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# ENERGY AUDIT REPORT

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## **Lalit Chandra Bharali College**

Address- Maligaon, Guwahati- 781011

August -2021

Prepared by

### **Thunderbolt Energy Consultancy**

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## TO WHOM IT MAY CONCERN

This is to certify that **Thunderbolt Energy Consultancy** has conducted the Energy Audit of Lalit Chandra Bharali College, Maligaon Guwahati Assam for estimating the Annual LED power requirement and it is estimated that the annual LED power requirement is 11,550 kWh /Yr (Through Existing LED is 6,150 kWh/yr and Proposed LED Instead of CFL and Tube light is 5,400 kWh/yr) as per given data and Information by college.

Date – 27-August-2021

A handwritten signature in black ink, appearing to read 'K G Bhatwadekar', is written over a rectangular stamp.

Mr. K G Bhatwadekar

Certified Energy Auditor (EA- 22428)

(Bureau of Energy Efficiency, Govt. of India)



# LALIT CHANDRA BHARALI COLLEGE GUWAHATI ENERGY AUDIT



## Thunderbolt Energy Consultancy

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Cell + 91- 90 98 58 0420

### Certificate of Energy Audit

This is to certify that **Lalit Chandra Bharali College** Guwahati Assam has conducted **Energy Audit** in Aug-21 for knowing present electrical energy consumption, Identification of energy conservation and saving opportunities for Implementation to greenhouse gas emission for environmental protection.

This energy Audit is also aimed to assess impact of Installed renewable energy applications.

Date – 27-Aug-21

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### About Thunderbolt Energy Consultancy

We are pleased to introduce ourselves as Thunderbolt Energy Consultancy. We are a team of young Energy professionals, working to help Businesses and facilities become energy efficient and promote green and clean energy.

We are providing services in various areas like

- Energy Audit, Electrical Audit, Electrical Survey
- Safety Audit, Fire Audit, Electrical safety audit, Safety survey
- Street Light Energy Audit, SL Survey, SL Sales & Installation
- Electrical Repair & Maintenance Services

We have a highly trained and experienced team of certified Energy and Safety Auditors, Energy Manager, Analyst, Engineers & Retailers. We are presently working in pan India.





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## Disclaimer

This report was prepared for Lalit Chandra Bharali College, Guwahati. The information herein is confidential and shall not be divulged to a third party without the prior written permission of Thunderbolt Energy Consultancy, its affiliates and subsidiaries, including Thunderbolt Energy Consultancy, and their respective officers, employees or agents, individually and collectively, referred to in this clause as 'Thunderbolt Energy Consultancy'.

Thunderbolt Energy Consultancy, assumes no responsibility and shall not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided, unless that person has signed a contract with the relevant Thunderbolt Energy Consultancy, entity for the provision of this information or advice and in that case any responsibility or liability is exclusively on the terms and conditions set out in that contract.

All the calculations for energy savings and recommendations to achieve these savings given in this report is fully based on the data shared by the college with Thunderbolt Energy Consultancy.



## Acknowledgement

We express our sincere gratitude to the authorities of Lalit Chandra Bharali College, Guwahati for entrusting and offering the opportunity of energy performance assessment assignment.

- Mr. Adison Ali - Principal

We are thankful to Lalit Chandra Bharali College Guwahati for their positive support in undertaking the task of system mapping and energy efficiency assessment of all electrical system, air conditioners, utilities and other equipment. The field studies would not have been completed on time without their interaction and guidance. We are grateful to their cooperation during field studies and providing necessary data for the study.

We are also thankful to all field staff and agencies working with whom we interacted during the field studies for their wholehearted support in undertaking measurements and eagerness to assess the system / equipment performance and saving potential. Also thankful to all concerned staff interacted during the conduct of this exercise for completing official documentations.



## Why Energy Audit?

An energy audit determines the amount of energy consumption affiliated with a building and the potential savings associated with that energy consumption. Additionally, an energy audit is designed to understand the specific conditions that are impacting the performance and comfort in your facility to maximize the overall impact of energy-focused building improvements.

An energy audit is a systematic review of the energy consuming installations in a building or premises to ensure that energy is being used sensibly and efficiently. An energy audit usually commences with the collection and analysis of all information that may affect the energy consumption of the building or premises, then follows with reviewing and analyzing the condition and performance of various building services installations and building management, with an aim at identifying areas of inefficiency and suggesting means for improvement.

Through implementation of the suggested improvement measures, building owners can get the immediate benefit for paying less for energy bills. On the other hand, lowering of energy consumption in buildings will lead to the chain effect that less fossil fuel will be burnt for electricity generation by the power supply companies and relatively less pollutants and greenhouse gases will be introduced into the atmosphere, thus contributing to conserve the environment and to enhance sustainable development.



## Energy Audit Team

The team members of Thunderbolt Energy Consultancy:

Name	Role	Field of expertise
Mr. Mahesh Khode	Project coordinator, ECM verification, Report verification	Graduate Electrical engineer with 7 years of experience in Energy Efficiency Assessment, Electrical distribution system, Design, Power assets Evaluation and Project Management, resource management.
Mr. Kaustubh Bhatwadekar	Energy Auditor	Graduate Mechanical engineer, M.Tech IIT Bombay, Bureau of Energy Efficiency Certified Energy Auditor, Experience In Industrial energy, distribution system, Energy Efficiency Assessment.
Mr. Prashant Yadav	Data tabulation and analysis & report preparation	Graduate in Electrical & Electronics Engineering with 5 years of experience in Energy & Power projects.



## Executive Summary

After the Field measurements & analysis, we present herewith important observations made and various measures to reduce the Energy Consumption & mitigate the CO<sub>2</sub> emissions.

Lalit Chandra Bharali College, Guwahati, consumes Energy in the form of Electrical Energy used for various gadgets, Office & other facilities.

### 1. Present Energy Consumption

In the following Table, we present the details of Energy Consumption.

**Table 1 Details of energy consumption**

Sr no	Parameter	Energy consumed, (Units)	Maximum Demand, kVA	Bill Amount (Rs)
1	Maximum	3725	17.04	41081
2	Minimum	2074	5.88	26419
3	Average	2765	11	33010

### 2. Energy Conservation Projects already installed

1. Usage of STAR Rated ACs at new installations.
2. Usage of LED lights at some indoor locations.
3. Usage of LED Lights for outdoor lighting.
4. Solar Rooftop system Installed.

### 3. Key Observations

1. There are about 111 Nos old T-8 type fittings which need to be replaced by 18 W LEDs.
2. There are 09 Nos, 1.5 TR Old ACs which need to be replaced with STAR Rated ACs.
3. There are 399 Nos of ceiling fans which need to be replaced with STAR rated fans.
4. Optimize the temperature setting to 23-25 degree Celsius.



5. As per meter reading R phase to neutral voltage shows 188 V which is below the standard operating voltage of 230 V.

#### 4. Recommendations

**Table 2 Recommendations for energy savings**

Sr. No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 111 Nos T-8 fittings with 18 W LED fittings	1,832	13,187	71,151	65
2	Replacement of 399 Nos Old Ceiling Fans with STAR rating fans	5,985	43,092	8,67,426	242
3	Replacement of 10 Nos Old 1.5 TR ACs with STAR rating ACs	7,500	54,000	5,28,750	118
4	To reduce billed contract demand from 63.53 kVA to 20 kVA	NA	9,4024	0	NA
	<b>Total</b>	<b>15,317</b>	<b>2,04,303</b>	<b>14,67,327</b>	<b>-</b>

#### 5. Notes & Assumptions

1. Daily working hours-03
2. Annual working days- 250
3. Rate of Electrical Energy- Rs 7.2 /- per kWh



## Abbreviations

CFL	:	Compact Fluorescent Lamp
FTL	:	Fluorescent Tube Light
LED	:	Light Emitting Diode
V	:	Voltage
I	:	Current
kW	:	Kilo- Watt
kWh	:	kilo-Watt Hour
kVA	:	Active Power



## 1. Introduction

Lalit Chandra Bharali College, established in 1971, is a general degree undergraduate, coeducational college situated at Maligaon in Guwahati, Assam. This college is affiliated with the Gauhati University

The establishment of the college was driven by a holistic approach towards higher education to the marginal student community who could not access the central/city colleges for various reasons. It was also an educational outreach for the students who lived beyond the city limits and the entire Northeast.

The energy audit of college is conducted by our company.

### 1.1 Objectives

1. To study present level of Energy Consumption
2. To Study Electrical Consumption
3. To assess the various equipment/facilities from Energy efficiency aspect
4. To study various measures to reduce the Energy Consumption

### 1.2 Audit methodology

The objective of Energy Audit is to balance the total energy inputs with its use and to identify the energy conservation opportunities in the stream. Energy Audit also gives focused attention to energy cost and cost involved in achieving higher performance with technical and financial analysis. The best alternative is selected on financial analysis basis. Energy Audit Study is divided into following four steps

### 1.3 Historical Data Analysis

The historical data analysis involves establishment of energy consumption pattern to establish base line data on energy consumption and its variation with change in production volumes.

### 1.4 Actual measurement and data analysis

This step involves actual site measurement and field trials using various portable measurement instruments. It also involves input to output analysis to establish actual operating equipment efficiency and finding out losses in the system.



### 1.5 Identification and evaluation of Energy Conservation Opportunities

This step involves evaluation of energy conservation opportunities identified during the energy audit. It gives potential of energy saving and investment required to implement the proposed modifications with payback period. All recommendations for reducing losses in the system are backed with its cost benefit analysis.

### 1.6 Monitoring and Control

Energy accounting followed by energy monitoring and controlling is the first step of an Energy Management Program. With increasing energy prices, many organizations have incorporated sub-metering system in their plants. Sub metering is essential for monitoring, establishing energy consumption pattern, detailed engineering and energy saving after implementation of energy conservation projects. It is required to identify and monitor parameters for energy consumption per unit of production or services i.e., Specific Energy Consumption (SEC). SEC monitoring is an important tool for monitoring and proving of energy conservation measures.

### 1.7 Instruments used for conducting Energy Audit

The following instruments were used during the study for measurements.

**Table 3 Instruments used for measurements**

No.	Name of instrument	Purpose
1	Three phase power quality analyzer	Logging of data for study of variation in electrical parameters and power quality
2	Single phase power analyzer	Instantaneous measurements for power consumption
3	Anemometer	Measurement of air velocities
4	Sling Psychrometer	Measurement of Dry Bulb Temperature (DBT) and Wet Bulb Temperature (WBT)
5	Contact type temperature indicators	Bulk temperature measurements of gasses, liquids by direct contact
6	Non-contact type – IR temperature gun	Measurements of surface temperatures without contact
7	Digital thermometers	Accurate measurements of temperatures by direct contact
8	Lux meter	Measurement of light intensity



### 1.8 About Thunderbolt Energy Consultancy

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## 2. Energy Details

### Energy Details

The electricity supply for LCB College is provided by Assam Power Distribution Company Limited. The energy consumed by LCB College falls under HT bulk Category. The facility also has 1 DG sets of 63 KVA. The DG set is mainly used for power failure from APDCL.

Sr. No	DG details	Name of the building
1	63 KVA	College Building

The energy efficiency assessment was conducted for the load connected to the mains supply.

Consumer details:

Name of Consumer	Tariff Category	Consumer Account No.
Principal Lalit Bharali College	HT Bulk supply	025000000270

Mainly energy is used on this facility for the following purposes:

- 1) Lighting's load
- 2) Air conditioners
- 3) Fan
- 4) Water pump



### 3. Study of connected load

In this chapter, we present details of various connected electrical equipment and electrical load.

**Table 4 Location wise study of Electrical fittings in various buildings**

Sr. No	Location	LED (20W)	Box type LED (12W)	Bracket type LED (9W)	FTL (40W)	Ceiling Fan	1.5TR Star rated AC	1.5TR old Acs
1	<b>Block A</b>							
	Ground Floor	18	2	1		13	2	
	First Floor	53	32			40		
	Second Floor	28	12			34		
2	<b>Block B</b>							
	Ground Floor	22	2	6		19		2
	First Floor	22	2			19		
	Second Floor	22	2			19		
	Third Floor	22	2			19		
	Fourth Floor	22	2			19		
3	<b>Block C</b>							
	Ground Floor	10	17	10		12		2
	First Floor	10		10		11		
	Second Floor	10		10		11		
	Library building		28			28		3
4	<b>Girls Hostel</b>							
	Hostel Canteen				7	9		
	corridor	8			15	4		
	Ground Floor rooms				4	13		
	First floor	24			32	47		2



Sr. No	Location	LED (20W)	Box type LED (12W)	Bracket type LED (9W)	FTL (40W)	Ceiling Fan	1.5TR Star rated AC	1.5TR old Acs
	rooms							
	Second Floor rooms	49			14	51		
	Third floor rooms				21	15		
	Fourth floor rooms	2			18	16		
5	Canteen	15						
	<b>Total</b>	<b>337</b>	<b>101</b>	<b>37</b>	<b>111</b>	<b>399</b>	<b>2</b>	<b>9</b>

Table 5 Lighting load consumption details

Particulars	Quantity	Energy In kW
LED (20W)	337	6.7
Box type LED (12W)	101	1.2
Bracket type LED (9W)	37	0.3
FTL (40W)	111	7.2
<b>Total</b>	<b>586</b>	<b>15.4</b>

Table 6 Lighting load percentage in total consumption

Particulars		Total Lighting requirement	Lighting met Through LED Bulb	Lighting met through other type lamp
(A)	Load in kW	15.4	8.2	7.2
	Percentage	100	53	47
(B)	Energy in kWh per year	11,550	6,150	5,400
	Percentage	100	53	47

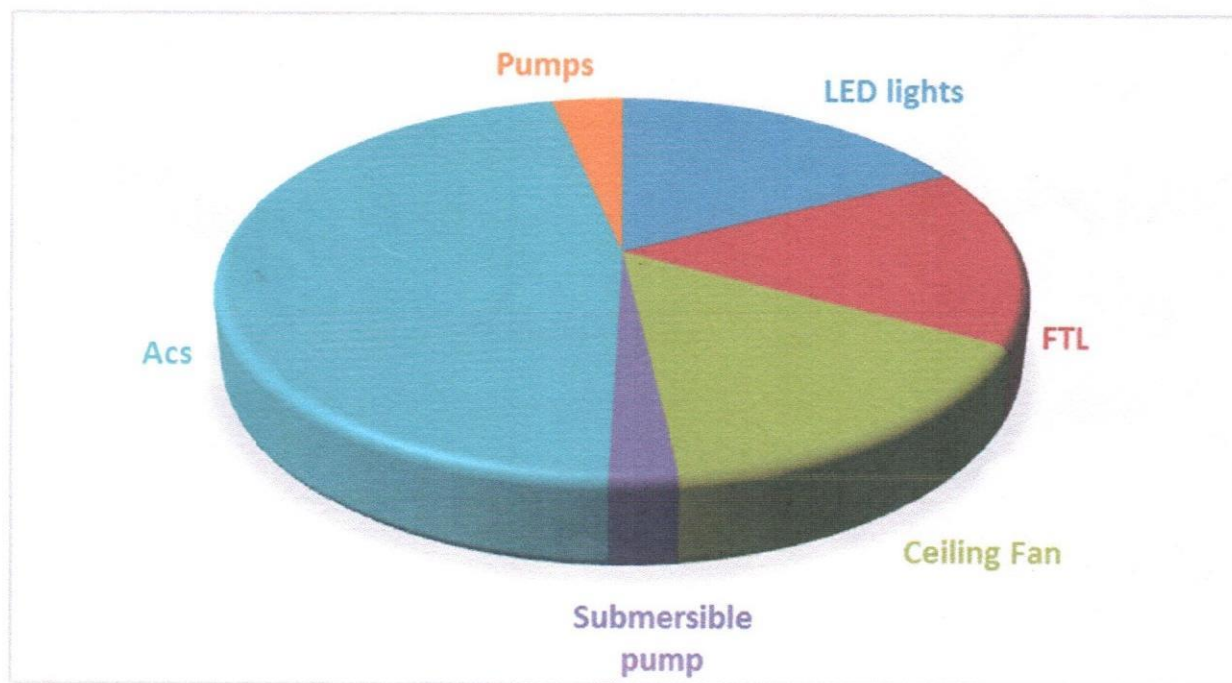
Note- Above calculation is based on 3 hours working and 250 days per annum.

Apart from above load, the college has pumps, street lights. Individual fitting wise load is as under

**Table 7 Equipment wise Connected Load**

No	Equipment	Qty	Load, W/Unit	Load, kW
1	LED (20W)	337	20	6.7
2	Box type LED (12W)	101	12	1.2
3	Bracket type LED (9W)	37	9	0.3
4	FTL (40W)	111	65	7.2
5	Ceiling Fan	399	18	7.2
6	Submersible pump (2HP)	1	1550	1.6
7	Star rated AC (1.5Tr)	2	1150	2.3
8	Old AC (1.5Tr)	9	2150	19.4
<b>Total</b>				<b>45.9</b>

Data can be represented in terms of PIE chart as under,



**Figure 1 Distribution of connected load.**



## 4. Study of Electrical Energy Consumption

In this chapter, electricity bills are studied for the analysis of electrical energy consumption.

**Table 8 Summary of electricity bills**

Sr. No	Month	Energy (kWh)	M D (kVA)	Bill Amount (Rs)
1	Jul-21	2490	7.98	31597
2	Jun-21	2290	8.28	29662
3	May-21	2074	5.88	28525
4	Apr-21	2973	13.68	35025
5	Mar-21	3725	17.04	41081
6	Feb-21	2835	11.76	26419
7	Jan-21	2569	10.38	32615
8	Dec-20	2401	7.74	30856
9	Nov-20	2542	14.16	31546
10	Oct-20	3405	13.98	38582
11	Sep-20	3213	11.94	37057
12	Aug-20	2665	10.92	33159
	<b>Total</b>	<b>33182</b>	<b>-</b>	<b>396124</b>



Variation in energy consumption is as follows,

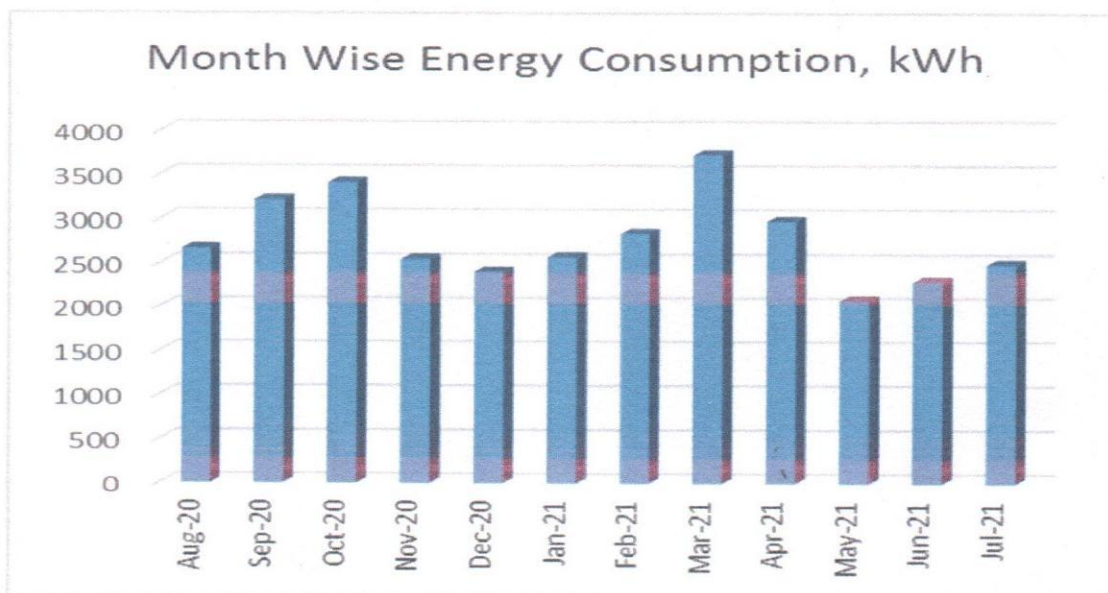


Figure 2 Month wise energy consumption

Monthly variation in electricity bill is as follows,

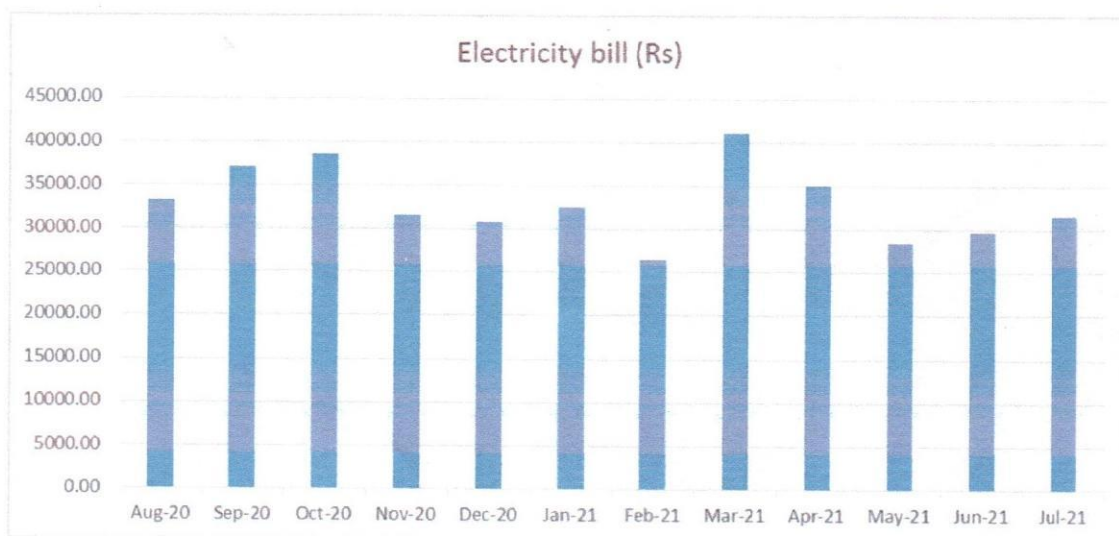


Figure 3 Month wise electricity bill



Key observations of electricity bill are as follows,

**Table 9 Key observations**

Sr no	Parameter	Energy consumed, (Units)	Maximum Demand, (kVA)
1	Maximum	3725	17.04
2	Minimum	2074	5.88
3	Average	2765	11



## 5. Carbon Footprint

1. **A Carbon Foot print** is defined as the Total Greenhouse Gas emissions (CO<sub>2</sub> emissions), emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various form of Electrical Energy used by the College for performing its day-to-day activities
2. **Basis for computation of CO<sub>2</sub> Emissions:**

The basis of Calculation for CO<sub>2</sub> emissions due to Electrical Energy is as under

1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO<sub>2</sub>** into atmosphere.

Based on the above Data we compute the CO<sub>2</sub> emissions which are being released in to the atmosphere by the College due to its Day-to-Day operations.

We herewith furnish the details of various forms of Energy consumption as under

**Table 10 Month wise Consumption of Electrical Energy & CO<sub>2</sub> Emissions**

No	Month	Energy Consumed, kWh	CO <sub>2</sub> Emissions, MT
1	Jul-21	2490	1.99
2	Jun-21	2290	1.83
3	May-21	2074	1.66
4	Apr-21	2973	2.38
5	Mar-21	3725	2.98
6	Feb-21	2835	2.27
7	Jan-21	2569	2.06
8	Dec-20	2401	1.92
9	Nov-20	2542	2.03
10	Oct-20	3405	2.72
11	Sep-20	3213	2.57
12	Aug-20	2665	2.13
	<b>Total</b>	<b>33182</b>	<b>26.55</b>



In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

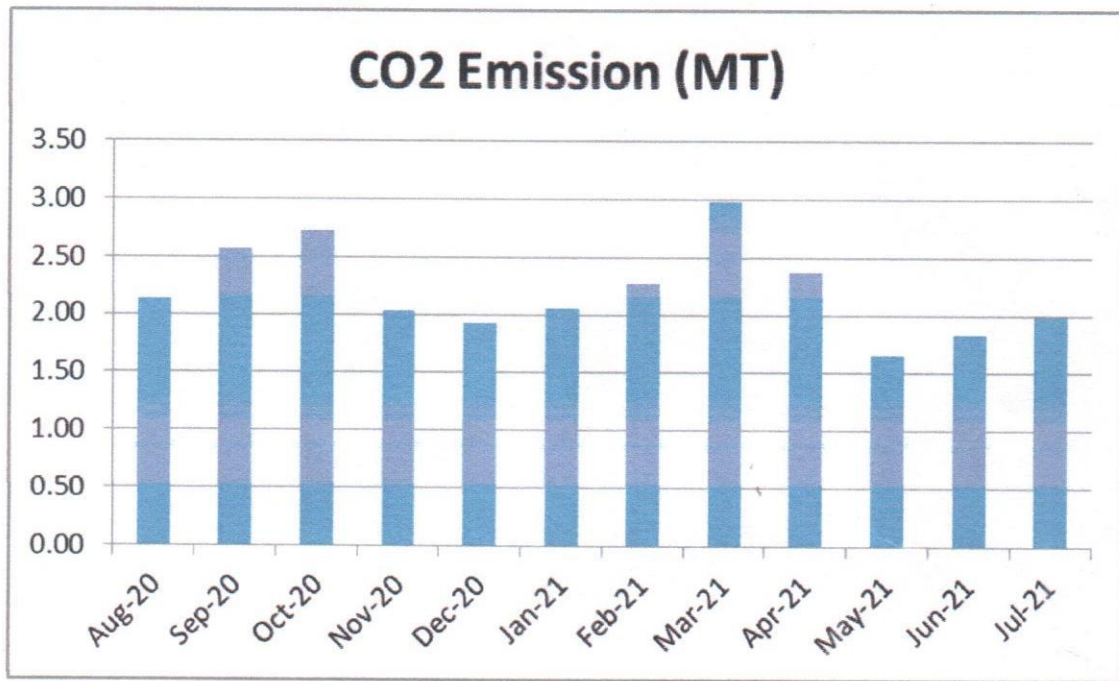


Figure 4 Representation of Month wise CO2 emissions



## 6. Study of utilities

### 6.1 Study of Lighting

In the facility, the lighting system can be divided mainly in two parts, indoor lighting and outdoor lighting. There are 111 FTL fittings with electronic/ magnetic chokes and 337 LEDs in lightings. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. Apart from this, there are 101 no of 12W box type LEDs and 37 no of 9W bracket type LEDs.

### 6.2 Air-conditioners

In the facility, there are about 10 Nos. of 1.5 Tr old Air-conditioners. It is recommended to replace these Old ACs with BEE STAR Rated ACs. There is 2 star rated new AC of 1.5Tr capacity.

### 6.3 Ceiling Fans

At building facility, there are about 399 Nos Old Ceiling Fans, which consumed about 65 W of Electrical Energy. It is recommended to replace these old Fans with BEE STAR Rated Ceiling Fans.

### 6.4 Water Pumps

There are 2 water pumps. It is submersible pump with 2 HP capacity.



## 7. Energy conservation proposals

### 7.1 Replacement of 111 Nos Old, T-8 FTLs with 20 W LED fittings

In the facility, there are about 111 Nos, T-8, FTL fittings with electronic/magnetic chokes. It is recommended to install the 18 W LED Tube light fittings in place of these old T-8 fittings. In the following Table, we present the savings, investment required & payback analysis.

**Table 11 Tube light calculation**

Sr. No	Particulars	Value	Unit
1	Present Qty of T-8 fittings	111	Nos
2	Energy Demand of T-8 fitting	40	W/Unit
3	Energy Demand of 18 W LED fitting	18	W/Unit
4	Reduction in demand	22	W/Unit
5	Average Daily Usage period	3	Hrs /Day
6	Daily saving in Energy	7	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving potential	1832	kWh/Annum
9	Rate of Electrical Energy	7	Rs/kWh
10	Annual Monetary saving	13187	Rs/Annum
11	Cost of 18 W LED Tube	641	Rs/Unit
12	Investment required	71151	Rs lump sum
13	Simple Payback period	65	Months



## 7.2 Replacement of 399 Nos Old Ceiling Fans with STAR Rated Ceiling Fans

During the Audit, it was observed that there are 399 Nos, old ceiling fans. It is recommended to replace these old fans with 5 STAR Rated Fans.

In the following Table, we present the savings, investment required & payback analysis.

**Table 12 Fan calculation**

Sr. No	Particulars	Value	Unit
1	Present Qty of Old Ceiling Fan fittings	399	Nos
2	Energy Demand of Old Ceiling Fan fitting	65	W/Unit
3	Energy Demand of STAR Rated Fan	45	W/Unit
4	Reduction in demand	20	W/Unit
5	Average Daily Usage period	3	Hrs/Day
6	Daily saving in Energy	24	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving potential	5985	kWh/Annum
9	Rate of Electrical Energy	7	Rs/kWh
10	Annual Monetary saving	43092	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	867426	Rs lump sum
13	Simple Payback period	242	Months



### 7.3 Replacement of 02 Nos 1.5 TR Old ACs with STAR Rated ACs

During the Audit, it was observed that there are 10 Nos, of 1.5 TR old ACs. It is recommended to replace these old ACs with STAR Rated ACs.

In the following Table, we present the savings, investment required & payback analysis.

**Table 13 Air conditioner calculation**

Sr. No	Particulars	Value	Unit
1	Present Qty of 1.5 TR Old ACs	10	Nos
2	Energy Demand of Old 1.5 TR AC	2.15	kW/Unit
3	Energy Demand of New AC	1.15	kW/Unit
4	Reduction in demand	1	kW/Unit
5	Average Daily Usage period	3	Hrs /Day
6	Daily saving in Energy	30	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving potential	7500	kWh/Annum
9	Rate of Electrical Energy	7.2	Rs/kWh
10	Annual Monetary saving	54000	Rs/Annum
11	Cost of STAR Rated 1.5 TR AC	52875	Rs/unit
12	Investment required	528750	Rs lump sum
13	Simple Payback period	118	Months



#### 7.4 Reduce billed contract demand from 63.5 kVA to 20 kVA

During analysis of last bills, it found out that highest maximum demand of month in last year is 17.4 kVA. Electricity bill can be reduced by reducing contract demand from 63.5 kVA to 20 kVA. In the following Table, we present the saving calculations.

**Table 14 Reduce demand calculation**

No	Particulars	Value	Unit
1	Current contract billed demand	63.5	kVA
2	Current highest maximum demand	17.4	kVA
3	Recommended contract billed demand	20	kVA
4	Reduction in billed demand	43.5	kVA
5	Per unit charges for billed demand	180	Rs/kW/ month
6	Monthly Monetary savings	7835.4	Rs/month
7	Annual monetary savings	94024.8	Rs/year



## 8. Summary of Savings

**Table 15 Summary of savings**

Sr. No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 111 Nos T-8 fittings with 18 W LED fittings	1,832	13,187	71,151	65
2	Replacement of 399 Nos Old Ceiling Fans with STAR rating fans	5,985	43,092	8,67,426	242
3	Replacement of 10 Nos Old 1.5 TR ACs with STAR rating ACs	7,500	54,000	5,28,750	118
4	To reduce billed contract demand from 63.53 kVA to 20 kVA	NA	9,4024	0	NA
	<b>Total</b>	<b>15,317</b>	<b>2,04,303</b>	<b>14,67,327</b>	<b>-</b>



## 9. Site Photograph

