

ENERGY AUDIT REPORT
of
Shiksha Mandal's
Bajaj College of Science, Wardha
(Formerly known as Jankidevi Bajaj College of Science)



Year: 2022-23

Prepared by:

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ISO: 14001-2015 Certified (Cert No: 23EEKW20)

ENERGY AUDIT CERTIFICATE

Certificate No: ES/BSC/22-23/01

Date: 05/04/2023

This is to certify that we have conducted an Energy Audit at Bajaj College of Science, Wardha, in the Year 2022-23.

The Institute has adopted following Energy Efficient practices:

- Usage of Energy Efficient LED Fittings
- Usage of Energy Efficient BEE STAR Rated equipment
- Maximum usage of Day Lighting
- Installation of 50 kWp Roof Top Solar PV Plant

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

For Engress Services,



A Y Mehendale,
B E-Mechanical, M Tech- Energy
BEE Certified Energy Auditor, EA-8192



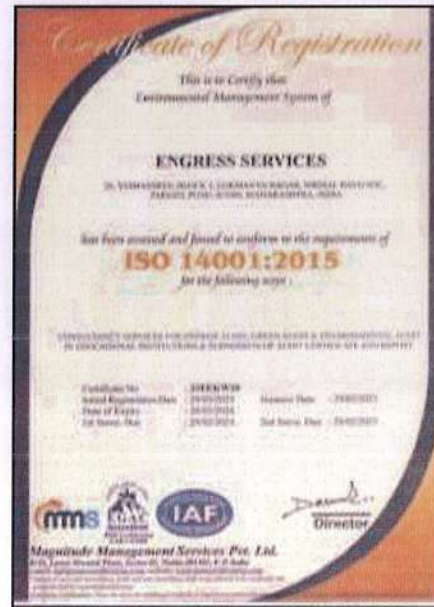
Registration Certificates



MEDA Registration Certificate



ISO: 9001-2015 Certificate



ISO: 14001-2015 Certificate



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ACKNOWLEDGEMENT

We Engress Services, Pune, express our sincere gratitude to the management of Bajaj College of Science, Wardha for awarding us the assignment of Energy Audit of their Campus for the Year: 2022-23.

We are thankful to all the staff members for helping us during the field study.



EXECUTIVE SUMMARY

1. Bajaj College of Science, Wardha consumes Energy in the form of **Electrical Energy**; used for various Electrical Equipment, office & other facilities.

2. Present Connected Load & Annual Energy Consumption:

No	Particulars	Value	Unit
1	Total Connected Load	121.47	kW
2	Annual Energy Consumption	90942	kWh
3	Annual CO ₂ Emissions	72.75	MT

3. Energy Performance Index:

No	Particulars	Value	Unit
1	Total Annual Energy Consumed	90942	kWh
2	Total Built up area of Institute	13731.118	m ²
3	Energy Performance Index =(1) / (2)	6.62	kWh/m ²

4. Study of Lighting Power Density & % of LED Lighting:

No	Particulars	Value	Unit
1	Lighting Power density	1.00	W/m ²
2	% of Usage of LED Lighting to Total Lighting Load	96.45	%

5. Renewable Energy & Energy Efficiency Projects:

- Usage of Energy Efficient LED Fittings
- Usage of Energy Efficient BEE STAR Rated equipment
- Maximum usage of Day Lighting
- Installation of 50 kWp Roof Top Solar PV Plant

6. Assumption:

1. 1 kWh of Electrical Energy releases 0.9 Kg of CO₂ into atmosphere

7. References:

- Audit Methodology: www.mahaurja.com
- Energy Conservation Building Code: ECBC-2017: www.beeindia.gov.in
- For CO₂ Emissions: www.tatapower.com



ABBREVIATIONS

LED	:	Light Emitting Diode
MSEDCL	:	Maharashtra State Electricity Distribution Company Limited
BEE	:	Bureau of Energy Efficiency
ECBC	:	Energy Conservation Building Code
MEDA	:	Maharashtra Energy Development Agency
PV	:	Photo Voltaic
Kg	:	Kilo Gram
kWh	:	kilo-Watt Hour
CO ₂	:	Carbon Di Oxide
MT	:	Metric Ton



