

ENERGY AUDIT REPORT
of
SMT. K. L. TIWARI COLLEGE OF ARCHITECTURE,
Shree L. R. Tiwari Educational Complex, Mira Road (East) 401 107



Year: 2022-23

Prepared by:

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

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

ENERGY AUDIT CERTIFICATE

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

Date: 13/7/2023

CERTIFICATE

This is to certify that we have conducted Energy Audit at Smt. K. L. Tiwari College of Architecture, Mira Road (East) 401 107 in the Academic year 2022-23.

.The College has adopted following Energy Efficient Practices:

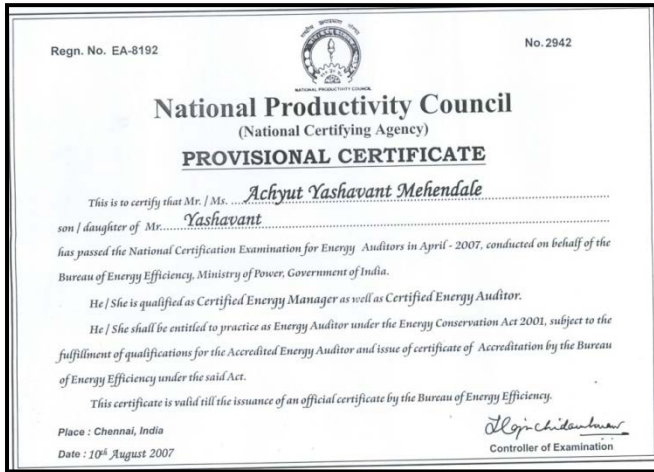
- Usage of Energy Efficient LED Fittings
- Usage of Energy Efficient BEE STAR Rated equipment
- Maximum usage of Day Lighting

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,
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 Smt. K L. Tiwari College of Architecture, Mira Road (East) 401 107, for awarding us the assignment of Energy Audit of their Campus for the Year: 2022-23.

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

EXECUTIVE SUMMARY

1. Smt. K. L. Tiwari College of Architecture, Mira Road consumes Energy in the form of Electrical Energy; used for various Electrical Equipment, office & other facilities.

2. Present Connected Load & Energy Consumption:

No	Particulars	Value	Unit
1	Total Connected Load	48.44	kW
2	Annual Energy Purchased	44151	kWh

3. Energy Performance Index:

No	Particulars	Value	Unit
1	Total Annual Energy Purchased	44151	kWh
2	Total Built up area of College	3010	m ²
3	Energy Performance Index =(1) / (2)	14.67	kWh/m ²

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

No	Particulars	Value	Unit
1	Lighting Power Density	2.51	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
- Usage of BEE STAR Rated Equipment

6. Assumptions:

1. Energy Consumption is computed based on Load Factor
2. 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
BEE	:	Bureau of Energy Efficiency
FTL	:	Fluorescent Tube Light
CFL	:	Compact Fluorescent Light
PV	:	Photo Voltaic
Kg	:	Kilo Gram
kWh	:	kilo-Watt Hour
CO ₂	:	Carbon Di Oxide
MT	:	Metric Ton

CHAPTER-I INTRODUCTION

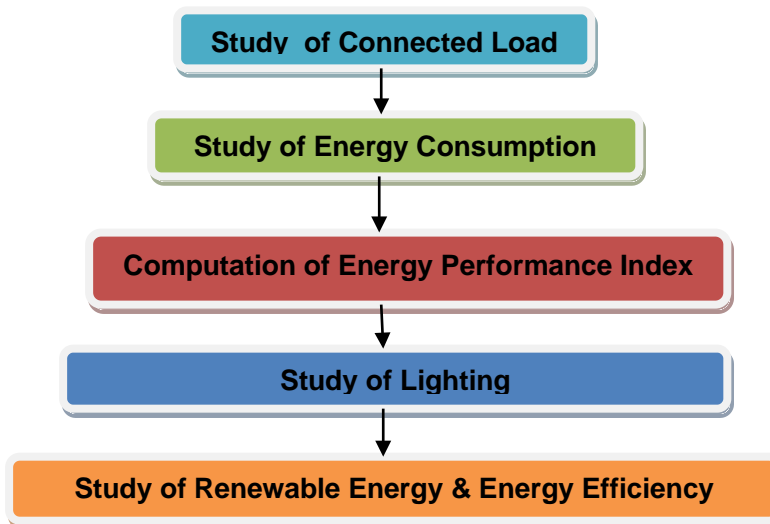
1.1 Introduction:

An Energy Audit is conducted at Smt. K L. Tiwari College of Architecture, Mira Road (East) 401 107.

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 Google Earth Image:



College
Campus

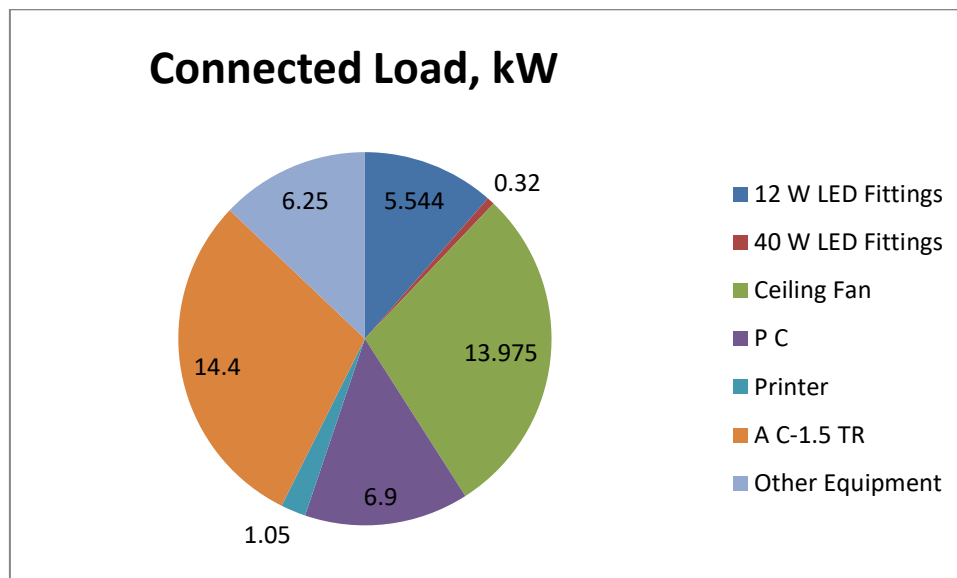
CHAPTER-II STUDY OF CONNECTED LOAD

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

Table No 2: Study of Equipment wise Connected Load:

No	Equipment	Qty	Load, W/unit	Load, kW
1	12 W LED Fittings	462	12	5.544
2	40 W LED Fittings	8	40	0.32
3	Ceiling Fan	215	65	13.98
4	P C	46	150	6.9
5	Printer	6	175	1.05
6	A C-1.5 TR	8	1800	14.4
7	Other Equipment	25	250	6.25
8	Total			48.44

Chart No 1: Study of Connected Load:



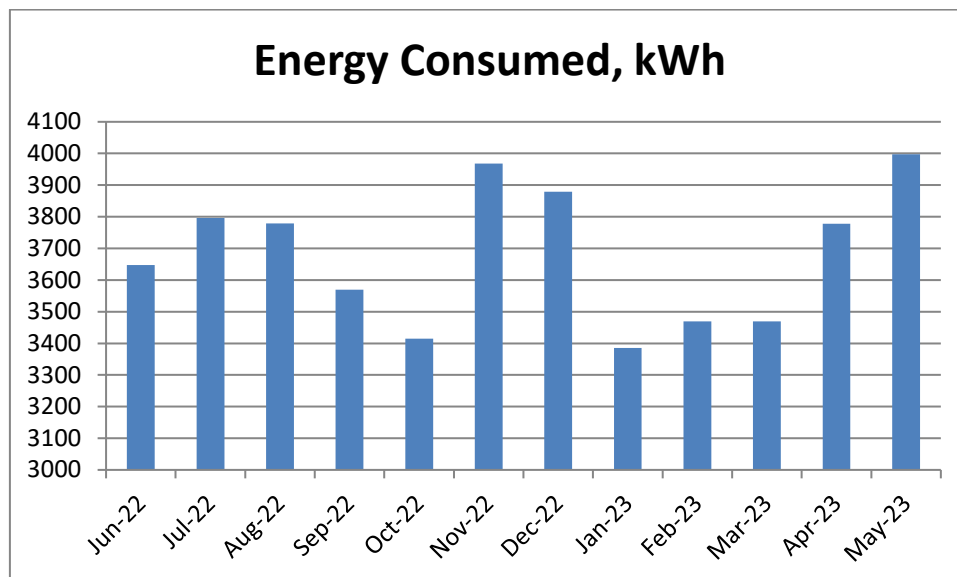
CHAPTER-III STUDY OF PRESENT ENERGY CONSUMPTION

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

Table No 3: Electrical Bill Analysis- 2022-23:

No	Month	Energy Consumed, kWh	CO ₂ Emissions, MT
1	Jun-22	3647	3.28
2	Jul-22	3796	3.42
3	Aug-22	3779	3.40
4	Sep-22	3569	3.21
5	Oct-22	3415	3.07
6	Nov-22	3968	3.57
7	Dec-22	3879	3.49
8	Jan-23	3385	3.05
9	Feb-23	3469	3.12
10	Mar-23	3469	3.12
11	Apr-23	3778	3.40
12	May-23	3997	3.60
13	Total	44151	39.74
14	Maximum	3997	3.60
15	Minimum	3385	3.05
16	Average	3679.25	3.31

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 College as under:

Table No 3: Computation of Energy Performance Index:

No	Particulars	Value	Unit
1	Total Annual Energy Purchased	44151	kWh
2	Total Built up area of College	3010	m ²
3	Energy Performance Index =(1) / (2)	14.67	kWh/m²

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: Lecture Room:

No	Particulars	Value	Unit
1	Qty of 12 W LED Fittings in Lecture Room	15	Nos
2	Load of 12 W LED Fitting	12	W/unit
3	Total Load of 15 Nos, 12 W LED Fittings	180	W
4	Carpet Area of Lecture Room	71.70	m ²
5	Lighting Power Density = (3)/(4)	2.51	W/m ²

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

No	Particulars	Value	Unit
1	Qty of 12 W LED Fittings	462	Nos
2	Load per unit of 12 W LED Fitting	12	W
3	Total Load of 12 W LED Fittings	5.544	kW
4	Qty of 40 W LED Fittings	8	Nos
5	Load per unit of 40 W LED Fitting	40	W
6	Total Load of 40 W LED Fittings	0.32	kW
7	Total LED Lighting Load= 3+6	5.864	kW
8	Total Lighting Load= 3+6	5.864	kW
9	% of LEDs to Total Lighting Load = $7 \times 100 / 8$	100	%

CHAPTER-VI

STUDY OF RENEWABLE ENERGY & ENERGY EFFICIENCY

6.1 Usage of Renewable Energy:

- The College has yet to install Roof Top Solar PV Plant

6.2 Energy Efficiency Projects:

- Usage of Energy Efficient LED Lighting
- Usage of Energy Efficient BEE STAR Rated Equipment

Photographs of LED Lighting & STAR Rated AC:

