Energy Audit Report

of

Bharati Vidyapeeth's

College of Engineering

Lavale, Pune

Auditing Agency –
Prathamesh Energy Solution,
A-302, Shiv Unnati Residency,
Kalepadal, Hadapsar
Pune- 411 028

Prathamesh Energy Solution
A-302, Shiv Unnati residency, Kalepadal, Hadapsar, Pune-411028

Ref: PES/BVCOEL/2023-24/52

Date: 07/02/2024

To,

The Principal
Bharati Vidyapeeth's
College of Engineering,
Lavale, Pune

Sub: Submission of Report on Energy Audit of College Campus

Respected Sir,

Please find enclosed herewith the report

Thanking you
Yours faithfully

For Prathamesh Energy Solution

Vandana

Authorized Signatory

Prathamesh Energy Solution

A-302, Shiv Unnati Residency, Kalepadal, Hadapsar, Pune 411028

Ref: EC/BVCoEL/23-24/53

CERTIFICATE

This is to certify that we have conducted Energy Audit at **Bharati Vidyapeeth's College of Engineering, Lavale, Pune**, in the Academic year 2023-24

.The College has adopted following Energy Efficient and best practices:

- Usage of Energy Efficient LED Fittings
- Maximum usage of Day Lighting
- Installed APFC of 270KVAr
- Green Campus
- Rain water Harvesting system

We appreciate the support of Management, involvement of faculty members and students in the process of making the Campus Energy Efficient.

For,

Vandana

Prathamesh Energy Solution, Pune

M/s. Prathamesh Energy Solution Pune

Certificate of Registration

This is to Certify that
Quality Management System of

PRATHAMESH ENERGY SOLUTION

A-302, SHIV UNNATI RESIDENCY, KALEPADAL, HADAPSAR, PUNE-411028,
MAHARASHTRA, INDIA.

has been assessed and found to conform to the requirements of

ISO 9001:2015

for the following scope :

CONSULTANCY SERVICES FOR ENERGY AUDIT, GREEN AUDIT AND ENVIRONMENTAL AUDIT IN EDUCATIONAL INSTITUTIONS AND OTHER ORGANIZATIONS & SUBMISSION OF AUDIT CERTIFICATE AND REPORT.

Certificate No	: **23EQMD10**		
Initial Registration Date	: 19/06/2023	Issuance Date	: 19/06/2023
Date of Expiry	: 18/06/2026		
1st Surve. Due	: 19/05/2024	2nd Surve. Due	: 19/05/2025

EGAC Accredited
QMS Certification
CAB # 118005

Director

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ACKNOWLEDGEMENT

We at Prathamesh Energy Solution, Pune, express our sincere gratitude to the management and Principal of Bharati Vidyapeeth's College of Engineering, Lavale, Pune for awarding us the assignment of Energy Audit of their College campus located at Lavale, Pune.

We are very much thankful to

- Dr. Vishwajeet Kadam, Secretary Bharati Vidyapeeth, Pune
- Dr. Shivajirao Kadam, Chancellor, Bharati Vidyapeeth Deemed to be University.
- Dr. K D Jadhav, Jt. Secretary (Admin), bharati Vidyapeeth, Pune
- Dr. R N Patil, Principal, Bharati Vidyapeeth's College of Engineering, Lavale, Pune

for giving us opportunity to conduct detailed energy audit of the institute and provide all the required data and information promptly for the smooth conduction of detailed energy and green audit.

We are also thankful to various Heads of Departments, IQAC Coordinator & other Staff members for helping us during the survey and field visit.

We are also thankful to all the technical staff and office staff for helping during the field visit and measurements at the college campus.

EXECUTIVE SUMMARY

After the Field measurements & analysis, we present herewith important observations made and various measures to reduce the Energy Consumption & mitigate the CO_2 emissions

1. Bharati Vidyapeeth's College of Engineering, Lavale, Pune, consumes electrical Energy in majority used for various gadgets & office operations.

2. The various projects already implemented by the College are

- Installed APFC of 270 kVAR at Main electrical distribution to maintain Power factor.
- Usage of natural day lights and natural air circulation
- Usage of Natural Day light in corridors specifically
- Usage of LED lighting for Admin & outdoor lighting
- Initiatives for water conservation through STP at the campus

3. Important Parameters: Electrical Energy:

Electricity is used for different purposes and at different sections in the college campus. The details of electricity distribution as mentioned below.

Sr. No.	Consumer No.	Electrical Meter No.	Location/Purpose	Payee
1	182829055190	076-05040425	College building/building operation	M/S. Joint Secretary Bharati Vidyapeeth College of Engineering, Lavale

The important parameters of electrical consumption as per Consumer no. in the campus are mentioned as below.

Sr. No	Consumer No.	Parameter	Max	Min	Average
1	182829055190	Units consumed, kVAh	26246	14403	18447.33
		Electricity Bill amount	516876	347361	406580.3
		Total			425027.63

4. Important Parameters: CO_2 Emissions (Average, MT/Annum)

No	Consumer No.	Particulars	Value MT
1	182829055190	CO_2- Emissions- Electricity Usage	177.09
		Total	177.09

On the basis of average electricity consumption CO_2 emission is 177.09 MT /annum. In addition to this LPG is being consumed for canteen for food preparation. Nearly LPG consumption annually is 12 commercial cylinders i.e. 228 kg/annum. On the basis of average LPG usage CO_2 emission is 0.68MT/annum.

5. Benchmark: In terms of Electrical Energy & CO_2 emissions:

We now present two important benchmarks in respect of Electrical Energy consumption & CO_2 emissions as under.

No	Particulars	Value	Unit
1	Electrical Energy consumed	**2.44**	kWh/sq. ft.
3	CO_2- Emissions	**1.01**	Kg per annum /sq. ft.

6. Recommendations:

We present herewith various proposals to reduce the Electrical Energy demand and reduce the CO_2 emissions

S. No.	Recommendation	Annual saving potential in kWh /Kg of LPG	Annual Saving Potential in MT of CO_2	Annual monetary gain, Rs.
1	Installation of 50kW Solar PV roof top on college building	84000 kWh	67.2	840000
2	Solar street lights	262.8 kWh	0.21	2628
3	Solar powered light for hoarding	-	-	-
4	Solar charging stations	-	-	-
	Total	**84262.8**	**67.41**	**842628**

Notes & assumptions:

1. 1 Unit of Electrical Energy releases 0.8 Kg of CO_2 into atmosphere
2. 1 Kg of LPG releases 3 Kg of CO_2 into atmosphere
3. Daily working hours-10
4. Annual working Days-280
5. Average Rate of Electrical Energy- Rs 10 per kWh

ABBREVIATIONS

DP	:	Double Pole
CFL	:	Compact Fluorescent Lamp
EESL	:	Energy Efficiency Services Limited
F P	:	Feeder Pillar
MSEDCL	:	Maharashtra State Electricity Distribution Company Ltd.
MEDA	:	Maharashtra Energy Development Agency
MIDC	:	Maharashtra Industrial Development Corporation
V	:	Voltage
I	:	Current
kW	:	kilo-Watt
kVA	:	Apparent Power
kVAr	:	Reactive Power
P F	:	Power Factor
kWp	:	Kilo Watt peak

CHAPTER-I
ENERGY AUDIT: INTRODUCTION

1.1 Objectives:

1. To study present level of Energy Consumption
2. To Study the present CO_2 emissions
3. To assess the various equipment/facilities from Energy efficiency aspect
4. To measure various Electrical parameters
5. To study Scope for usage of Renewable Energy
6. To study various measures to reduce the Energy Consumption

1.2 Audit Methodology:

1. Study of connected load
2. Study of various Electrical parameters
3. To prepare the Report with various ENCON measures with payback analysis

1.3 Energy Audit Instruments:

1. Portable Power Analyzer
2. Lux meter
3. Anemometer
4. Digital Temperature Indicator
5. CO_2 Meter
6. Water TDS meter

1.4 General Details of Bharati Vidyapeeth's College of Engineering, Lavale, Pune:

No	Head	Particulars
1	Name of Institution	Bharati Vidyapeeth's College of Engineering
2	Address	Lavale, Pune
3	Year of Establishment	2012
4	Salient Features	Affiliated to Savitribai Phule Pune University
4	Courses offered	UG in Civil, Computer, E&TC and Mechanical Engineering
5	No of Students	654
6	Total built up area	173695 Sq. ft.

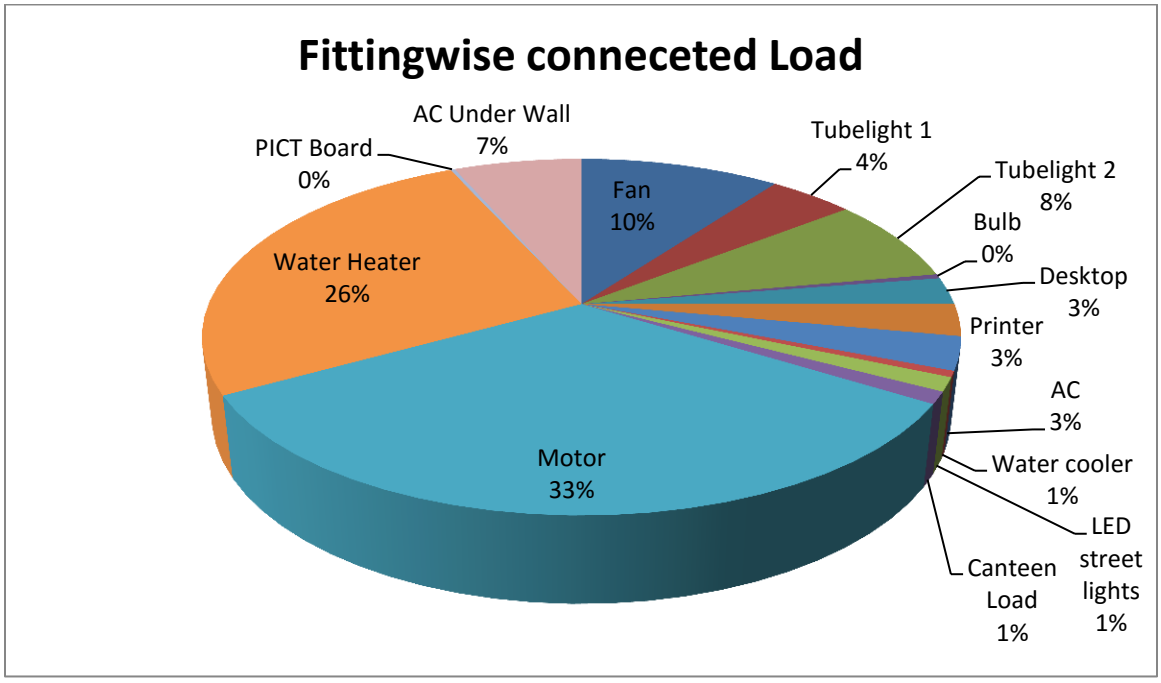
CHAPTER-II
STUDY OF CONNECTED LOAD

In this chapter, we present the details of various Electrical loads as under

2.1 Study of Fitting wise Connected Load:

Sr. No.	Name of Appliance	Wattage/unit (approx.)	Quantity (approx.)	Total Wattage (approx.)
1	Fan	60	464	27.84
2	Tubelight 1	24	493	11.83
	Tubelight 2	40	523	20.92
3	Bulb	18	60	1.08
4	Desktop	18	375	6.75
5	Printer	360	22	7.92
6	AC	1650	05	8.25
7	Water cooler	300	05	1.5
8	LED street lights	90	38	3.42
10	Canteen Load	All	-	2.98
11	Motor	All	16	90.76
14	Water Heater	3000	24	72.00
15	PICT Board	100	6	0.60
16	AC Under Wall	1050	17	17.85
	Total			**245.87**

We present the same in a PIE Chart as under



CHAPTER-III
HISTORICAL DATA ANALYSIS: ELECTRICAL ENERGY

In this chapter, we present the analysis of last year Electricity Bills

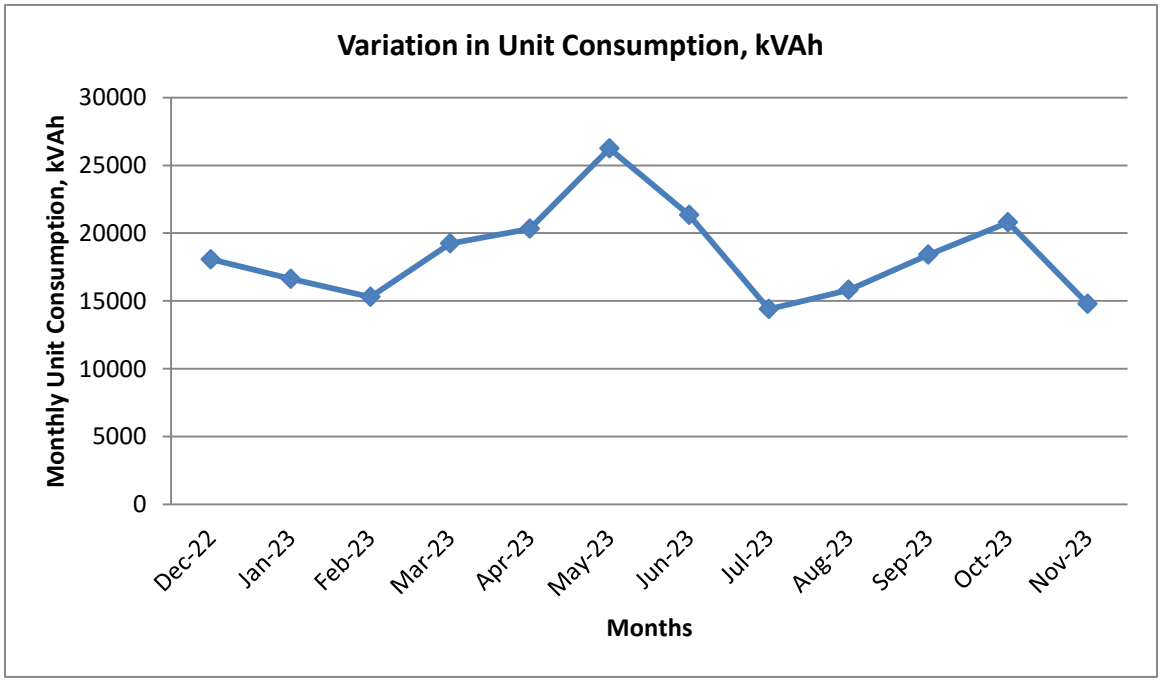
3.1 Consumer No. 182829055190

This consumer is the major contributors for billing in the Bharati Vidyapeeth's College of Engineering, Lavale campus, Pune. BV's College of Engineering, building load is connected to the same meter. Monthly consumption for last few months and bill amount is as follows.

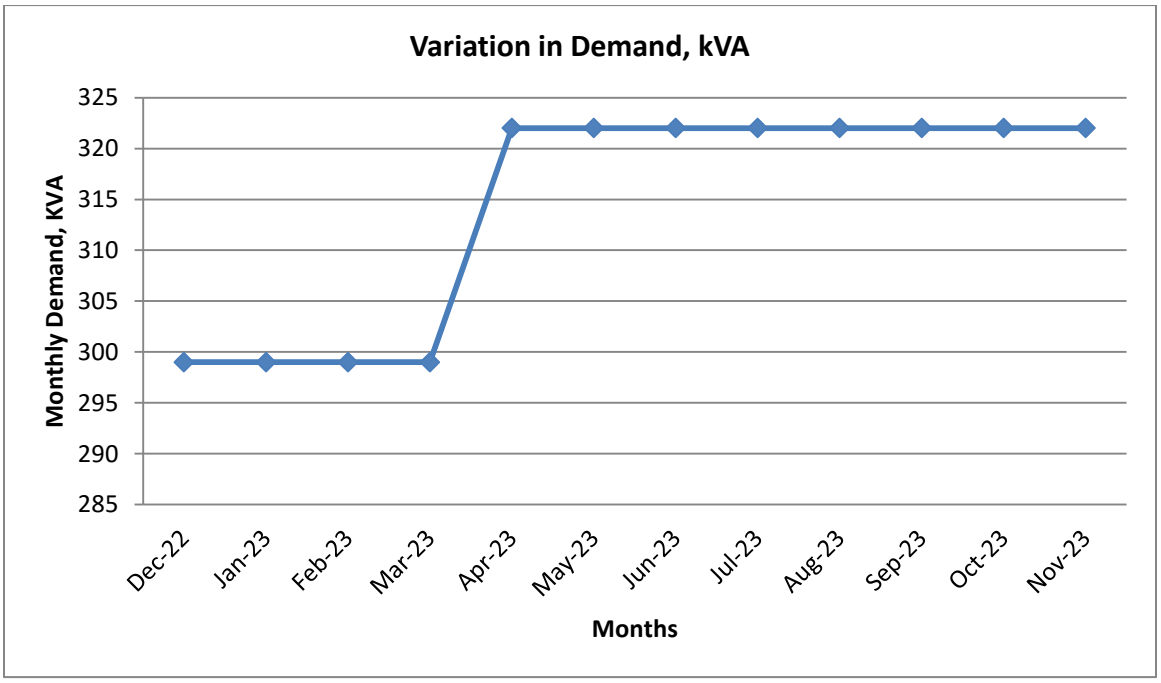
Table No. 1: Electrical Bill Analysis- 2023-24: 182829055190

Sr. No	Month	kVAh	Demand	Amount
1	Nov-2023	14785	322	368958
2	Oct-2023	20795	322	449042
3	Sep-2023	18412	322	415571
4	Aug-2023	15822	322	374885
5	July-2023	14403	322	355560
6	June-2023	21338	322	450002
7	May-2023	26246	322	516876
8	April-2023	20323	322	441108
9	March-2023	19238	299	407576
10	Feb-2023	15298	299	347361
11	Jan-2023	16631	299	366146
12	Dec-2022	18077	299	385878
13	Total	221368		4878963
14	Average	18447.33		406580.3
15	Max	26246		516876
16	Min	14403		347361

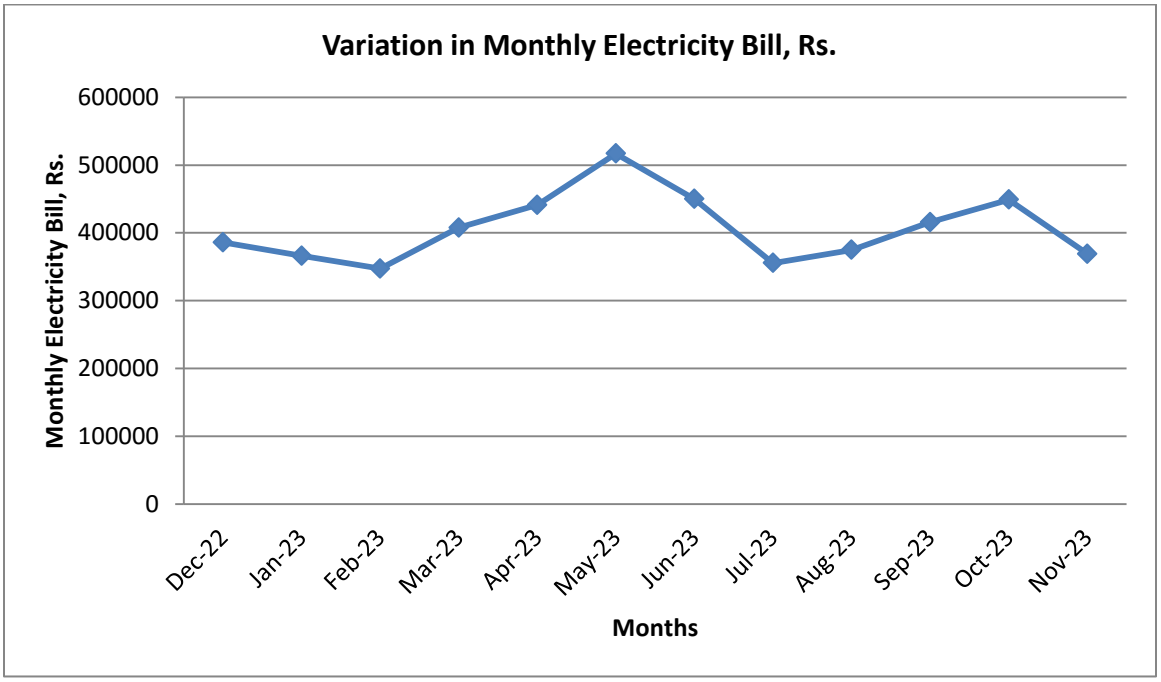
3.1.1 To study the variation of Monthly Units' Consumption:



3.1.2 To study the variation of Demand



3.1.3 To study the variation of Monthly Electricity Bill:



3.2 Summary:

Sr. No.	Consumer No.	Annual Electricity Consumption, kVAh	Annual Bill, Rs
1	182829055190	**221368**	**4878963**

3.3 Key Inference drawn:

From the above analysis, we present following important parameters:

Sr. No	Consumer No.	Parameter	Max	Min	Average
1	182829055190	Units consumed, kVAh	26246	14403	18447.33
		Electricity Bill amount	516876	347361	406580.3
		Total			425027.63

3.4 Benchmarking: Now we compute the Electrical Energy Consumed per square feet of the College Building as under

No	Parameter	Value	Unit
1	Units consumed, kVAh	**425027.63**	kVAh
2	College area	173695	Sq. ft.
3	**Unit consumed/sq. ft.**	**2.44**	**kVAh/sq. ft.**

CHAPTER-IV
CARBON FOOTPRINTING

A Carbon Foot print is defined as the Total Greenhouse Gas emissions, emitted due to various activities.

In this we compute the emissions of Carbon-Di-Oxide, by usage of the various forms of Energy used by the College for performing its day to day activities. The college uses electrical energy for operating various electrical gadgets.

We herewith furnish the details of electrical Energy consumption consumer number wise as under

4.1 Month wise Consumption of Electrical Energy: 182829055190

Sr. No	Month	kVAh
1	Nov-2023	14785
2	Oct-2023	20795
3	Sep-2023	18412
4	Aug-2023	15822
5	July-2023	14403
6	June-2023	21338
7	May-2023	26246
8	April-2023	20323
9	March-2023	19238
10	Feb-2023	15298
11	Jan-2023	16631
12	Dec-2022	18077
13	Total	221368
14	Average	18447.33
15	Max	26246
16	Min	14403

4.2 Basis for computation of CO_2 Emissions:

The basis of Calculation for CO_2 emissions due to Electrical Energy are as under

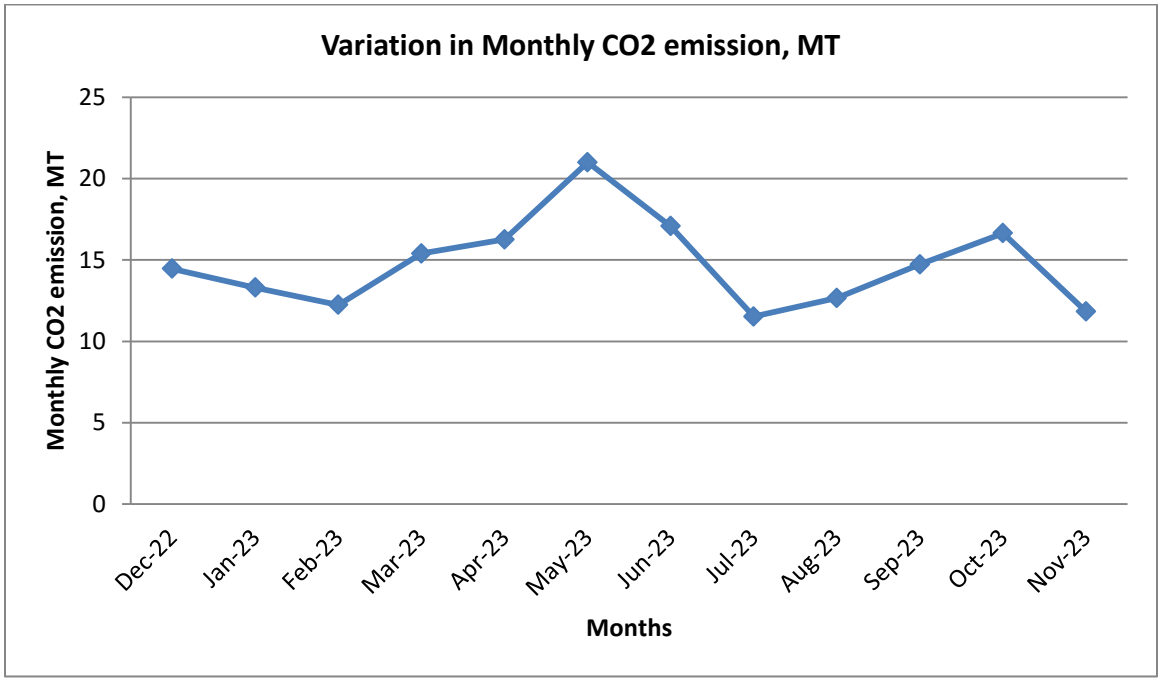
- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO_2** into atmosphere

Based on the above Data we compute the CO_2 emissions which are being released in to the atmosphere by the College due to its Day to Day operations.

4.3 Month wise CO2 Emissions: 182829055190

Sr. No	Month	Electrical Energy Consumed, kVAh	CO2 Emissions due to Electricity, MT
1	Nov-2023	14785	11.83
2	Oct-2023	20795	16.64
3	Sep-2023	18412	14.73
4	Aug-2023	15822	12.66
5	July-2023	14403	11.52
6	June-2023	21338	17.07
7	May-2023	26246	21.00
8	April-2023	20323	16.26
9	March-2023	19238	15.39
10	Feb-2023	15298	12.24
11	Jan-2023	16631	13.30
12	Dec-2022	18077	14.46
13	Total	221368	177.09
14	Average	18447.33	14.76
15	Max	26246	21.00
16	Min	14403	11.52

4.4 Representation of Month wise CO_2 emissions:



4.5 Benchmarking:

Now we compute the CO2 emissions per sq. ft. basis as under:

No	Parameter	Value	Unit
1	CO2 emissions	177.09	MT/annum
2	College area	173695	Sq. ft.
3	**CO2 emissions/sq. ft.**	**1.01**	**Kg of CO_2 per annum/sq. ft.**

CHAPTER-V
ELECTRICAL MEASUREMENTS

In this Chapter, we present the details of measurements at the distribution center and main meter room.

5.1 Measurement at Main Incomer feeder:

With the help of power analyzer various electrical parameters like voltage, current, KW and PF are measured. The sample extract of measured data is as follows.

Recording																
Date:	V1 rms	V2 rms	V3 rms	A1 rms	A2 rms	A3 rms	AN rms	F	PT (W)	PFT	V1 THDf	V2 THDf	V3 THDf	A1 THDf	A2 THDf	A3 THDf
	V	V	V	A	A	A	A	Hz	W		% f	% f	% f	% f	% f	% f
05-02-2024	246.1	247.4	246.2	65	34.6	34.8	31.1	50.04	32988	0.994	1	1.1	0.9	6.2	10.9	11.1
05-02-2024	245.9	247	245.9	64.8	47.2	35.6	24.6	50.01	36219	0.995	1	1.1	0.9	6.2	8.6	11.2
05-02-2024	246.7	247.5	246.7	64.8	47.9	35.7	24.3	50.03	36545	0.995	0.9	1.1	0.8	6.2	8.4	11
05-02-2024	246.7	247.6	246.5	60.8	35.6	35.9	26.3	50.03	32519	0.994	0.9	1.1	0.8	6.9	10.7	11
05-02-2024	246.3	247.2	246	53.2	35.2	35.3	20.1	50.03	30334	0.993	1	1.1	0.9	8.3	10.6	11.2
05-02-2024	246.1	247	245.8	52.6	34.4	35	21	50.03	29884	0.993	0.9	1.1	0.8	8.8	10.7	11.2
05-02-2024	246	246.9	245.8	40.1	33.6	34.7	12.8	50.02	26477	0.99	1	1	0.8	11.8	10.8	11.2
05-02-2024	245.8	246.5	245.4	39.2	33.8	35	12.4	50.01	26328	0.99	1	1.1	0.8	11.9	10.7	11.2
05-02-2024	245.8	246.6	245.5	39.3	34.2	35.5	12.8	50	26582	0.99	0.9	1	0.8	11.8	10.4	11
05-02-2024	245.4	246.1	245.1	41.9	37.4	39	13.7	50	28536	0.983	0.8	1	0.8	11.2	9.7	10.5
05-02-2024	245.3	246.3	245.1	48.3	44.2	44.4	12.8	50	33119	0.985	0.9	1	0.9	10.4	9.3	9.7
05-02-2024	245.3	246.4	245.2	65.7	50.2	49.6	19.6	50.02	40440	0.993	1	1.1	1	7.9	9.4	9.4
05-02-2024	245	246.1	244.8	66.6	49.4	49	21.7	50.02	40229	0.993	1	1.1	1	7.9	9.5	9.6
05-02-2024	244.9	245.8	244.6	45.9	40.5	40.7	12.7	50.02	30842	0.988	1	1.1	0.9	11.3	9.9	10.7
05-02-2024	245	245.7	244.7	39.4	34.3	33.8	11	50.02	26169	0.991	0.9	1	0.8	12.1	9.8	11.7
05-02-2024	244.6	245.4	244.3	39.6	34.2	33.9	11.1	50.03	26162	0.991	0.9	1	0.8	12.1	9.8	11.6
05-02-2024	244	244.7	243.7	39.7	34.2	33.7	10.9	50.02	26095	0.991	0.9	1	0.8	12.1	9.7	11.7
05-02-2024	244.3	245.2	244.1	49.3	33.9	33.7	18	50.02	28423	0.993	0.8	1	0.7	9.7	10	11.6
05-02-2024	244.1	245.2	243.9	52.2	33.6	32	21.1	50.01	28645	0.993	0.9	1	0.8	8.9	9.8	12.3
05-02-2024	243.9	244.8	243.6	52	33.3	30.1	21.8	50.03	28018	0.993	0.9	1.1	0.9	9	9.8	13.4
05-02-	244.1	244.9	244	51.8	37.5	30	20.2	50.03	29026	0.993	1	1.2	0.9	9.1	9.2	13.4

2024																
05-02-2024	244.1	244.9	244	48.3	38.7	26.8	17.8	50.02	27304	0.98	1	1.2	1	9.7	8.6	15.3
05-02-2024	244.7	245.7	244.6	40.9	29.2	24.7	16.3	50.01	22418	0.962	1	1.1	0.9	11.6	12	16.9
05-02-2024	244.3	245.2	244.1	47.5	37.5	32.5	15.3	50	28489	0.99	0.9	1	0.8	9.7	9	12.5
05-02-2024	243.9	244.8	243.7	59.8	42.6	37.4	21.5	50	33903	0.991	1	1.1	0.8	6.9	8.5	10.6
05-02-2024	243.2	244.2	243.2	54.9	38.1	32.6	20.9	50.01	30378	0.992	1	1.1	0.9	8.1	9.5	12.1
05-02-2024	243.7	244.7	243.6	46.3	30.5	25.2	19.2	50.03	24319	0.975	1	1.1	0.9	10.3	12	15.3
05-02-2024	244.1	245	244.1	42.9	28.8	23.8	17.6	50.02	22682	0.97	1.1	1.2	0.9	11.1	12.8	16.1
05-02-2024	244.8	245.7	244.8	43.4	28.5	23.9	18.5	50.02	22815	0.97	1	1.1	0.8	10.7	13.1	16.1
05-02-2024	244.3	245.2	244.2	47.7	33.1	28.5	19	50.01	26487	0.988	1	1.1	0.9	9.4	11.1	13.5
05-02-2024	244.3	245.2	244.1	49	34.2	33.4	19.9	50.03	28332	0.992	1	1.1	0.9	9.2	10.5	12.1
05-02-2024	244.7	245.7	244.6	49	34.4	34.4	20.1	50.05	28692	0.992	1	1.1	0.8	9.3	10.4	11.8
05-02-2024	244.7	245.9	244.8	52.8	40.2	30.4	21.1	50.04	30119	0.993	1	1.1	0.8	8.8	9.2	12.2
05-02-2024	244.7	245.8	244.8	50.3	44.5	30.9	19.5	50.03	30674	0.993	0.9	1.1	0.8	9.8	8.6	12
05-02-2024	244.5	245.3	244.4	48.7	49.5	37.9	13.5	50.04	32956	0.989	0.9	1.1	0.8	10.6	8.2	10.6
05-02-2024	244.9	245.9	244.9	59.1	60.1	56.1	1	50.09	42843	0.995	1	1.1	0.9	9.2	7.8	7.7
05-02-2024	244.8	245.7	244.7	57.1	52.6	55.6	8	50.1	40336	0.995	1	1.1	0.9	9.2	8.9	7.4
05-02-2024	244.2	245.1	244	47.9	40	42.9	14.7	50.09	31742	0.991	0.9	1	0.8	10.7	9.8	9.5
05-02-2024	244.5	245.5	244.3	44	36.3	41.9	15.2	50.07	29697	0.99	0.9	1	0.8	11.3	9.8	9.8
05-02-2024	244.6	245.5	244.4	43.5	36.9	41.8	14.6	50.05	29666	0.99	1	1.1	0.9	11.5	9.7	9.9
05-02-2024	244.1	244.9	243.7	43.4	36.8	41.8	14.7	50.04	29556	0.99	1	1.1	0.9	11.5	9.8	10
05-02-2024	243.5	244.4	243.1	41.1	32.9	39.2	15.9	50.02	27297	0.987	1.1	1.2	0.9	12.3	10.8	10.9
05-02-2024	243.7	244.7	243.4	42	33.3	39.8	17.2	50.01	27676	0.985	1	1.1	0.8	11.7	10.5	10.9
05-02-2024	243.6	244.5	243.3	42.6	34.3	39.9	16.1	50.01	28262	0.991	1	1.1	0.8	11.5	10	10.5
05-02-2024	243.2	244	242.9	40.3	34.7	37.6	13.1	50.02	27112	0.988	0.9	1	0.8	11.8	10.1	11.2
05-02-2024	243.3	244.1	243	36.2	43.1	35.6	4.3	50.03	27594	0.985	1	1.1	0.8	12.8	8.2	11.8
05-02-2024	243.1	243.9	242.8	36.4	48.4	41.3	7.7	50.02	30273	0.986	1	1.1	0.9	12.3	7.8	10.1
05-02-2024	241.6	242.3	241.1	45.2	57.8	49.6	11.7	49.97	36459	0.987	1.1	1.1	0.9	10.5	7.3	9.4
05-02-2024	241.3	242	240.8	46.1	58.5	50.2	11.4	49.94	36980	0.988	1.1	1.1	0.9	10.5	7.5	9.2
05-02-2024	241.2	242	240.7	47.1	49.3	48.3	12.8	49.94	34623	0.989	1.1	1.1	0.9	11.2	10.1	9.7
05-02-	241.4	242.2	240.9	41.7	41.2	42.6	12.7	49.95	30030	0.989	1.1	1.1	0.9	11.7	10.8	9.8

2024																
05-02-2024	241.9	242.8	241.6	35.6	36.2	38.3	12.2	49.98	26354	0.987	1	1	0.8	12.6	10.5	10
05-02-2024	241.5	242.3	241.2	33.3	34.5	36.5	12	50.02	24950	0.987	1	1	0.8	13	10.2	9.7
05-02-2024	241.4	242.3	241.1	33.4	32.3	36.7	13.2	50.03	24482	0.988	1	1.1	0.8	12.9	10.9	9.7
05-02-2024	241.8	242.6	241.4	32.5	30.4	36.7	14.7	50.03	23824	0.987	1.1	1.1	0.9	13.8	11.5	9.6
05-02-2024	241	241.9	240.6	30.8	31.1	37.1	14.2	49.98	23592	0.986	1.1	1	0.9	14	11.9	10
05-02-2024	241.2	241.9	240.7	28.9	30.9	36.4	14	49.99	22921	0.986	1.1	1.1	0.9	14.6	12.2	10.2
05-02-2024	240.8	241.6	240.4	29	31	37.3	15	49.97	23116	0.983	1	1	0.8	14.6	12.4	10.1
05-02-2024	240.8	241.5	240.3	28.7	31.3	37.1	15.1	49.95	23023	0.982	1.1	1.1	0.9	14.9	12.5	10.3
05-02-2024	241	241.6	240.4	29	31.3	38.3	16.4	49.98	23321	0.98	1	1	0.8	15.1	12	10.1
05-02-2024	241.1	241.8	240.5	29.2	32	37.7	15.4	50	23461	0.982	1.1	1.1	0.9	15	12.6	10.2
05-02-2024	241.1	242	240.7	29.1	31.2	36.5	14.9	50	22987	0.983	1.1	1.1	0.9	15.1	12.9	10.4
05-02-2024	240.6	241.5	240.2	29.1	31.2	35.6	13.9	50	22762	0.984	1.1	1.1	0.9	15.1	13.2	10.6
05-02-2024	241.1	241.8	240.6	29.2	31.9	35.5	13.6	49.98	23000	0.985	1.1	1.1	0.9	14.9	13.4	10.8
05-02-2024	241.2	242	240.8	29.5	32	35.6	13.5	49.97	23114	0.985	1.1	1.2	1	15.4	13.7	11.1
05-02-2024	241.3	242.2	241	29.2	31.2	34.8	13.7	49.97	22643	0.983	1.1	1.2	0.9	15.5	14	11.2
05-02-2024	241.4	242.2	241	30.2	30.3	35	14.7	49.98	22718	0.982	1.1	1.2	0.9	15.4	14.5	11.5
05-02-2024	241.3	242.2	241	31.2	29.5	35.4	15.9	49.97	22842	0.982	1.2	1.2	0.9	15.6	14.8	11.6
05-02-2024	240.9	241.9	240.6	32.2	29.5	35.5	16.4	49.95	23068	0.982	1.1	1.2	0.9	15.8	15	11.6
05-02-2024	241.1	242	240.8	28.7	25.5	30.4	16.3	49.96	19615	0.958	1.1	1.2	0.9	17.6	19	13.6
05-02-2024	241.4	242.4	241.1	28.9	24.9	29.3	16.9	49.95	19253	0.956	1.2	1.2	0.9	17.8	19.9	13.7
05-02-2024	241	242	240.6	29.3	24.7	29.8	18.3	49.95	19360	0.956	1.1	1.2	0.9	17.3	20.2	13.6
05-02-2024	240.5	241.4	240.2	29.9	24.8	29.3	17.9	49.93	19360	0.956	1.1	1.2	0.9	17	20.2	13.5
05-02-2024	240.6	241.5	240.3	29.9	24.2	28.1	17.1	49.89	18925	0.953	1.1	1.2	0.9	16.8	20.6	13.8
05-02-2024	240.3	241.2	239.9	30.6	24.2	28.4	17.5	49.87	19155	0.955	1.1	1.2	0.9	16.4	20.4	13.4
05-02-2024	241	241.7	240.6	30.9	24.4	28.7	17.7	49.9	19388	0.955	1.1	1.2	0.9	16.7	19.9	14.5
05-02-2024	240.4	241.2	239.9	30.2	24.7	28.5	17.2	49.93	19110	0.952	1.2	1.2	1	17.1	20.5	14.6
05-02-2024	239.5	240.5	239	30.5	24.7	28.9	17.4	49.92	19249	0.953	1.3	1.3	1.1	16.8	20.3	14.1
05-02-2024	240.7	241.5	240.2	30.5	25	29.1	17.5	49.94	19451	0.952	1.3	1.3	1.1	17	20.5	14
05-02-2024	240.3	241.3	239.8	30.4	25.3	28.9	17.1	49.93	19427	0.953	1.3	1.4	1.1	16.9	20.4	14.1
05-02-	240	240.9	239.5	30.5	25.1	28.6	17.2	49.93	19284	0.952	1.2	1.3	1.1	16.6	20.8	14

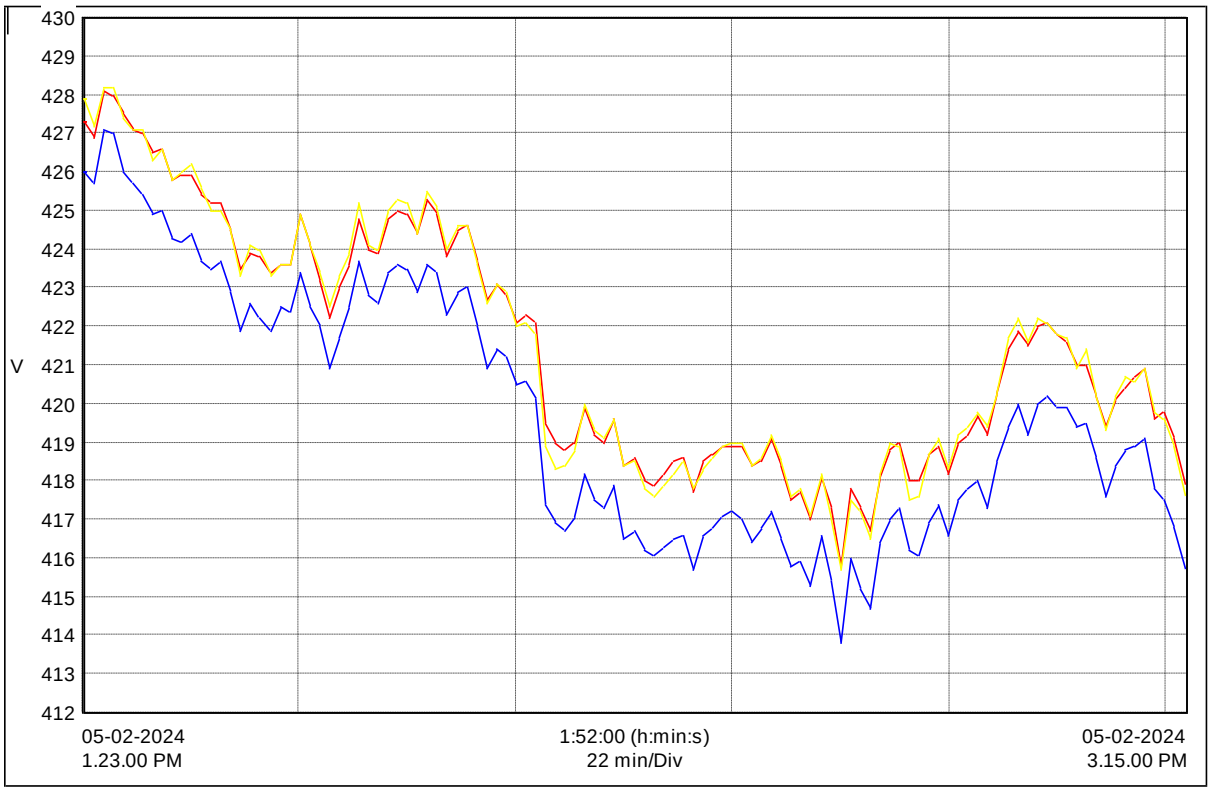
2024																
05-02-2024	240.9	241.8	240.5	35.2	25.2	28.5	19.1	49.93	20724	0.965	1.1	1.2	0.9	15.6	20.4	13.9
05-02-2024	241.2	242.3	241	36.8	25.7	28.4	19	49.93	21401	0.972	1.1	1.2	1	15.6	20.3	13.9
05-02-2024	241.4	242.3	241	37.2	25.4	28.7	19.7	49.94	21509	0.973	1	1.1	0.9	15.4	20	13.6
05-02-2024	240.8	241.6	240.2	37.2	25.5	30.2	21.1	49.93	21818	0.973	1	1.1	0.9	15.2	19.6	13.2
05-02-2024	240.8	241.6	240.2	37	24.9	30	21.3	49.91	21606	0.974	1	1.1	0.9	15.1	18.7	13.4
05-02-2024	241.1	242.1	240.8	37	25.3	29	19.4	49.9	21537	0.976	1	1.1	0.9	15.5	18	13.8
05-02-2024	241.4	242.3	241.1	37.5	25	28.8	19.9	49.89	21547	0.975	1	1.1	0.8	15.3	18.1	13.7
05-02-2024	240.9	241.9	240.6	38.2	25.3	29.1	20.6	49.87	21804	0.974	1	1.1	0.9	15.1	18.2	13.8
05-02-2024	241.4	242.4	241.2	43.3	25.3	29.2	24.2	49.93	23166	0.979	1	1.1	0.8	13.4	17.9	13.9
05-02-2024	241.5	242.5	241.3	43.7	25.4	29	24	49.95	23312	0.98	1	1.1	0.9	13.3	17.5	13.8
05-02-2024	241.7	242.8	241.5	38.8	25.9	29.1	19.3	49.99	22278	0.979	0.9	1.1	0.8	14.7	16.7	13.5
05-02-2024	241.4	242.5	241.1	38.5	26.3	29.5	18.9	50.02	22310	0.978	0.9	1	0.8	14.5	17	13.6
05-02-2024	242	243.1	241.8	42.6	34.9	30.6	16.4	50.04	25811	0.984	0.9	1	0.7	12.9	12.4	13.1
05-02-2024	242.7	243.8	242.4	38.7	32	42.2	18.6	50.05	27062	0.985	0.9	1	0.7	13.9	13.8	9.3
05-02-2024	243	244.1	242.7	37.2	26.6	42.4	23	50.06	25381	0.981	0.8	0.9	0.7	14.3	16.9	9.1
05-02-2024	242.7	243.8	242.2	32.7	26.1	41.9	24.8	50.04	23820	0.972	0.9	1	0.7	15.8	17.5	9.3
05-02-2024	243	244.1	242.7	32.8	26	35.4	21.1	50.04	22262	0.969	0.8	0.9	0.7	15.7	17.3	11.1
05-02-2024	243.1	244.1	242.7	31.9	25.9	29	16.7	50.03	20396	0.964	0.9	1	0.7	16.1	17.6	13.4
05-02-2024	242.9	243.9	242.6	31.9	25.9	28.9	16.5	50.01	20356	0.963	0.9	0.9	0.7	16.1	17.9	13.7
05-02-2024	242.9	243.8	242.6	31.5	25.8	28.8	16.3	50.01	20188	0.963	0.9	1	0.8	16.4	18.1	13.7
05-02-2024	242.6	243.4	242.2	33	25.9	28.7	17.1	49.98	20543	0.964	0.9	0.9	0.7	15.9	18.3	13.8
05-02-2024	242.5	243.6	242.3	38.4	26.1	28.7	20	49.94	21985	0.97	0.9	0.9	0.7	13.9	18.4	13.8
05-02-2024	242.1	243	241.7	38.4	26	28.3	20.3	49.93	21787	0.968	1	1	0.8	14.3	19	14.2
05-02-2024	241.6	242.5	241.2	38.6	25.4	28.1	20.3	49.93	21644	0.969	1	1	0.8	14.4	18	14.2
05-02-2024	242	243	241.7	32	24.9	27.8	16.4	49.99	19770	0.962	0.9	1	0.7	16.7	18	14
05-02-2024	242.2	243.2	242	31.9	24.7	28	16.8	50.01	19762	0.961	0.9	1	0.7	16.7	17.7	13.7
05-02-2024	242.3	243.2	241.9	32	24.7	28.2	17.1	49.98	19825	0.961	0.9	0.9	0.7	16.5	18	13.6
05-02-2024	242.4	243.4	242.1	32.1	24.5	29.9	18.8	49.99	20229	0.961	0.8	0.9	0.7	16.2	17.6	12.6
05-02-2024	241.7	242.7	241.4	37.5	30.2	37.3	19.7	49.99	25015	0.982	0.9	1	0.7	14.2	12.8	10.1
05-02-	241.7	242.8	241.2	37.7	29.8	36.1	18.6	49.99	24733	0.985	0.9	1	0.7	14.2	13.6	10.3

2024																
05-02-2024	241.3	242.4	240.8	37.7	29.8	35.6	18.3	49.99	24566	0.985	0.9	0.9	0.7	14.5	13.7	10.6
05-02-2024	240.7	241.6	240	38.7	29.6	36.4	19.5	49.96	24869	0.985	1	1	0.8	14.5	13.9	10.2

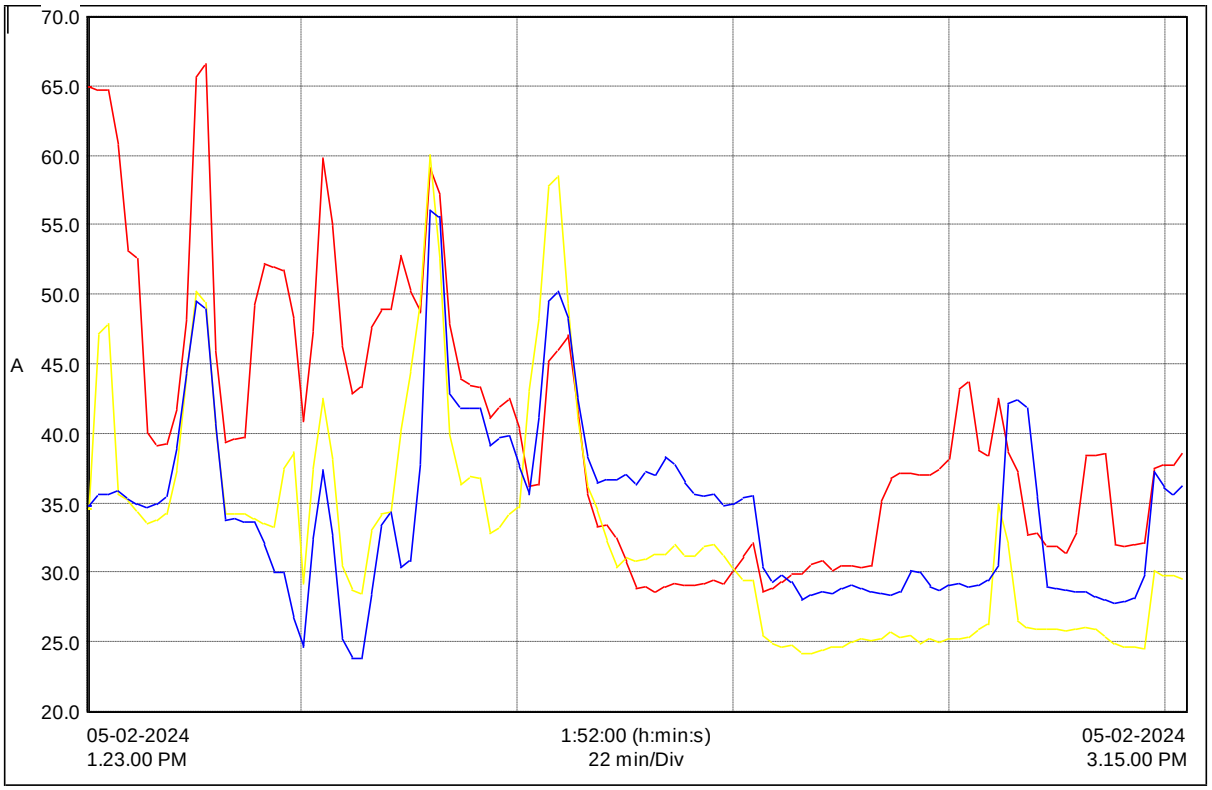
5.2 Variation in Electrical Parameters

Now we present the variation in various Electrical parameters as under.

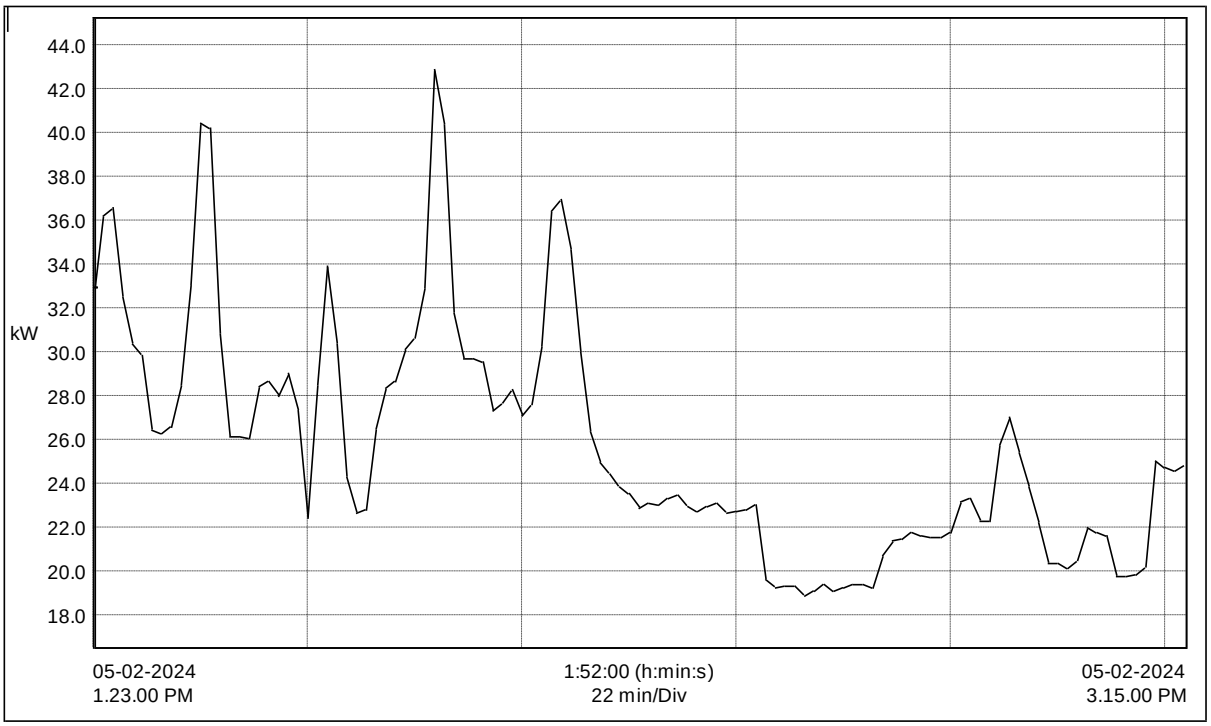
5.2.1 Voltage



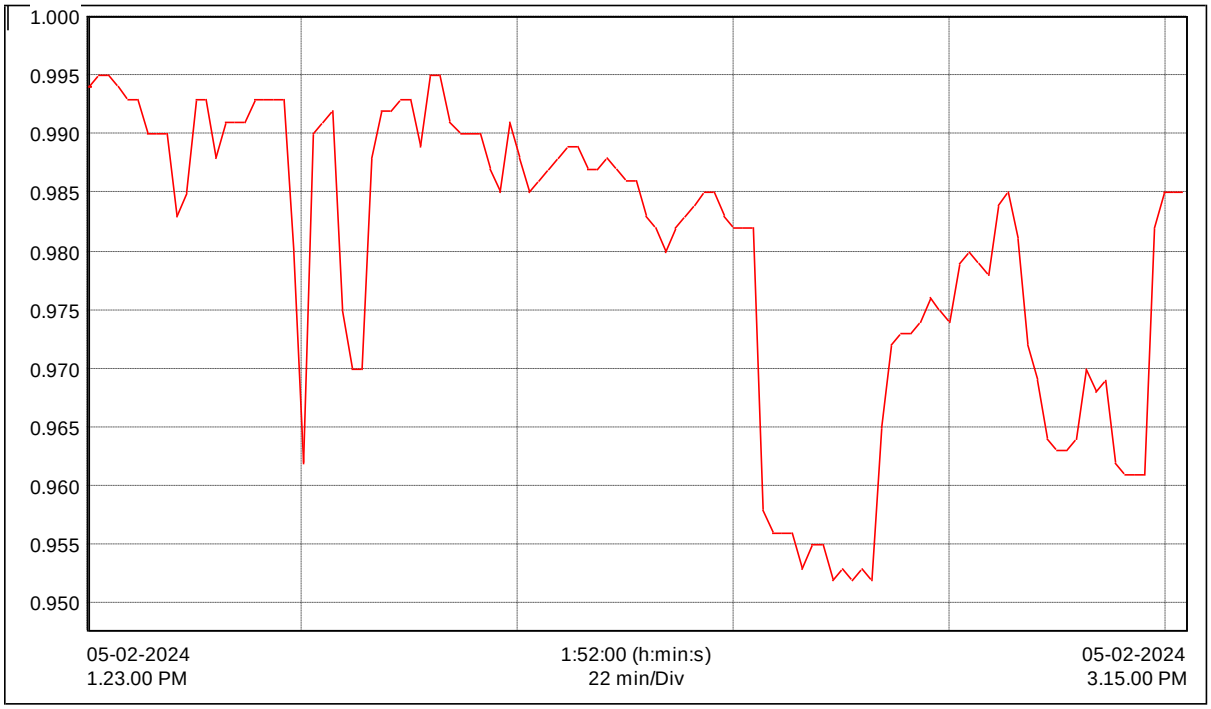
5.2.2 Current


70.0
65.0
60.0
55.0
50.0
A 45.0
40.0
35.0
30.0
25.0
20.0
05-02-2024
1.23.00 PM
1:52:00 (h:min:s)
22 min/Div
05-02-2024
3.15.00 PM

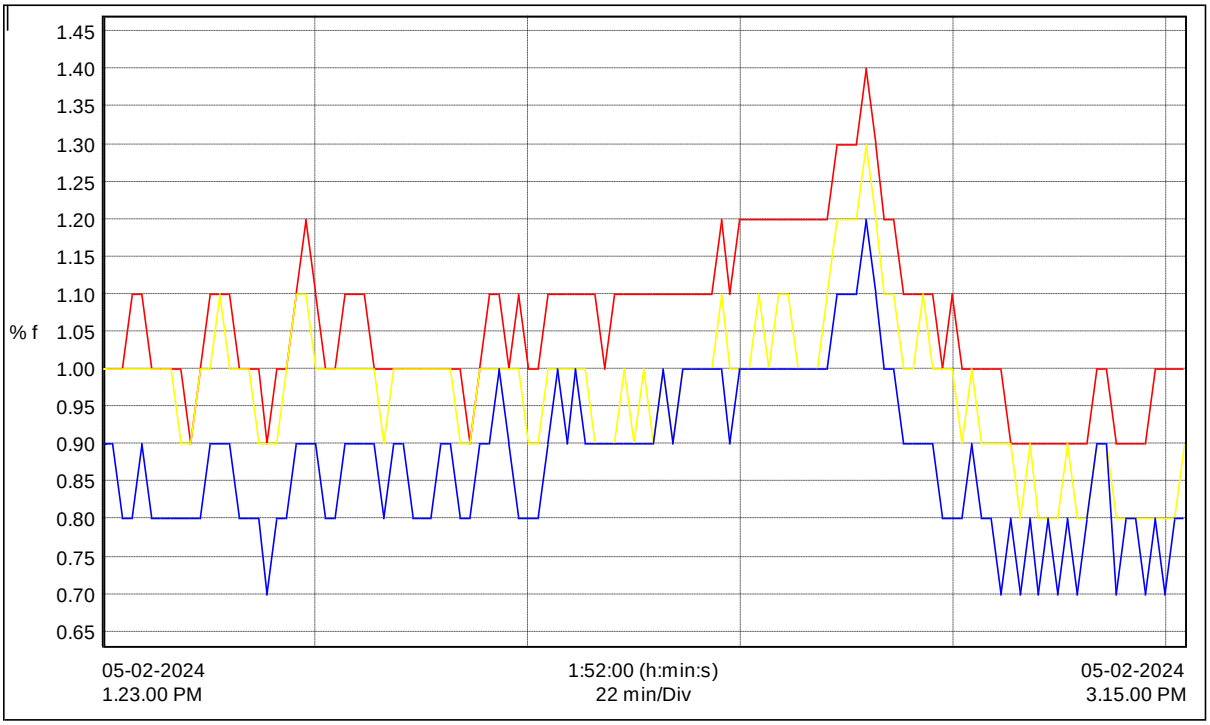
5.2.3 Total Active power (kW)



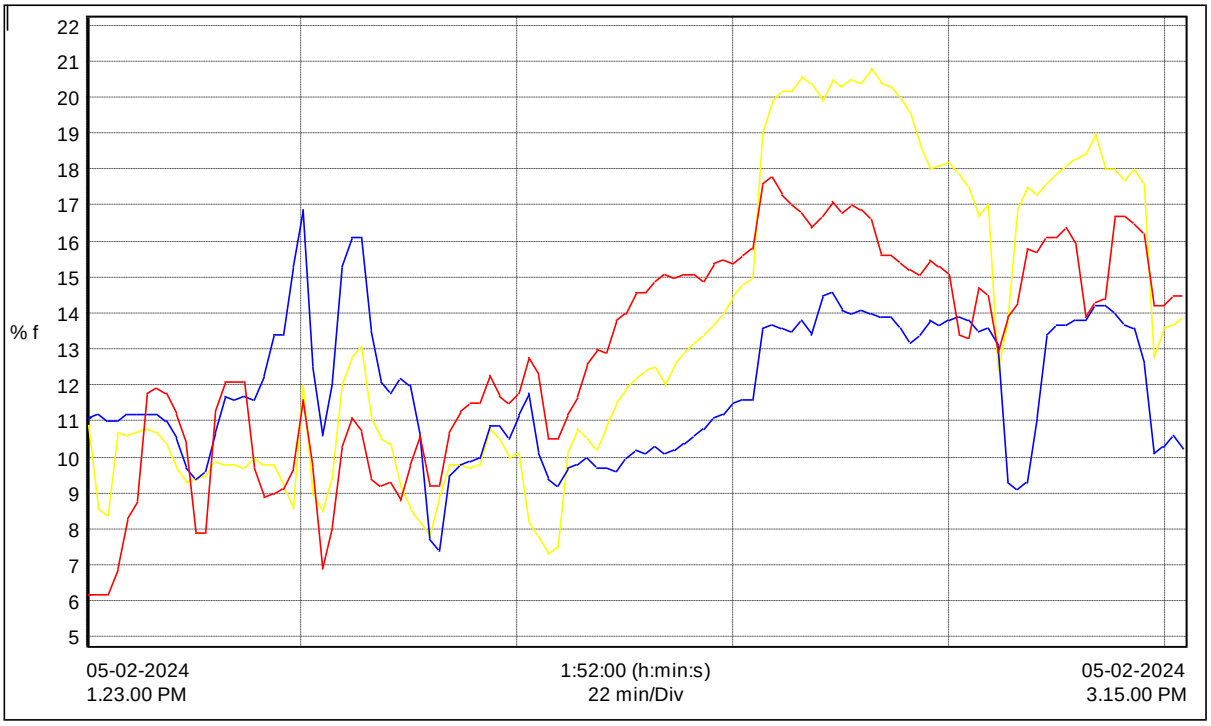
5.2.4 Power factor



5.2.5 Voltage THD%



5.2.6 Current THD%



CHAPTER-VI
SCOPE OF RENEWABLE ENERGY AND EFFICIENT FACILITY AT COLLEGE CAMPUS

6.1 Installation of 50 kWp Solar PV roof Top on Bharati Vidyapeeth's College of Engineering building:

During the Audit, it was revealed that the College has ample space on the Terrace but top two floors under construction. It is proposed once construction completes Solar Photovoltaic roof top with net meter of capacity **50 kWp can be installed.** The system will cater the Day load Demand of the College.

We furnish herewith the saving potential as under

No	Particulars	Value	Unit
1	Installed Capacity of Solar PV Pack	50	kWp
2	Daily working period	6	Hrs./Day
3	Daily units generated	300	kWh/Day
4	Annual working days	280	Day/annum
5	Annual saving in Grid Electrical Energy	84000	kWh/annum
6	Annual CO_2 saving potential	67.2	MT/Annum
7	Present Energy Charges	10	Rs/kWh
8	Annual monetary Gain	840000	Rs/Annum
9	Investment required	22,50000	Rs lump sum
10	Payback period	2.67	Years

6.2 Solar Water heater

Today we are facing the shortage problem between supply and demand of electric energy especially during peak summer and winter seasons. The situation further worsens during early hours of peak winter season when enormous heating load is switched 'ON'. This has been a consistent problem. If the heating load is switched over to non-conventional source of energy, from conventional energy sources, the gap can be bridged considerably. 'Solar Energy' is an unlimited source of non-conventional energy. Solar energy can provide cost-effective solutions to fight climate change and reduce our dependency on expensive and polluting fuels. A solar water heater is an efficient and reliable technology that converts sunlight into heat to produce your hot water. At present Bharati Vidyapeeth's College of Engineering, Lavale campus uses electric gysers in 24 nos. having capacity of 15 litrs and 3 kW coil for hot water production in boys hostel.

Photo-1: Electric heaters in the boys hotel at BV CoE, Lavale, Pune

Solar water heating system of total capacity of 1000 LPD can be used to provide hot water for bathing purpose for students, which will decrease the electrical energy consumption.

6.3 Solar powered light for hoarding

Lighting solar systems are the fixed installations designed for domestic as well as small scale commercial application. The component of the solar lighting system includes solar PV module (solar cells), charge controller, solar battery and lighting system (lamps & fans). Modules are installed in the open on roof/terrace - exposed to sunlight and the charge controller and battery are kept inside a protected place in the house.

Figure-1: Solar powered light for Hoarding

This system comes with multiple benefits such as:

- **Economical:** Since the sun provides energy free of charge, 30% power savings on the electricity bill can be availed with longer back up lighting system at zero running cost.
- **Non-Polluting:** Powered by the sun's renewable energy, the system is energy neutral and an absolutely clean source of illumination. 1kWp solar installation reduces 1⁄2 ton of CO_2 (carbon dioxide) per annum.
- **No Maintenance:** The system has few moveable parts – reducing the risk of breakage. Once installed, it lasts for long time and requires little attention.

This system can be used to power the huge hoardings in the college campus.

Solar powered hoarding lighting system proposed will provide a better, faster, cheaper (and cleaner) alternative with solar. Since this product competes with diesel or conventional fuels, we needed to ensure we beat the cost of a diesel solution. In order to achieve that with solar, we consider the following system:

1. Highly Efficient Solar Panel

2. Charge Controllers with MPPT Technology – increases solar electricity production by up to 30% compared to conventional charge controllers

3. LED Projection Light – consumes 10-times less electricity compared to conventional bulbs, and has a 50,000 hour warranty.

Features:

- Auto on off

- 4 Days Battery Back Up
- Robust housing
- Weather proof

With this entire put together, we ended up with systems that provide 6 hours of lighting each night with 4 -lamp system to light up boards up to 15′x30′, and a 8-lamp system to light larger boards up to 20′x40′.More importantly, with these options, payback of the system will come around 2.5 years. This system provides a way to reduce the lightings costs, get rid of all the operational hassles of owning a diesel generator, plus brand benefits from being "green" with the use of renewable energy like solar powered light hoarding board.

6.4 Solar charging stations

Solar cell phone chargers use solar panels to charge cell phone batteries. They are an alternative to conventional electrical cell phone chargers and in some cases can be plugged into an electrical outlet. Solar mobile charger is a device which can charge mobile phones using solar radiation. Its major component is a compact solar panel. This solar panel traps solar energy and produces an output voltage. But, since the light radiations falling on the solar panel can vary, the output voltage becomes unstable. For charging a mobile phone, stable voltage is required. So, to make the output voltage stable and regulated, voltage regulator circuit along with the solar panel is used.

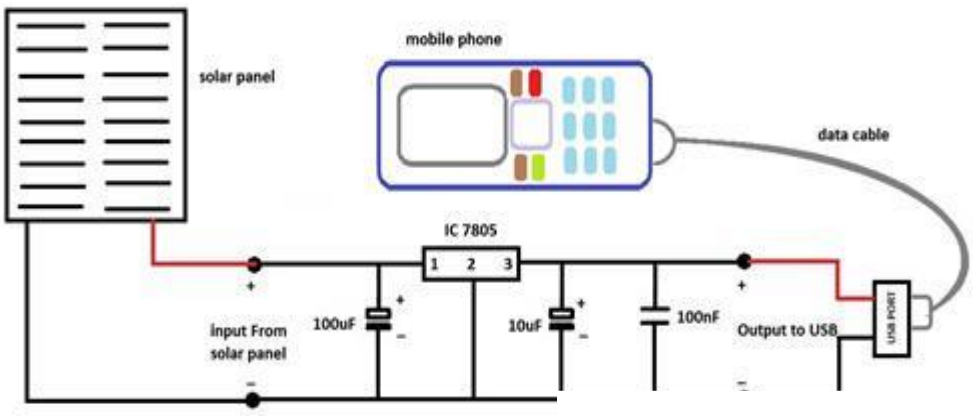


Figure-4: Solar charging Stations

Most of the mobile phones have computer connectivity via USB cable. USB port establishes 4 connection terminals. The connection terminals at the two extreme ends are the supply terminals. In a female USB connector (port via which we plug in USB devices to computer), these terminals carry 5V DC. When a mobile phone is connected to the USB port of a computer, it utilizes this 5V supply to recharge battery. This feature is used in a solar mobile charger. It converts and regulates solar energy to 5V DC and the output will be available through the female USB connector. To this connector, we can easily connect a mobile phone via data cable.

Chapter VII
SUGGESTIONS AND RECOMMENDATIONS

Following Energy Conservation Opportunities and actions on the basis of energy audit are suggested to implement in the campus on the basis of funds availability and institute preferences.

a) Energy Audit: Energy Conservation opportunities:

- The contract demand is 460 KVA, but actual maximum demand is very less so the demand charges are heavily paid evry month by the consumer. The contract demand may be lower down with the consideration of expansion of the Institute.
- APFC of 270KVAr is already installed at the main electrical panel with steps of 50, 20, 10 and 5. Still there is a difference between KVAh and kWh. The APFC can be fine-tuned with lower steps.
- Energy efficient tubes and fans can be replaced. Already the phasing out of old tubes has been undertaken during regular maintenance practices.
- Installation of 50 kW solar roof top system as ample space available on the roof of the college building. At present top floor construction is going on, Once it is over, roof area can be used for the installation of solar roof top. As sanctioned load is 771.5 kW, the solar roof top of 50 kW capacity with net meter can be installed in the college campus to meet the requirement of electricity.
- Installation of Solar powered light for hoarding.
- Installation of 05 Nos. solar mobile phone charging stations in the college campus.
- Water management system must be in place. Overhead tanks can be with float control and Time of the day (TOD) can be implemented for water pumping for filling the overhead water tanks.

Rajendrakumar Narayan Patil

Digitally signed by Rajendrakumar Narayan Patil
Date: 2024.04.10 11:20:23 +05'30'