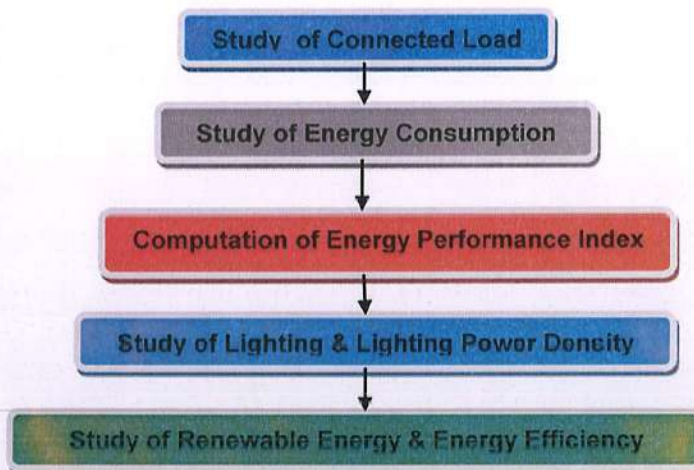
CHAPTER-I INTRODUCTION

1.1 Introduction:

An Energy Audit is conducted at Bajaj College of Science, Wardha. The guidelines followed for conducting the Energy Audit are:

- BEE India's Energy Conservation Building Code: ECBC-2017
- Maharashtra Energy Development Agency (www.mahaurja.com)
- Tata Power: www.tatapower.com

1.2 Audit Procedural Steps:



1.3 Institute Location Image:



Institute
Campus



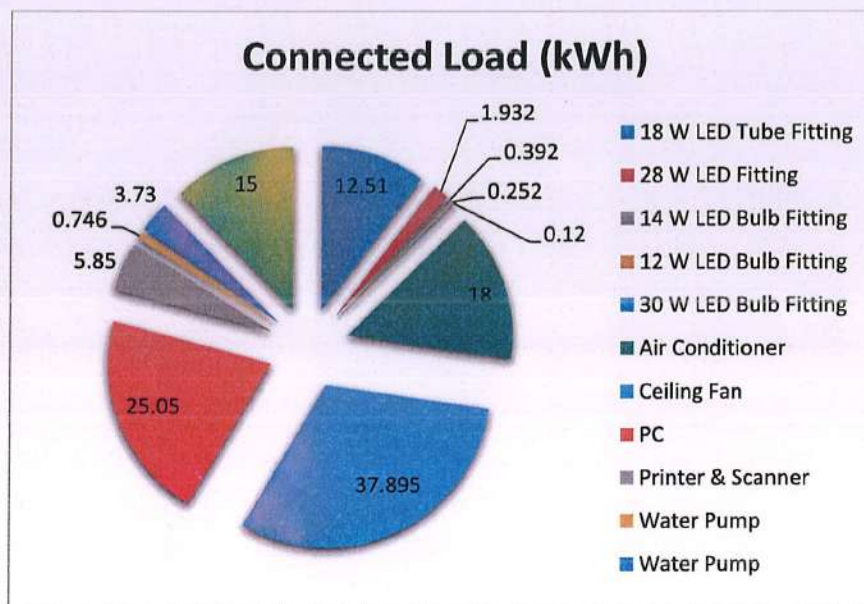
CHAPTER-II STUDY OF CONNECTED LOAD

The major contributors to the connected load of the Institute include:

Table No 1: Study of Equipment wise Connected Load:

No	Equipment	Qty	Load, W/Unit	Load, kW	
1	40 W FTL Fitting	14	40	0.56	
2	18 W LED Tube Fitting	695	18	12.51	
3	28 W LED Fitting	69	28	1.932	
4	14 W LED Bulb Fitting	28	14	0.392	
5	12 W LED Bulb Fitting	21	12	0.252	
6	30 W LED Bulb Fitting	4	30	0.12	
7	Air Conditioner	12	1500	18	
8	Ceiling Fan	583	65	37.895	
9	PC	167	150	25.05	
10	Printer & Scanner	39	150	5.85	
11	Water Pump 1HP	1	746	0.746	
12	Water Pump 5HP	1	3730	3.73	
13	Other Equipment	100	150	15	
14	Total				121.477

Chart No 1: Study of Connected Load:



CHAPTER-III STUDY OF PRESENT ENERGY CONSUMPTION

In this chapter, we present the analysis of Electrical Energy Consumption.

