

ENERGY AUDIT REPORT

of

Shri. Datta Prasadik Shikshan Prasarak Mandal's

**Late Rajkamalji Bharti Arts, Commerce and
Smt. Sushilabai R. Bharti Science College,
Arni, Dist-Yavatmal (M.H.) 445103**

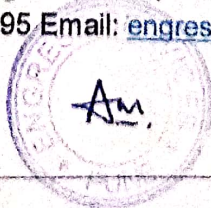


Year: 2022-23

Prepared by:

ENGRESS SERVICES

Yashashree, 26, Nirmal Bag Society
Near Mukangan English School, Parvati, Pune 411009
Phone: 09890444795 Email: engress123@gmail.com



ENGRESS SERVICES

Yashashree, 26, Nirmal Bag Society, Near Mukhtangan English School, Parvati, Pune 411 009
Tel: 09890444795 Email: engress123@gmail.com

MEDA Registration No: ECN/2022-23/CR-43/1709

ISO: 9001-2015 Certified (Cert No: 23EQKC13),

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

ENERGY AUDIT CERTIFICATE

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

Date: 20/04/2023

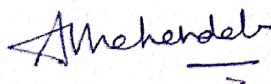
This is to certify that we have conducted an Energy Audit at Late Rajkamalji Bharti Arts, Commerce and Smt. Sushilabai R. Bharti Science College, Arni, in the Year 2022-23.

.The Institute has adopted following Energy Efficient practices:

- Usage of Energy Efficient LED Fittings
- Maximum Usage of Day Lighting

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

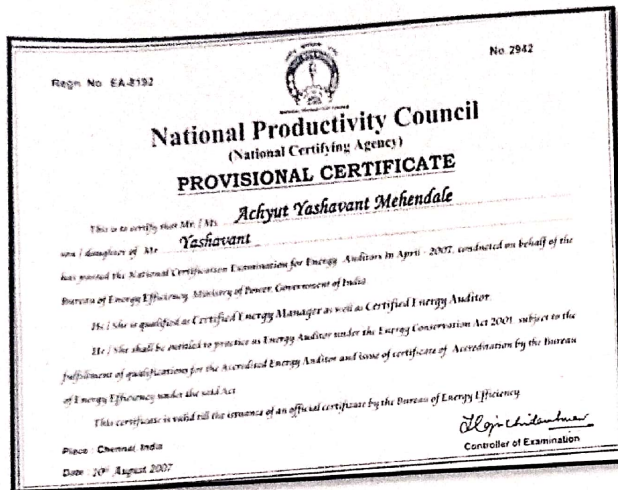
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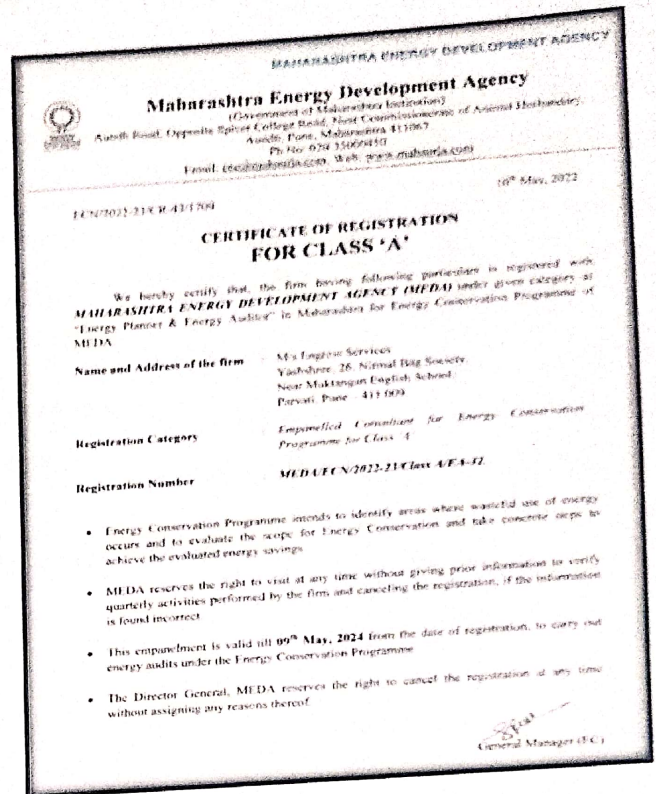
A Y Mehendale,
B E-Mechanical, M Tech- Energy
BEE Certified Energy Auditor, EA-8192



Registration Certificates



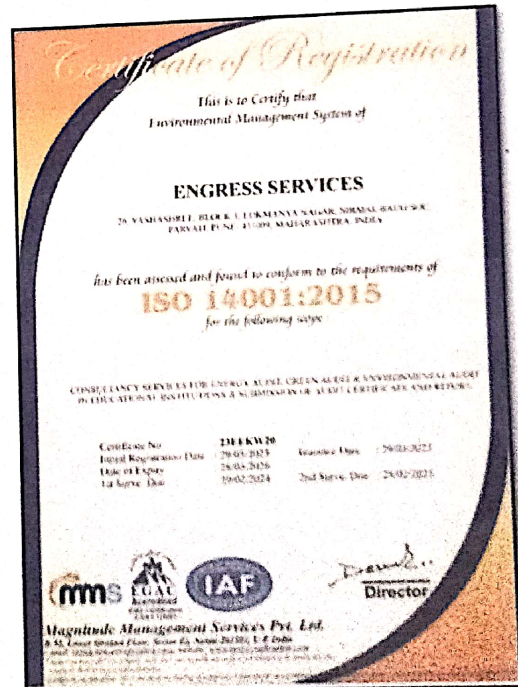
AUDITOR Certificate



MEDA Registration Certificate



ISO: 9001-2015 Certificate



ISO: 14001-2015 Certificate

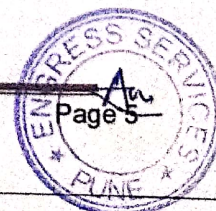
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ACKNOWLEDGEMENT

We Engress Services, Pune, express our sincere gratitude to the management of Late Rajkamalji Bharti Arts, Commerce and Smt. Sushilabai R. Bharti Science College, Arni 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. Late Rajkamalji Bharti Arts, Commerce and Smt. Sushilabai R. Bharti Science College, Arni 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	17	kW
2	Annual Energy Consumption	10814	kWh
3	Annual CO ₂ Emissions	9.73	MT

3. Energy Performance Index:

No	Particulars	Value	Unit
1	Total Annual Energy Consumed	10814	kWh
2	Total Built up area of Institute	1277.04	m ²
3	Energy Performance Index = (1) / (2)	8.47	kWh/m ²

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

No	Particulars	Value	Unit
1	Lighting Power Density	1.1	W/m ²
2	% of Usage of LED Lighting to Total Lighting Load	100	%

5. Renewable Energy & Energy Efficiency Projects:

- Usage of Energy Efficient LED Fittings
- Maximum usage of Day Lighting

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

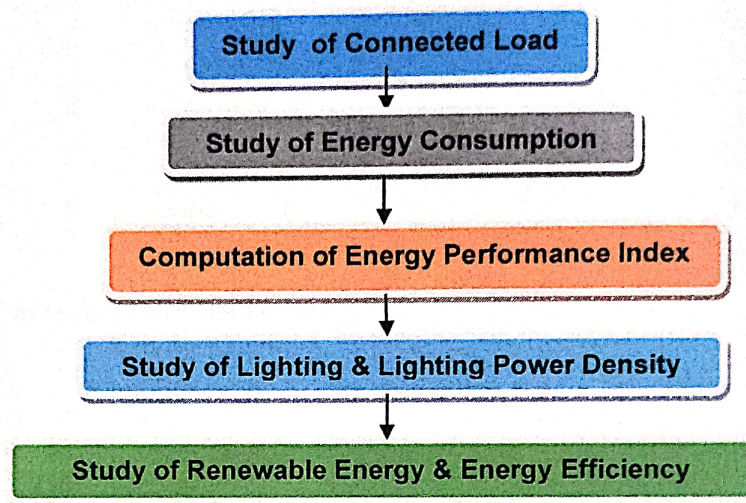
CHAPTER-I INTRODUCTION

1.1 Introduction:

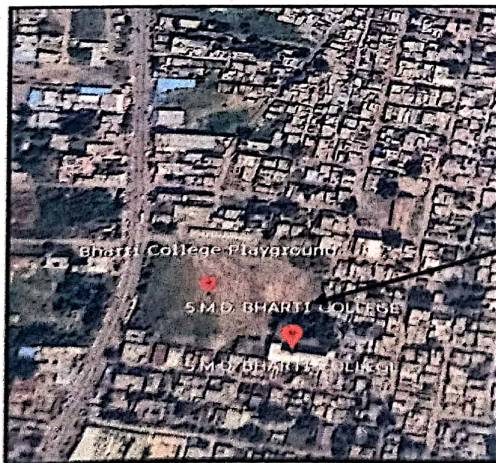
An Energy Audit is conducted at Late Rajkamalji Bharti Arts, Commerce and Smt. Sushilabai R. Bharti Science College, Arni. The guidelines followed for conducting the Energy Audit are:

- 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

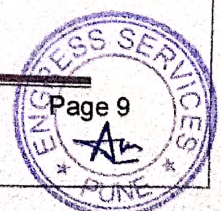
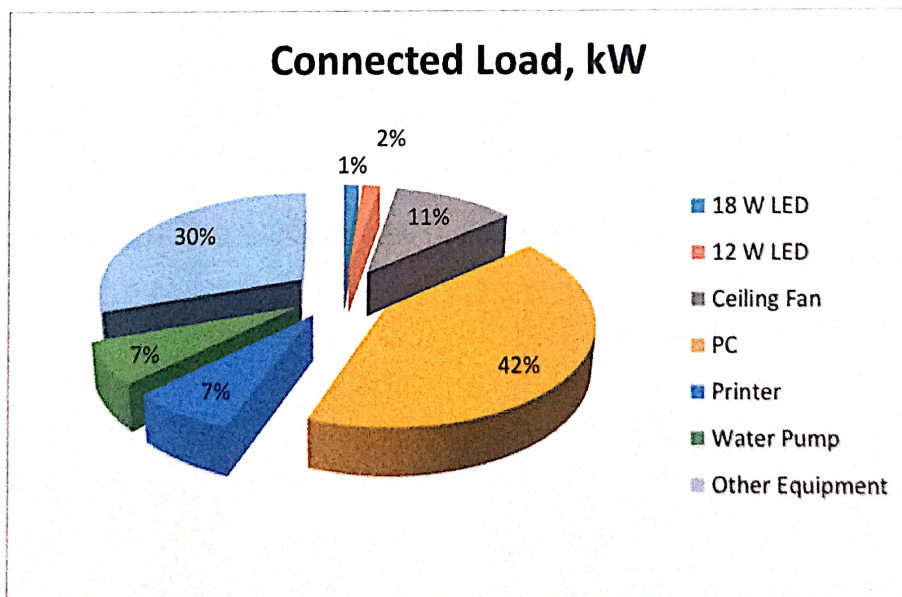
CHAPTER-II STUDY OF CONNECTED LOAD

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	18 W LED	12	18	0.216
2	12 W LED	26	10	0.26
3	Ceiling Fan	28	65	1.82
4	Computers	46	150	6.9
5	Printer/Scanner	8	150	1.2
6	Water Pump	1	1119	1.119
7	Other Equipment	50	100	5
8	Total			17

Chart No 1: Study of Connected Load:



CHAPTER-III

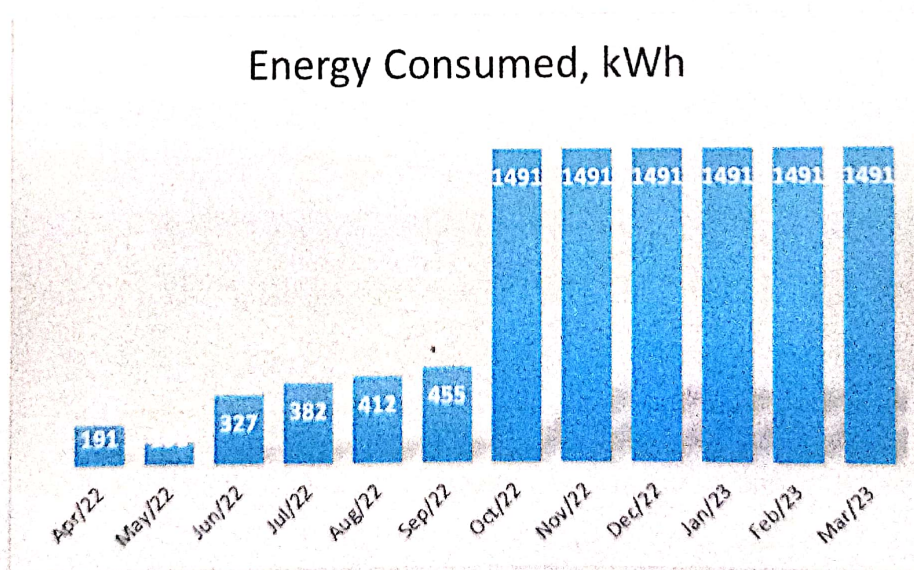
STUDY OF PRESENT ENERGY CONSUMPTION

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

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

No	Month	Energy Consumption	CO ₂ Emissions, MT
1	Apr-22	191	0.172
2	May-22	101	0.091
3	Jun-22	327	0.294
4	Jul-22	382	0.344
5	Aug-22	412	0.371
6	Sep-22	455	0.410
7	Oct-22	1491	1.342
8	Nov-22	1491	1.342
9	Dec-22	1491	1.342
10	Jan-23	1491	1.342
11	Feb-23	1491	1.342
12	Mar-23	1491	1.342
13	Total	10814	9.733
14	Maximum	1491	1.342
15	Minimum	101	0.091
16	Average	901.167	0.811

Chart No 2: Variation in Monthly Energy Consumption:



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 No4: Computation of Energy Performance Index:

No	Particulars	Value	Unit
1	Total Annual Energy Consumed	10814	kWh
2	Total Built up area of Institute	1277.04	m ²
3	Energy Performance Index =(1) / (2)	8.47	kWh/m ²

CHAPTER V STUDY OF LIGHTING

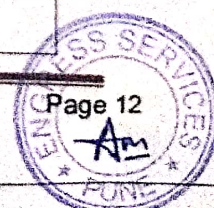
Terminology:

- 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 12 W LED Tube Lights in Class Room	4	Nos
2	Demand of 12 W LED Tube Light	12	W/Unit
3	Total Lighting Load in the Class Room= (1) * (2)	48	W
4	Area of Class Room	43.36	m ²
5	Lighting Power Density = (3)/ (4)	1.1	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	No of 18 W LED Tube Lights	12	Nos
2	Demand of 18 W LED Tube Light	18	W/Unit
3	Total Electrical Load of 18 W LED Fittings	0.216	kW
4	No of 12 W LED Tube Lights	26	Nos
5	Demand of 12 W LED Tube Light	12	W/Unit
6	Total Electrical Load of 12 W LED Fittings	0.312	kW
7	Total Lighting Load = 3+6	0.528	kWh
8	LED Lighting Load = 6+9	0.528	kWh
9	Lighting Requirement met by LED= $8 \times 100 / 7$	100.00	%

CHAPTER-VI STUDY OF RENEWABLE ENERGY & ENERGY EFFICIENCY

As on today College has not install solar roof-top PV plant, It is recommended to install solar rooftop plant on the college building., But College has installed solar lighting in the campus for night lightning.

