

ENGRESS SERVICES

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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/RSCOPR/22-23/01

Date: 11/6/2023

This is to certify that we have conducted Energy Audit at Jayawant Shikshan Prasarak Mandal's, Rajarshi Shahu College of Pharmacy & Research, Tathawade, Pune 411 033, in the Year 2022-23.

The College has adopted following Energy Efficient Initiatives:

- Usage of Energy Efficient LED Fittings
- Usage of Energy Efficient BEE STAR Rated equipment
- Maximum usage of Day Lighting
- Installation of 10 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.

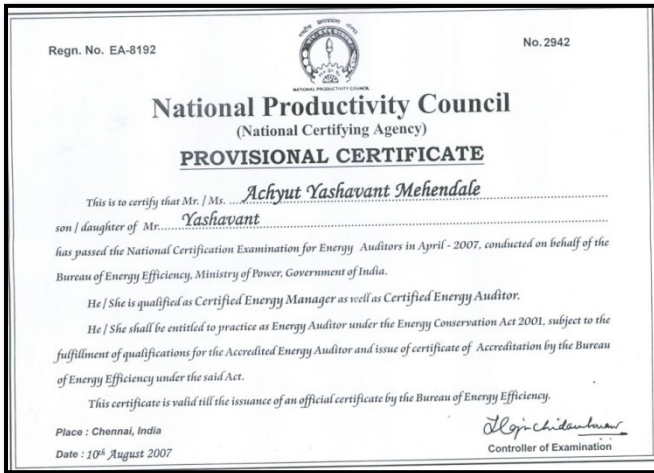
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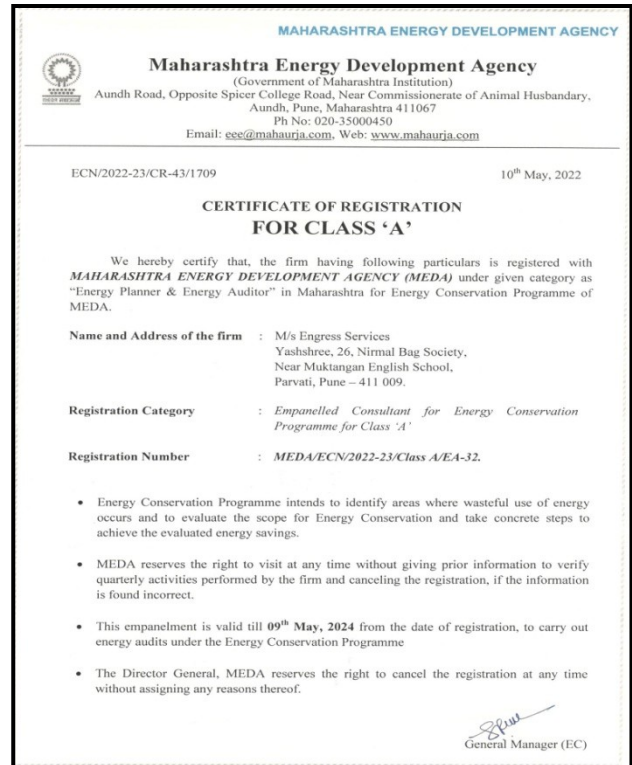
B E-Mechanical, M Tech- Energy

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 Jayawant Shikshan Prasarak Mandal's Rajarshi Shahu College of Pharmacy & Research, Tathawade, Pune, for awarding us the assignment of Energy Audit of their Campus for the Year: 22-23.

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

EXECUTIVE SUMMARY

1. Jayawant Shikshan Prasarak Mandal's Rajarshi Shahu College of Pharmacy & Research, Tathawade, Pune consumes Energy in the form of **Electrical Energy & LPG**; used for various Electrical Equipment, office & other facilities.