Table No 2: Electrical Bill Analysis- 2022-23:

No	Month	Energy Generated (kWh)=A	Energy Purchased (kWh)=B	Energy Exported (kWh)=C	Net Energy Consumption (kWh) =A+B-C
1	Mar-22	18531	4951	4564	18918
2	Apr-22	6407	5089	4754	6742
3	May-22	6377	4446	4996	5827
4	Jun-22	5936	3667	4696	4907
5	Jul-22	6400	4545	5151	5794
6	Aug-22	4771	4594	3619	5746
7	Sep-22	4229	5974	2780	7423
8	Oct-22	4673	4491	3502	5662
9	Nov-22	3192	5875	2273	6794
10	Dec-22	4365	5301	3281	6385
11	Jan-23	5693	5029	4225	6497
12	Feb-23	6413	7696	3862	10247
13	Total	76987	61658	47703	90942
14	Maximum	18531	7606	5151	18018
15	Minimum	3192	3667	2273	4907
16	Average	6415.583	5138.166	3975.25	7578.5

Chart No 2: Variation in Monthly Energy Consumption:

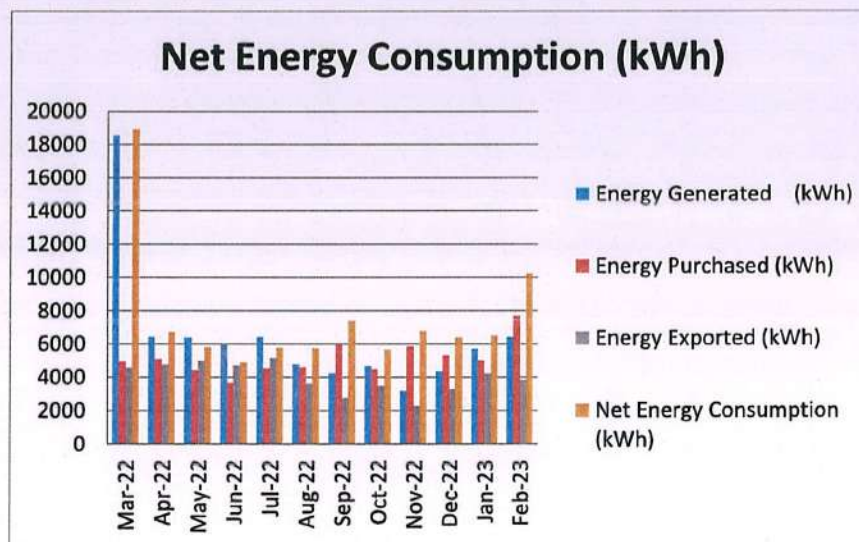


Table No 3: Important Parameters:

No	Parameter/ Variation	Energy Generated, kWh	Energy Exported, kWh	Energy Purchased, kWh	Net Energy Consumed, kWh
1	Total	76987	61658	47703	90942
2	Maximum	18531	7696	5151	18918
3	Minimum	3192	3667	2273	4907
4	Average	6415.583	5138.166	3975.25	7578.5

CHAPTER-IV

STUDY OF ENERGY PERFORMANCE INDEX

Energy Performance Index: Energy Performance Index of a Building is its Annual Energy Consumption in Kilo Watt Hours per square meter of the Building

It is determined by:

$$\text{EPI} = \frac{\text{(Annual Energy Consumption in kWh)}}{\text{(Total Built-up area in m}^2\text{)}}$$

Now we compute the EPI for the Institute as under:

Table No 4: Computation of Energy Performance Index:

No	Particulars	Value	Unit
1	Total Annual Energy Consumed	90942	kWh
2	Total Built up area of Institute	13731.118	m ²
3	Energy Performance Index =(1) / (2)	6.623	kWh/m ²



CHAPTER V STUDY OF LIGHTING

Terminology:

1. **Lumen** is a unit of light flow or luminous flux. The lumen rating of a lamp is a measure of the total light output of the lamp. The most common measurement of light output (or luminous flux) is the lumen. Light sources are labeled with an output rating in lumens.

2. **Lux** is the metric unit of measure for illuminance of a surface. One lux is equal to one lumen per square meter.

3. **Circuit Watts** is the total power drawn by lamps and ballasts in a lighting circuit under assessment.

4. **Installed Load Efficacy** is the average maintained illuminance provided on a horizontal working plane per circuit watt with general lighting of an interior. Unit: lux per watt per square metre (lux/W/m²)

5. **Lamp Circuit Efficacy** is the amount of light (lumens) emitted by a lamp for each watt of power consumed by the lamp circuit, i.e. including control gear losses. This is a more meaningful measure for those lamps that require control gear. Unit: lumens per circuit watt (lm/W)

6. **Installed Power Density.** The installed power density per 100 lux is the power needed per square metre of floor area to achieve 100 lux of average maintained illuminance on a horizontal working plane with general lighting of an interior

Unit: watts per square metre per 100 lux (W/m²/100 lux) 100 Installed power density (W/m²/100 lux)

7. **Lighting Power Density:** It is defined as Total Lighting Load in a room divided by the Area of that Room in square meters.

In this Chapter we compute: Lighting Power Density of a Class Room. We also compute the percentage usage of LED Lighting to total Lighting Load of the Institute.

Table No 5: Computation of Lighting Power Density:

No	Particulars	Value	Unit
1	No of 18 W LED Tube Lights in Class Room	06	Nos
2	Demand of 18 W LED Tube Light	18	W/Unit
3	Total Lighting Load in the Class Room= (1) * (2)	108	W
4	Area of Class Room	107.99	m ²
5	Lighting Power Density = (3)/ (4)	1.00	W/m ²



Now, we compute the usage of LED Lighting to Total Lighting Load, as under.

Table No 6: Percentage Usage of LED Lighting to Annual Lighting Load:

No	Particulars	Value	Unit
1	Qty of 40 W FTL Light Fittings	14	Nos
2	Load per Fitting	40	W/Unit
3	Total Load of 40 W FTL Fitting	0.56	kW
4	Qty of 18 W LED Light Fittings	695	Nos
5	Load per Fitting	18	W/Unit
6	Total Load of 18 W LED Fitting	12.51	kW
7	Qty of 28 W LED Light Fittings	69	Nos
8	Load per Fitting	28	W/Unit
9	Total Load of 28 W LED Fitting	1.932	kW
10	Qty of 30 W LED Light Fittings	4	Nos
11	Load per Fitting	30	W/Unit
12	Total Load of 30 W LED Fitting	0.12	kW
13	Qty of 14 W LED Light Fittings	28	Nos
14	Load per Fitting	14	W/Unit
15	Total Load of 14 W LED Fitting	0.392	kW
16	Qty of 12 W LED Light Fittings	21	Nos
17	Load per Fitting	12	W/Unit
18	Total Load of 12 W LED Fitting	0.252	kW
19	Total Lighting Load=3+6+9+12+15+18	15.766	kW
20	Total LED Lighting Load=6+9+12+15+18	15.206	kW
21	% of Total Lighting Demand met by LED Lighting= $23 \times 100 / 22$	96.45	%



CHAPTER-VI STUDY OF RENEWABLE ENERGY & ENERGY EFFICIENCY

The Institute has installed a **50 kWp** capacity Roof top Solar PV Plant.
Now we compute the Percentage of Alternate Energy to Annual Energy demand:

Table No 7: Percentage of Usage of Alternate Energy to Annual Energy Demand:

No	Particulars	Value	Unit
1	Total Annual Energy Imported from MSEDCL	90942	kWh
2	Total Annual Solar Energy Generated from 50 kWp Solar Plant	76987	kWh
3	Total Annual Energy Exported from MSEDCL	47703	kWh
4	Net Electricity Consumption $= (1+2)-(3)$	120226	kWh
5	% of Usage of Alternate Energy to Total Annual Energy Demand $= (2) * 100 / (4)$	64.035	%

Photograph of Roof Top Solar PV Plant:

