROOM AIR TEMP

DBT	25
WBT	21

ELECTRICAL POWER

V	I	PF	KW
230	8.06	0.978	1.81

Heat Extracted by AC per hr 2859.4 kcal/hr 0.946 TR
 Input KW 1.81
 Input KCl/hr 1559.19 Kcal /Hr

EER **1.834** **Result : THIS AC IS NOT RUNNING EFFICIENTLY**

7.7 Performance measurement data

SI No	Room No	Rating (TR)	Rated EER	Measured EER	Heat Extraction	Actual TR	Actual Input Power	Designed input power	Saving Potential (Rs)
1	112	2	3.02	2.819	4460.5	1.48	1.84	1.717	2328.9
2	202	1.5	3.17	1.104	1821.1	0.60	1.92	0.668	23788.0
3	309	2	2.91	2.117	3525	1.17	1.94	1.409	10097.8
4	406	2	2.91	1.834	2859.4	0.95	1.81	1.143	12681.1

7.3 Observation and Recommendations

- It has been observed that most of the ACs are kept at very low setting. This should be increased to at least 24 deg C to save power. It should be noted that 1 degree rise in evaporator temperature will give 3% saving in energy.
- The performance study of ACs reveals that most of the ACs have been deteriorated in terms of Efficiency. Power consumption is high. Modern Inverter compressor uses an external variable frequency drive - to control the speed of the compressor. The refrigerant flow rate is changed by the change in the speed of compressor and contribute saving of energy to a large extent.

CHAPTER # 8 LIGHTING

8.1 Lighting system

Different types of Lumanaire has been used in the Building . A list of Luminaries Installed has been furnished as annexure 2

Though in Some floors LED lights has been used , some rooms are having CFL Lamps .These CFL lamps can be replaced by LED lamps which will give substantial power saving .



Are LED lights brighter than or equal to Compact Fluorescent (CFL) bulbs? The trick is to understand the technology. In short, LED and CFL as technologies do not have a difference in brightness intrinsically. Brightness is determined by lumens. Lumens is best described as the measurement of light. A single CFL and LED bulb might have the same lumen (brightness) output but vary greatly in the amount energy needed to generate that level of brightness.

LED vs Fluorescent		
	LED	Fluorescent
Correlated Color Temperature	✓	✓
CRI	✓	
Cycling (Turning On/Off)	✓	
Dimming	✓	
Directionality	✓	
Efficiency	✓	
Efficiency Droop	✓	
Emissions	✓	
Ultraviolet	✓	
Failure Characteristics	✓	
Foot Candles	✓	
Heat Emissions	✓	
Lifespan	✓	
Lifetime Costs	✓	
Maintenance Costs	✓	
Upfront Costs		✓
Shock Resistance	✓	
Size	✓	
Cold Tolerance	✓	
Heat Tolerance	✓	
Warm Up Time	✓	
Warranty	✓	
Winter Weather Conditions	✓	

✓ = Winner

Nearly 32 kw of Light is still Fluorescent type which can be replaced by LED at around 60% Wattage . Hence total saving per day will be around 20 KW and annual saving will be Rs 1,09,000/- considering 180 days / yr , 5 hrs / day working and per unit cost of Rs 7.6 and 80% diversity factor

8.2 Measured data

Lux Level (With all lights on)

Table 8.1 Lux level measurement

Room No	Lux Measured	Average Lux	Recommended	Remarks
111	331, 253, 205, 207, 292, 289, 316, 346	280	250 Lux	Good
112	335,360,249,380,294,303,287,281,2846,303,311,312,	305	250 Lux	Good
409	225, 176, 160, 262, 265, 365, 215, 202, 221, 228, 250, 315	240	250 Lux	Needs Improvement
406	293, 157, 221, 236, 268, 330	250	250 Lux	Good
202	353, 337, 322, 311, 307	326	250 Lux	Good
209	362, 353, 245, 313, 242, 347, 351, 347, 346, 349, 352, 351, 351	331	250 Lux	Good
309	222, 243, 326, 225, 202, 218, 250, 204, 220	234	250 Lux	Needs Improvement
214	281, 375, 322, 275, 357, 283	315	250 Lux	Good
301	256, 307, 279, 207, 372, 269, 318, 315, 355, 329, 339, 119, 216	283	250 Lux	Good

Sample saving calculation

Room No : 111

Room Size ; 22' x 11 ' = 242 sqft or 22.48 m²

Room Lumen actual : 280 * 22.48 m² =6294 Lumen

Recommended Lumen : 250 x 22.48 m² = 5620 Lumen

Wattage of Light : 72 x 5 sets = 360 watt

Lumen / Watt = 17.48

LED bulb has luminous efficacy of 40 Lumen / watt and as per ECBC Building code recommended Lighting load should be 0.9 – 1.1 watt / sqft. So wattage requirement for 242 sqft is 266 watt .

Present wattage maintained is high (360 watt)

By Changing LED , we will have 5620/40 ie 140 watt

Saving in Room no 111 (360-140) 220 wa or .22 Kw

Annual saving (180 days / yr and 10 hrs/day) = 396 kw or Rs 3009

8.3 Observation and recommendations

8.3.1 Observations

- Lux maintained at various places are good
- Incorporating renewable energy for lighting has been taken up..
- In many places room lumen maintained is more than that recommended . This may be reduced suitably to reduce energy consumption
- Around 275 luminaires are CFL which needs to be changed to LED to save further energy..

ANNEXURES



CESC House, Chowringhee Square, Kolkata 700 001

Sub: Tariff and Associated Terms and Conditions vide Order dated July 4, 2018 of the Hon'ble West Bengal Electricity Regulatory Co

As per aforesaid Order of the Hon'ble Commission, the applicable tariff and related conditions for all categories of consumers of CESC Limited for the year 2017-18 are given below.

LOW AND MEDIUM VOLTAGE CONSUMERS																	
Sl No.	Type of Consumer	Applicable Tariff Scheme					Optional Tariff Scheme										
		Consumer category	Name of the Tariff Scheme	Monthly consumption in KWH	Energy Charge P/kWh	Fixed Charge/Demand Charge* in Rs./KVA/Mon	Optional Tariff Scheme – I				Optional Tariff Scheme – II						
							Consumer category	Name of the Tariff Scheme	Monthly consumption in KWH	Energy Charge P/kWh	Fixed Charge/Demand Charge* in Rs./KVA/Mon	Consumer category	Name of the Tariff Scheme	Monthly consumption in KWH	Energy Charge P/kWh	Fixed Charge/Demand Charge* in Rs./KVA/Mon	
1.	Life Line Consumer (Domestic)	Rate G (LL)	Normal	0 to 25	378	5.00	Not Applicable				Not Applicable						
2.	Domestic (Urban)	Rate G	Normal	First	25	489	15	Rate G (p)	Prepaid	All Units	722	15	Not Applicable				
				Next	40	641											
				Next	50	716											
				Next	50	733											
				Next	100	733											
				Above	300	892											
3.	Commercial (Urban)	Rate M (i)	Normal	First	60	628	24	Rate M (i) (TOD)	Normal TOD	06:00 hrs to 17:00 hrs	760	24	Rate M (i) (pTOD)	Prepaid - TOD	06:00 hrs to 17:00 hrs		
				Next	40	695				17:00 hrs to 23:00 hrs	836				17:00 hrs to 23:00 hrs		
				Next	50	764				23:00 hrs to 06:00 hrs	707				23:00 hrs to 06:00 hrs		
				Next	150	820											
				Above	300	897											
4.	Short-term Supply	Rate STLT	Prepaid - TOD	06:00 hrs to 17:00 hrs	724	28	Not Applicable				Not Applicable						
				17:00 hrs to 23:00 hrs	796												
				23:00 hrs to 06:00 hrs	673												
5.	Specified Institution Municipal or Non-Municipal	Rate P	Normal	On all Units	634	28	Rate P(p)	Prepaid	On all Units	617	28	Rate P (pTOD)	Prepaid - TOD	06:00 hrs to 17:00 hrs & 20:00 hrs to 23:00 hrs	All Units		
														17:00 hrs to 20:00 hrs	All Units		
														23:00 hrs to 06:00 hrs	All Units		
6.	Government School, Government aided School or Government Sponsored School	P1	Normal	On all Units	495	12	P1 (TOD)	Normal (TOD)	06:00 hrs to 17:00 hrs & 20:00 hrs to 23:00 hrs	All Units	488	12	Not Applicable				
									17:00 hrs to 20:00 hrs	All Units	537						
									23:00 hrs to 06:00 hrs	All Units	473						
7.	Public Bodies Municipal or Non-Municipal	Rate C1	Normal	On all Units	693	42	Rate C1(p)	Prepaid	On all Units	658	42	Rate C1(pTOD)	Prepaid - TOD	06:00 hrs to 17:00 hrs & 20:00 hrs to 23:00 hrs	All Units		
														17:00 hrs to 20:00 hrs	All Units		
														23:00 hrs to 06:00 hrs	All Units		
8.	Cottage Industry/ Artisan / Weavers / Small production oriented establishment not run by electricity as motive power	Rate M (ii)	Normal	First	100	553	24	Rate M (ii) (pTOD)	Prepaid - TOD	06:00 hrs to 17:00 hrs	All Units	619	24	Not Applicable			
				Next	100	672				17:00 hrs to 23:00 hrs	All Units	681					
				Above	200	817				23:00 hrs to 06:00 hrs	All Units	576					