2. Present Connected Load & Energy Consumption:

No	Particulars	Value	Unit
1	Total Connected Load	67	kW
2	Annual Energy Purchased	34604	kWh
3	Annual Energy Purchased	114	Kg

3. Energy Performance Index:

No	Particulars	Value	Unit
1	Total Annual Energy Purchased	34604	kWh
2	Annual Energy Generated	12000	kWh
3	Annual Energy Consumed=1+2	46604	kWh
4	Total Built up area of College	4981	m ²
5	Energy Performance Index =(3) / (4)	9.36	kWh/m ²

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

No	Particulars	Value	Unit
1	Lighting Power Density	3.2	W/m ²
2	% of Usage of LED Lighting to Total Lighting Load	32.20	%

5. Renewable Energy & Energy Efficiency Projects:

- Usage of Energy Efficient LED fittings
- Installation of **10 kWp** Roof Top Solar PV Plant

6. Assumptions:

1. Energy Consumed is computed based on Load Utilization Factor
2. **1 kWh** of Electrical Energy releases **0.9 Kg of CO₂** into atmosphere
3. **1 Kg** of LPG releases **2.68 Kg of CO₂** into atmosphere
4. Energy generated by Roof Top Solar PV Plant: **4 kWh/kWp per Day**
5. Annual Solar Energy generation Days: **300 Nos**

7. References:

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

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

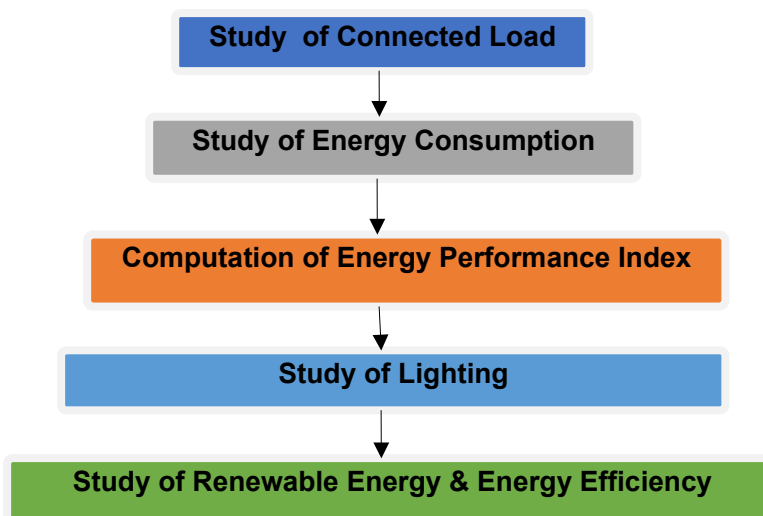
1.1 Introduction:

An Energy Audit is conducted at Jayawant Shikshan Prasarak Mandal's, Rajarshi Shahu College of Pharmacy & Research, Tathawade, Pune.

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 College Location Image:



CHAPTER-II

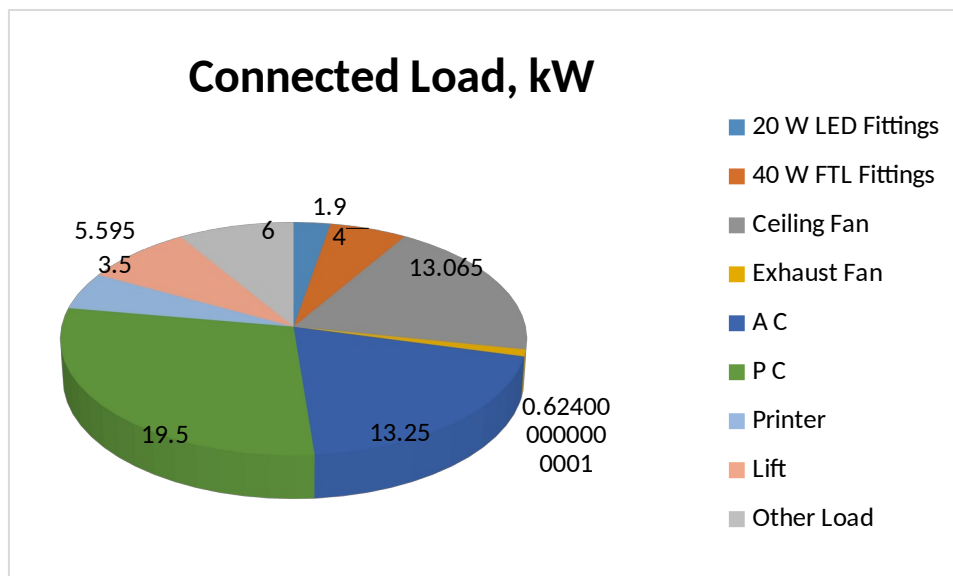
STUDY OF CONNECTED LOAD

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

Table No 1: Study of Equipment wise Connected Load:

No	Equipment	Qty	Load/Unit, W	Load, kW
1	20 W LED Fittings	95	20	1.9
2	40 W FTL Fittings	100	40	4
3	Ceiling Fan	201	65	13.07
4	Exhaust Fan	12	52	0.62
5	A C	10	1325	13.25
6	P C	130	150	19.5
7	Printer	20	175	3.5
8	Lift	1	5595	5.60
9	Other Load	30	200	6
10	Total			67

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 Energy & LPG Purchase Analysis- 2022-23:

No	Month	Energy Purchased, kWh	LPG Consumed, Kg	CO ₂ Emissions, MT
1	Apr-22	2796	10	2.54
2	May-22	2628	9	2.39
3	Jun-22	2696	10	2.45
4	Jul-22	2794	9	2.54
5	Aug-22	2905	9	2.64
6	Sep-22	3015	9	2.74
7	Oct-22	3118	10	2.83
8	Nov-22	2967	10	2.70
9	Dec-22	2896	10	2.63
10	Jan-23	2998	9	2.72
11	Feb-23	2785	9	2.53
12	Mar-23	3006	10	2.73
13	Total	34604	114	31.45
14	Maximum	3118	10	2.83
15	Minimum	2628	9	2.39
16	Average	2883.67	9.5	2.62

Chart No 2: Variation in Monthly Energy Purchased, kWh:

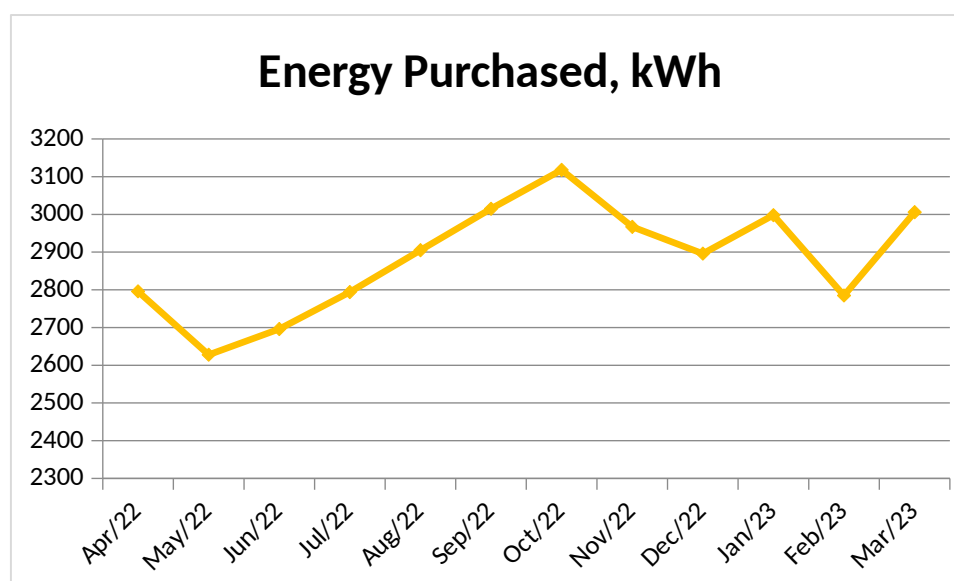
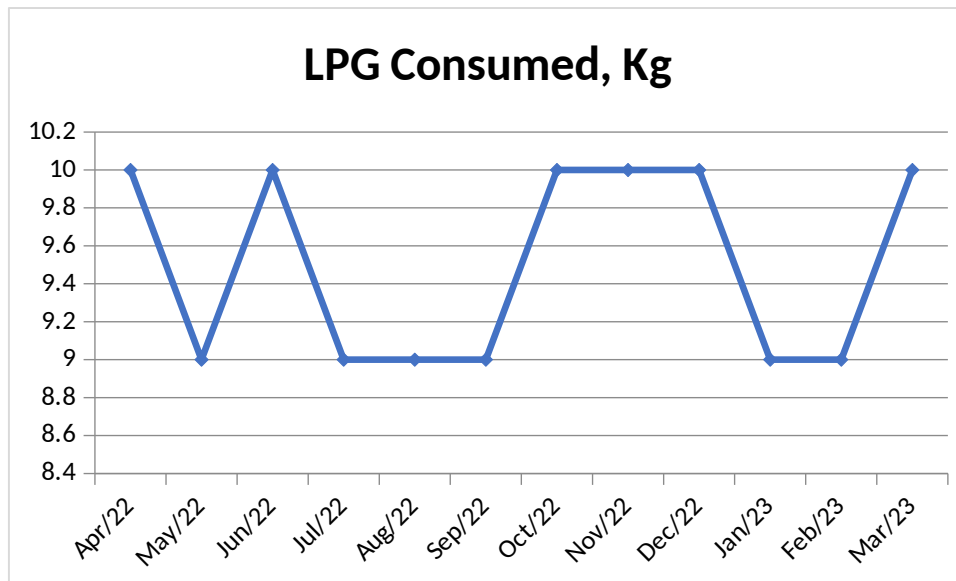


Chart No3: Variation in Monthly LPG Purchased, kWh:



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 College as under:

Table No 3: Computation of Energy Performance Index:

No	Particulars	Value	Unit
1	Total Annual Energy Purchased	34604	kWh
2	Energy Generated by Solar PV Plant	12000	kWh
3	Total Energy Consumed= 1+2	46604	kWh
4	Total Built up area of College	4981	m ²
5	Energy Performance Index =(3) / (4)	9.36	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 the Lighting Power Density of Class Room and the percentage usage of LED Lighting to total Lighting Load of the College.

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

Table No 4: Computation of Lighting Power Density: Class Room:

No	Particulars	Value	Unit
1	Qty of 40 W Fittings in Class Room:	6	Nos
2	Load of 40 W Fitting	40	W/unit
3	Total Load of 6 Nos, 40 W Fittings	240	W
4	Built up area of Class Room: GF-07	75	m ²
5	Lighting Power Density = (3)/(4)	3.2	W/m ²

Table No 5: Percentage Usage of LED Lighting to Total Lighting Load:

No	Particulars	Value	Unit
1	No of 40 W FTL Tube Lights	100	Nos

2	Demand of 40 W FTL Tube Light	40	W/Unit
3	Total Electrical Load of 40 W FTL Fittings	4	kW
4	No of 20 W LED Tube Lights	95	Nos
5	Demand of 20 W LED Tube Light	20	W/Unit
6	Total Electrical Load of 20 W LED Fittings	1.9	kW
7	Total LED Lighting Load= 6	1.9	kW
8	Total Lighting Load=3+6	5.9	kW
9	% of LEDs to Total Lighting Load = $7*100/8$	32.20	%

CHAPTER-VI

STUDY OF RENEWABLE ENERGY & ENERGY EFFICIENCY

6.1 Usage of Renewable Energy:

The College has installed:

- Roof Top Solar PV Plant of Capacity 10 kWp

Photograph of Roof Top Solar PV Plant:



6.2 Energy Efficiency Measures adopted:

- The College has Energy Efficient LED Fittings.

Photograph of LED Lighting:

