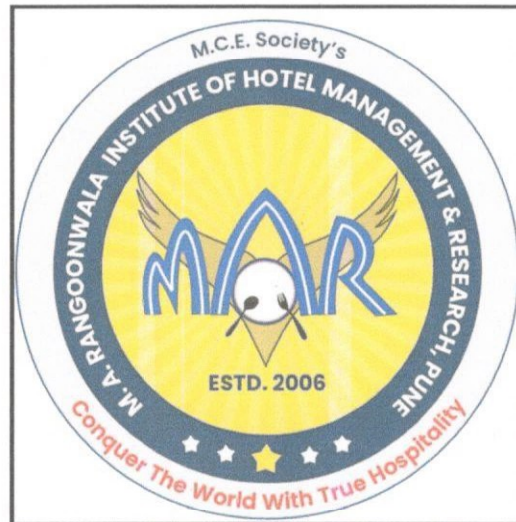


ENERGY AUDIT REPORT

of

Maharashtra Cosmopolitan Education Society's,
**M. A. RANGOONWALA INSTITUTE OF HOTEL
MANAGEMENT & RESEARCH PUNE**

Azam Campus, K B Hidaytullah Road, Camp, Pune 411 001



Year: 2022-23

Prepared by:

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/MARIHM/22-23/01

Date: 14/7/2023

This is to certify that we have conducted an Energy Audit at Maharashtra Cosmopolitan Education Society's M. A. Rangoonwala Institute of Hotel Management & Research Pune, Camp, Pune 411 001, 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,



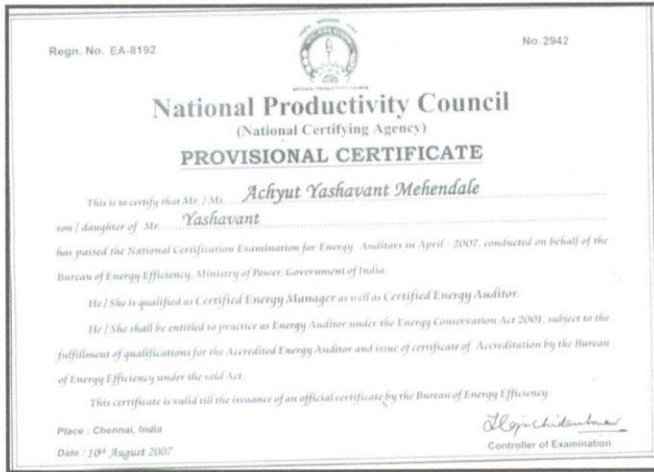
A Y Mehendale,

B E-Mechanical, M Tech- Energy

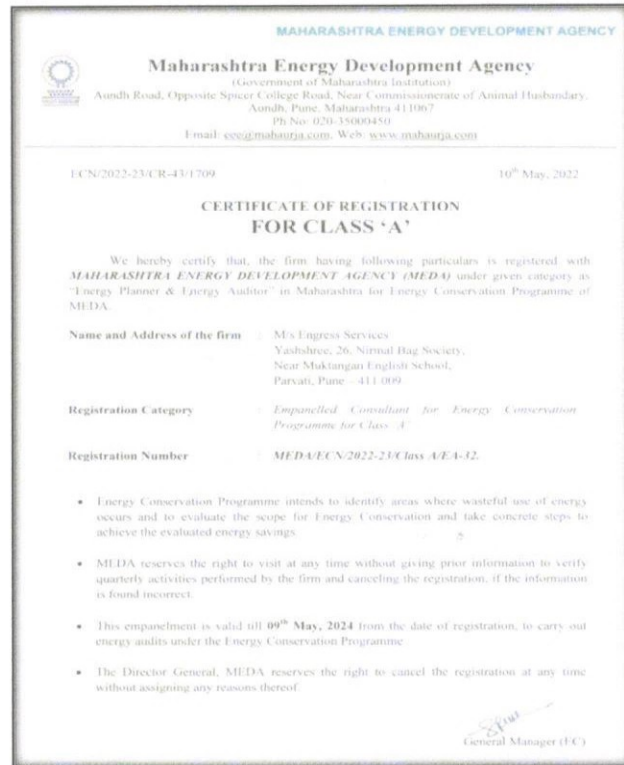
BEE Certified Energy Auditor, EA-8192



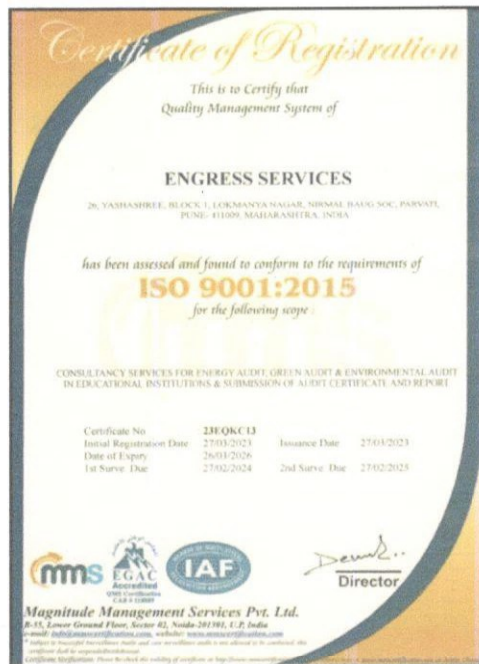
REGISTRATION CERTIFICATES



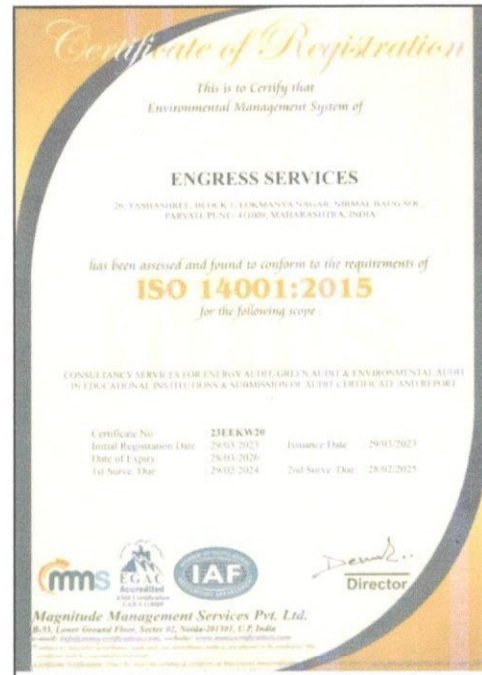
AUDITOR CERTIFICATE



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 Maharashtra Cosmopolitan Education Society's M. A. Rangoonwala Institute of Hotel Management & Research Pune, Camp, Pune 411 001 for awarding us the assignment of Energy Audit of their Pune Campus for the Year: 2022-23.

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

EXECUTIVE SUMMARY

1. Maharashtra Cosmopolitan Education Society's M. A. Rangoonwala Institute of Hotel Management & Research Pune, Camp, Pune 411 001 consumes Energy in the form of Electrical Energy & LPG; used for various Equipment.

2. Present Connected Load & Energy Consumption:

No	Particulars	Value	Unit
1	Total Connected Load	36	kW
2	Annual Energy Purchased	29205	kWh
3	Annual LPG Consumed	1330	Kg

3. Energy Performance Index:

No	Particulars	Value	Unit
1	Annual Energy Purchased	29205	kWh
2	Annual Solar Energy Generated	60000	kWh
3	Annual Energy Consumed =1+2	89205	kWh
4	Total Built up area of Institute	2072.16	m ²
5	Energy Performance Index =(3) / (4)	43.05	kWh/m ²

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

No	Particulars	Value	Unit
1	Lighting Power Density	1.06	W/m ²
2	% of Usage of LED Lighting to Total Lighting Load	88.37	%

5. Renewable Energy & Energy Efficiency Projects:

- Usage of Energy Efficient LED fittings
- Usage of BEE STAR Rated ACs
- Installation of **50 kWp** Roof Top Solar PV Plant

6. Assumptions:

1. Electrical Energy consumption is computed based on Capacity 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

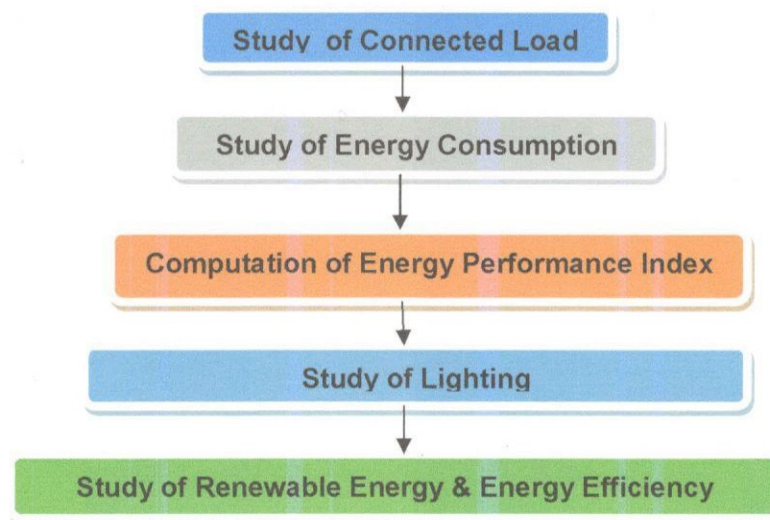
1.1 Introduction:

An Energy Audit is conducted at Maharashtra Cosmopolitan Education Society's M. A. Rangoonwala Institute of Hotel Management & Research 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 Institute Location Image:



Institute
Campus



CHAPTER-II

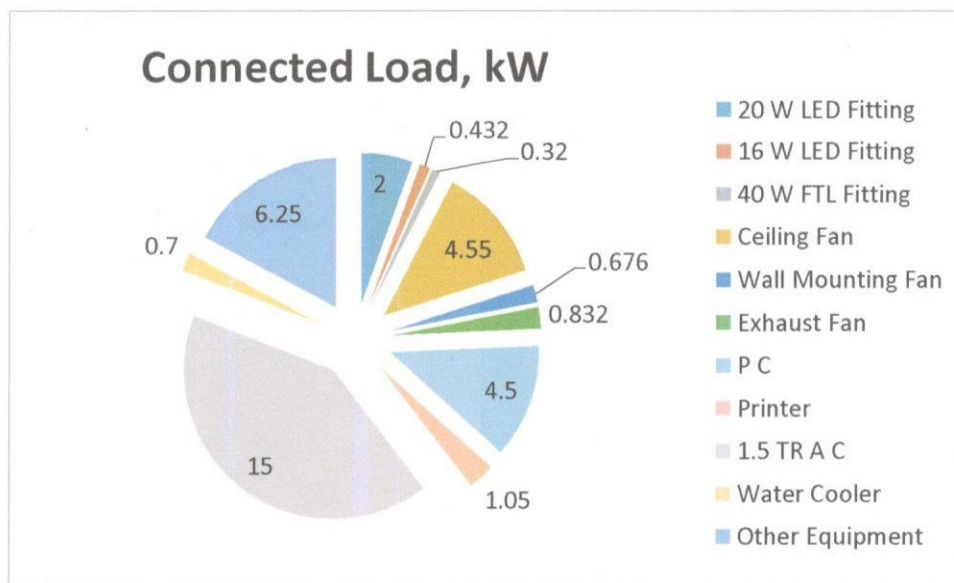
STUDY OF CONNECTED LOAD

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	20 W LED Fitting	100	20	2
2	16 W LED Fitting	27	16	0.432
3	40 W FTL Fitting	8	40	0.32
4	Ceiling Fan	70	65	4.55
5	Wall Mounting Fan	13	52	0.676
6	Exhaust Fan	16	52	0.832
7	P C	30	150	4.5
8	Printer	6	175	1.05
9	1.5 TR A C	8	1875	15
10	Water Cooler	2	350	0.7
11	Other Equipment	25	250	6.25
12	Total			36

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 Consumption Analysis- 2022-23:

No	Month	Energy Purchased, kWh	LPG Consumed, Kg	CO ₂ Emissions, MT
1	Apr-22	2295	112	2.37
2	May-22	2336	116	2.41
3	Jun-22	2456	111	2.51
4	Jul-22	2635	111	2.67
5	Aug-22	2239	111	2.31
6	Sep-22	2965	126	3.01
7	Oct-22	2069	124	2.19
8	Nov-22	2375	103	2.41
9	Dec-22	2436	111	2.49
10	Jan-23	2175	115	2.27
11	Feb-23	2239	95	2.27
12	Mar-23	2985	95	2.94
13	Total	29205	1330	29.85
14	Maximum	2985	126	3.01
15	Minimum	2069	95	2.19
16	Average	2433.75	110.83	2.49

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

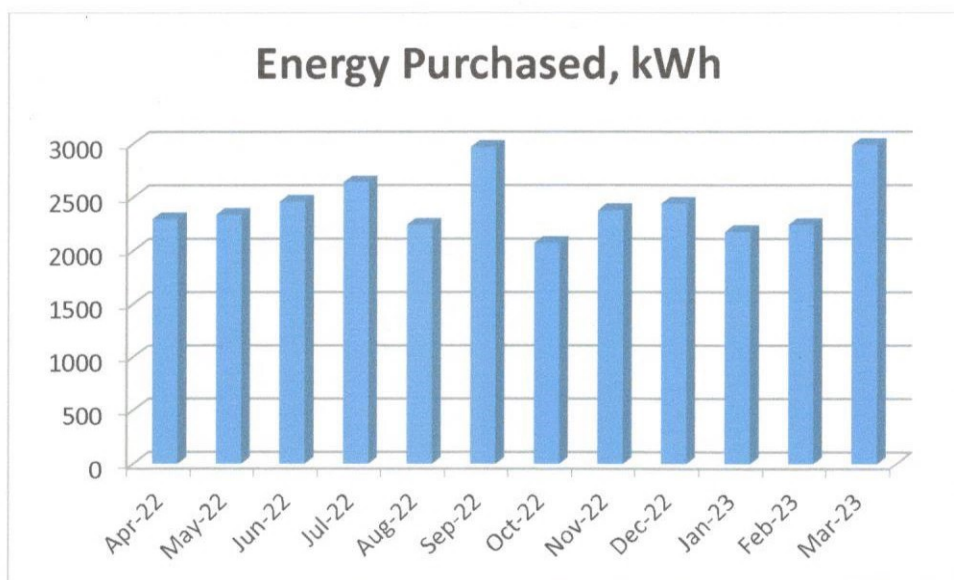
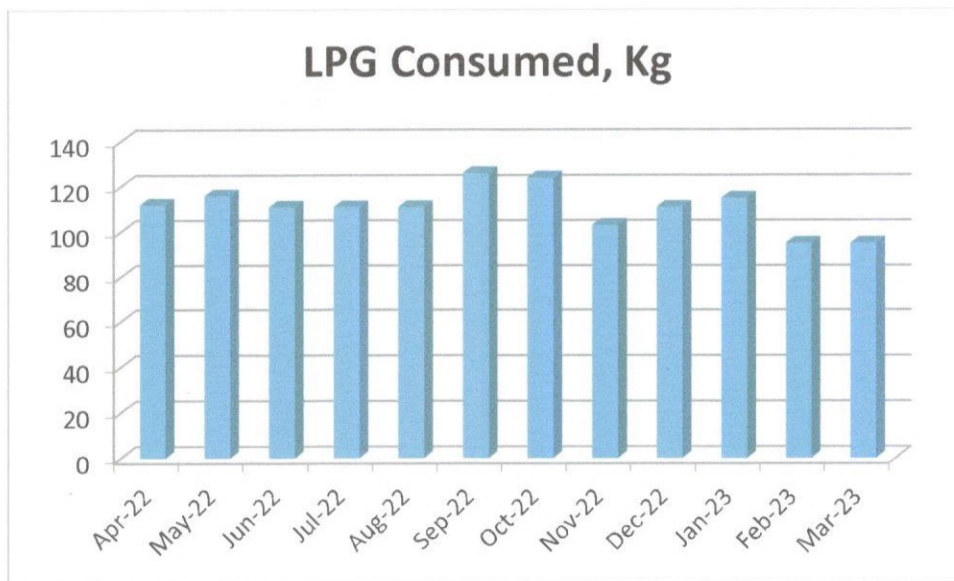


Chart No 3: Variation in Monthly LPG Consumed, kWh:



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 Institute as under:

Table No 3: Computation of Energy Performance Index:

No	Particulars	Value	Unit
1	Total Annual Energy Purchased	29205	kWh
2	Energy Generated by Solar PV Plant	60000	kWh
3	Total Energy Consumed= 1+2	89205	kWh
4	Total Built up area of Institute	2072.16	m ²
5	Energy Performance Index =(3) / (4)	43.05	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 meter 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 meter 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 Institute.

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

Table No 4: Computation of Lighting Power Density: Trg Kitchen: ATK:

No	Particulars	Value	Unit
1	Qty of 20 WLED Fittings in Room	6	Nos
2	Load of 20 W FLED Fitting	20	W/unit
3	Total Load of 6 Nos, 20 W LED Fittings	120	W
4	Built up area of Class Room: GF-07	112.77	m ²
5	Lighting Power Density = (3)/(4)	1.06	W/m ²

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

No	Particulars	Value	Unit
1	No of 20 W LED Fitting	100	Nos
2	Load/unit of 20 W LED Fitting	20	W
3	Total Load of 20 W LED Fittings	2	kW
4	No of 16 W LED Fitting	27	Nos
5	Load/unit of 16 W LED Fitting	16	W
6	Total Load of 16 W LED Fittings	0.432	kW
7	No of 40 W FTL Fitting	8	Nos
8	Load/unit of 40 W FTL Fitting	40	W
9	Total Load of 40 W FTL Fittings	0.32	kW
10	Total LED Lighting Load = 3+6	2.432	kW
11	Total Lighting Load = 3+6+9	2.752	kW
12	% of LED to Total Lighting Load = $10 \times 100 / 11$	88.37	%

CHAPTER-VI

STUDY OF RENEWABLE ENERGY & ENERGY EFFICIENCY

6.1 Usage of Renewable Energy:

The Institute has installed:

- Roof Top Solar PV Plant of Capacity 50 kWp

Photograph of Roof Top Solar PV Plant:



6.2 Energy Efficiency Measures adopted:

- The Institute has Energy Efficient LED Fittings.
- Usage of BEE STAR Rated ACs

Photographs of STAR Rated AC & LED Lighting:

