

ENERGY AUDIT REPORT

YASHAWANTRAO CHAVAN MAHARASHTRA OPEN UNIVERSITY,

Dnyangangotri, Near Gangapur Dam, Nashik 422 222



Year: 2023-24

Prepared by:

ENGRESS SERVICES

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MEDA Regn. No: ECN/2023-24/CR-43/1709
ISO: 9001-2015 Certified (Cert No: 23EQKC13),
ISO: 14001-2015 Certified (Cert No: 23EEKW20)



Certificate No: ES/YCMOU/23-24/01

Date: 18/7/2024

This is to certify that we have conducted Energy Audit at Yashwantrao Chavan Maharashtra Open University, Dnyangangotri, Near Gangapur Dam, Nashik in the year 2023-24.

The University has adopted following Energy Efficient practices:

- Usage of Energy Efficient LED Fittings
- Usage of BEE STAR Rated Equipment
- Installation Off Grid 218.184 kWp Capacity Solar PV Plant
- Installation of 27000 LPD Solar Thermal Water Heating System

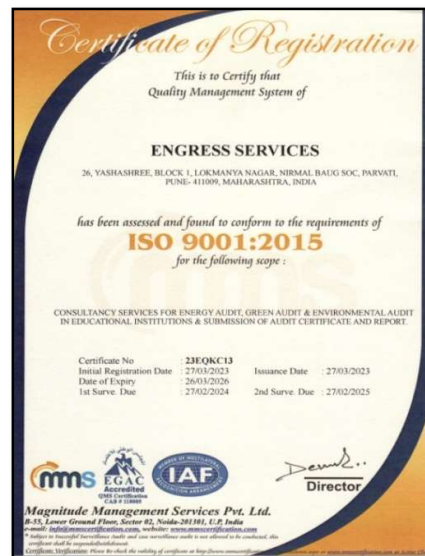
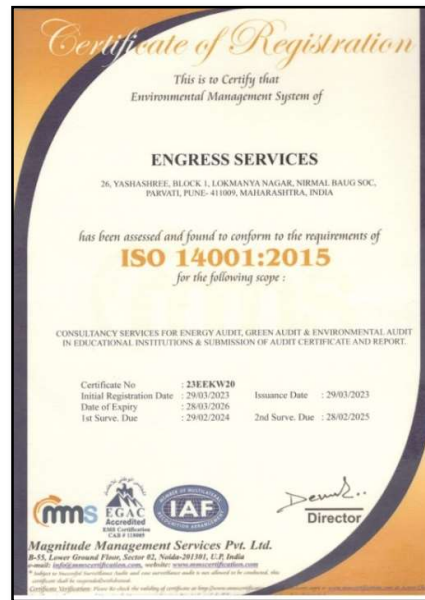
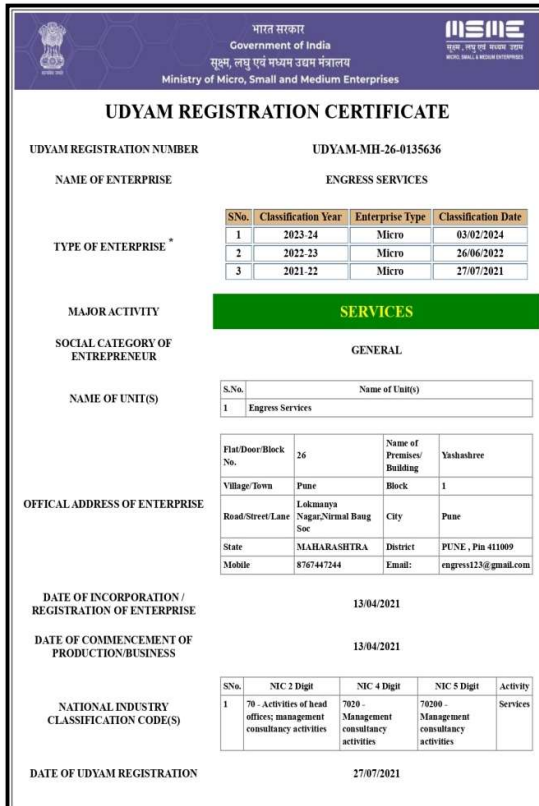
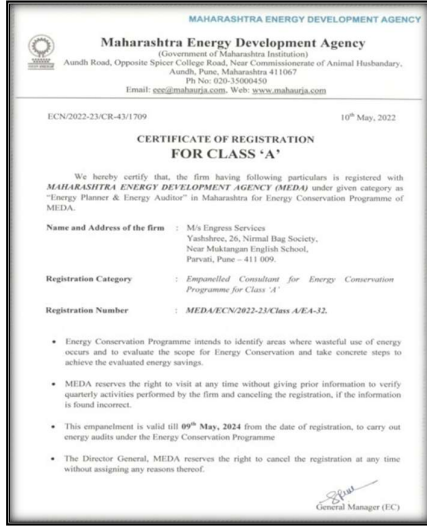
We appreciate the support of Management, involvement of faculty members and students in the process of making the Campus Energy Efficient.

For Engress Services,

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



REGISTRATION CERTIFICATES: BEE, UDYAM, MEDA, ISO-9001 & 14001:



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ACKNOWLEDGEMENT

We at Engress Services, Pune, express our sincere gratitude to the management of Yashwantrao Chavan Maharashtra Open University, Dnyangangotri, Near Gangapur Dam, Nashik 422 222 for awarding us the assignment of Energy Audit of their Nashik Campus, for the Year: 2023-24.

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

EXECUTIVE SUMMARY

1. **Yashwantrao Chavan Maharashtra Open University, Nashik** uses Energy in two forms, namely: **Electrical Energy and Diesel**; for various Equipment.

2. Present Connected Load & Energy Consumption:

No	Particulars	Value	Unit
1	Total Connected Load	872	kW
2	Annual Energy Purchased	593435	kWh
3	Annual Diesel Consumed	9240	Liters

3. Per Capita Energy Consumption Index:

No	Particulars	Value	Unit
1	Total Annual Energy Purchased	593435	kWh
2	Energy Generated by Solar PV Plant	261820.8	kWh
3	Total Energy Consumed= 1+2	855255.80	kWh
4	Total No of Students	20000	Nos
5	Per Capita Energy Consumption = (3) / (4)	43	kWh/Annum

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

No	Particulars	Value	Unit
1	Lighting Power density	7.89	W/m ²
2	% of Usage of LED Lighting to Total Lighting Load	100	%

5. Renewable Energy & Energy Efficiency Projects:

1. Usage of Energy Efficient LED fittings & BEE STAR Rated Equipment
2. The University has installed a **27000 LPD** Solar Thermal Water Heating System.
3. The Total Off Grid Solar PV Plant capacity is **218.184 kWp**.
4. The University is also going to install **300 kWp** Grid Connected Solar PV Plant

6. Assumptions:

1. **1 kWh** of Electrical Energy releases **0.93 Kg of CO₂** into atmosphere
2. **1 Liter of Diesel** releases **2.66 Kg of CO₂** into atmosphere
3. **1 kWp** Solar PV system generates **4 kWh** of Electrical Energy per Day
4. 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.ccd.gujarat.gov.in
- For Solar PV Energy Generation: www.rooftopsolar.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 Yashwantrao Chavan Maharashtra Open University Nashik.

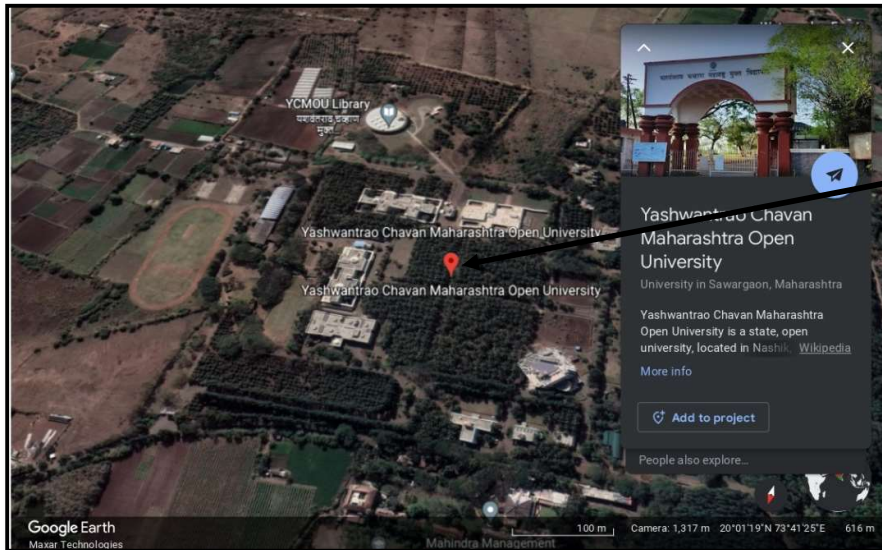
The guidelines followed for conducting the Energy Audit are:

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

1.2 Key Study Points:

No	Particulars
1	Study of Present Connected Load
2	Study of Present Energy Consumption
3	Study of Per Capita Energy Consumption
4	Study of Lighting
5	Study of Energy Efficiency & Renewable Energy

1.3 University Location Image:



University
Campus

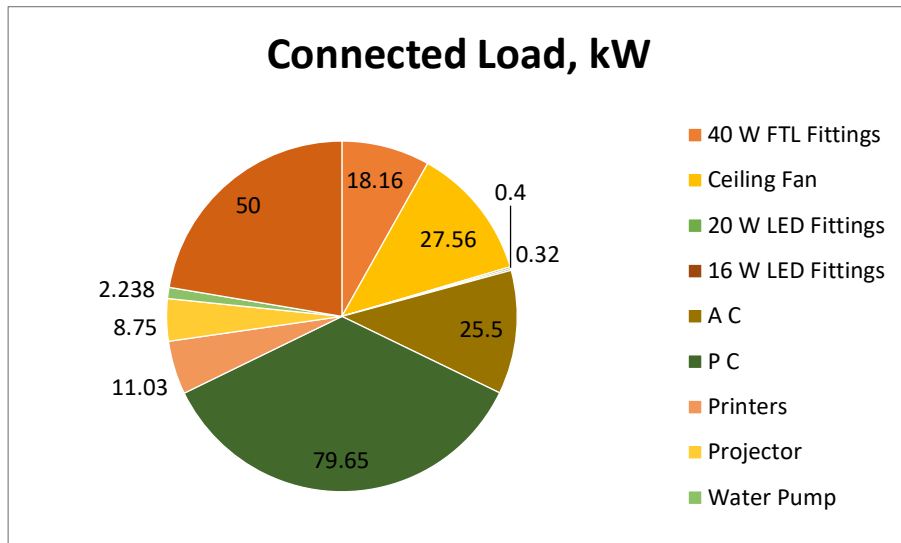
CHAPTER-II STUDY OF CONNECTED LOAD

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

Table No 1: Study of Equipment wise Connected Load:

No	Equipment	Qty	Load, W/Unit	Load, kW
1	15 W LED Fittings	728	15	10.92
2	20 W LED Fittings	1104	20	22.08
3	70 W LED Fittings	100	70	7.00
4	100 W LED Fittings	68	100	6.80
5	Ceiling Fans	410	65	26.65
6	P C	800	150	120
7	Printers	200	175	35
8	A C Load	317	1250	396.25
9	Water Pump Load	15	13667	205.01
10	Lift	4	6714	26.86
11	Other Equipment	100	150	15
12	Total			872

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 & Diesel Consumption Analysis- 2023-24:

No	Month	Energy Purchased, kWh	Diesel Consumed, Liters	CO ₂ Emissions, MT
1	Jul-23	44371	700	43.127
2	Aug-23	43944	1460	44.752
3	Sep-23	43054	2200	45.892
4	Oct-23	45634	300	43.238
5	Nov-23	40118	250	37.975
6	Dec-23	43500	250	41.120
7	Jan-24	45400	100	42.488
8	Feb-24	45488	300	43.102
9	Mar-24	53655	1200	53.091
10	Apr-24	62560	500	59.511
11	May-24	62299	1130	60.944
12	Jun-24	63412	850	61.234
13	Total	593435	9240	576.47
14	Maximum	63412	2200	61.23
15	Minimum	40118	100	37.97
16	Average	49452.92	770.00	48.04

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

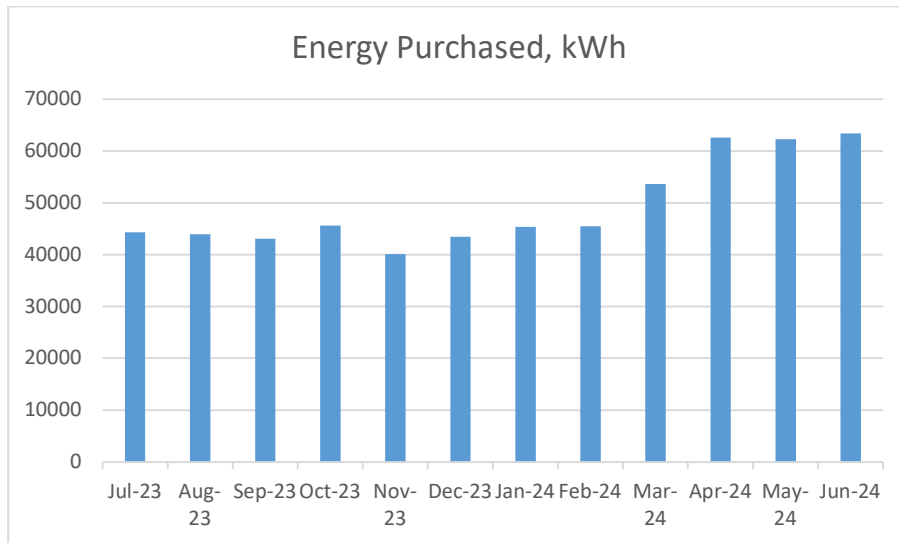
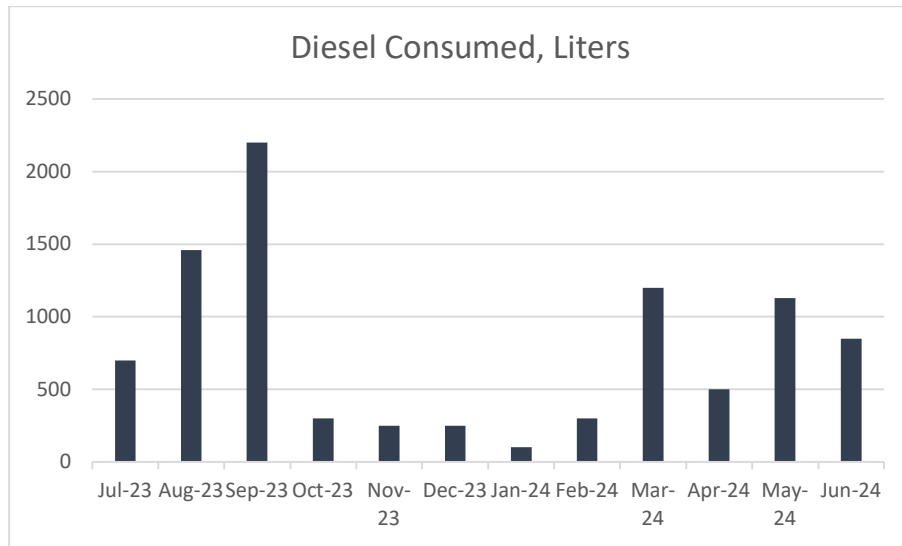


Chart No 3: Variation in Monthly Diesel Consumed, kWh:



CHAPTER-IV STUDY OF PER CAPITA ENERGY CONSUMPTION

Per Capita Energy Consumption Index: Per Capita Energy Consumption Index of an educational Institute/College is its Annual Energy Consumption in Kilo Watt Hours per student studying in the Institution.

It is determined by:

$$\text{Per Capita Energy Consumption Index} = \frac{\text{Annual Energy Consumption in kWh}}{\text{Total No of students studying}}$$

Now we compute the Per Capita Energy Consumption for the University as under:

Table No 3: Computation of Per Capita Energy Consumption:

No	Particulars	Value	Unit
1	Total Annual Energy Purchased	593435	kWh
2	Energy Generated by Solar PV Plant	261820.8	kWh
3	Total Energy Consumed= 1+2	855255.80	kWh
4	Total No of students	20000	Nos
5	Per Capita Energy Consumption = (3) / (4)	43	kWh/Annum

Note:

The University is an Open University. However, the University arranges many Training Programs in the University Campus. The number of Students considered for Calculations is the number of Students who attended the various Training Programs, in the University Campus, in the Year: 23-24.

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. 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 and the percentage usage of LED Lighting to total Lighting Load of the College.

Table No 4: Computation of Lighting Power Density: Executive Engineer Cabin:

No	Particulars	Value	Unit
1	Qty of 15 W LED Fittings in Executive Engineer Cabin	8	Nos
2	Load of 15 W LED Fitting	15	W/unit
3	Total Load of 8 Nos, 15 W LED Fittings	120	W
4	Built up area of Class Room:	15.21	m ²
5	Lighting Power Density = (3)/ (4)	7.89	W/m ²

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

No	Particulars	Value	Unit
1	Qty of 15 W LED Fittings	728	Nos
2	Load per unit of 15 W LED Fittings	15	W
3	Total Load of 15 W LED Fittings	10.92	kW
4	Qty of 20 W LED Fittings	1104	Nos
5	Load per unit of 20 W LED Fittings	20	W
6	Total Load of 20 W LED Fittings	22.08	kW
7	Qty of 70 W LED Fittings	100	Nos
8	Load per unit of 70 W LED Fittings	70	W
9	Total Load of 70 W LED Fittings	7	kW
10	Qty of 100 W LED Fittings	68	Nos
11	Load per unit of 100 W LED Fittings	100	W
12	Total Load of 100 W LED Fittings	6.8	kW
13	Total LED Lighting Load = 3+6+9+12	46.8	kW
14	Total Lighting Load = 3+6+9+12	46.8	kW
15	% of LEDs to Total Lighting Load= 13*14/100	100	%

CHAPTER-VI

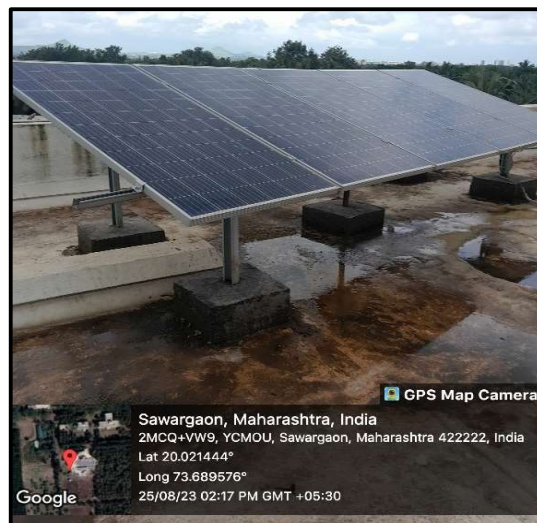
STUDY OF RENEWABLE ENERGY & ENERGY EFFICIENCY

6.1 Usage of Renewable Energy:

The University has installed:

- Roof Top Solar PV Plant on various Buildings, Solar Street Lights, Solar Based Traffic Signals & Solar High Mast Lights.
- The Total Installed Solar PV Capacity is **218.184 kWp**
- Solar Thermal Water Heating System of Capacity **27000** Liters per Day
- The University is also installing Grid Connected Solar PV Plant of Capacity **300 kWp**

Photograph of Roof Top Solar PV Plant & Solar Thermal Water Heating System:



6.2 Energy Efficiency Measures adopted:

- The University has Energy Efficient LED Fittings.
- Usage of BEE STAR Rated Equipment

Photographs of STAR Rated AC & Solar PV Based Lighting & BEE STAR Rated AC:

