

ENERGY AUDIT REPORT
of
REVA UNIVERSITY,
Yelahanka, Bengaluru



Year: 2021-22

Prepared by:

ENGRESS SERVICES

Yashashree, 26, Nirmal Bag Society
Near Mukhtangan 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

ENERGY AUDIT CERTIFICATE

Certificate No: ES/RUB/21-22/01

Date: 30/6/2022

This is to certify that we have conducted an Energy Audit at Reva University, Rukmini Knowledge Park, Kattigenhalli, Yelahanka, Bengaluru, in the Year 2021-22.

The University 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
- Installation of 80000 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

MAHARASHTRA ENERGY DEVELOPMENT AGENCY

Maharashtra Energy Development Agency
(Government of Maharashtra Institution)
Aundh Road, Opposite Spicer College Road, Near Commissionerate of Animal Husbandary,
Aundh, Pune, Maharashtra 411067
Ph No: 020-35000450
Email: eee@mahaerja.com, Web: www.mahaerja.com

ECN/2022-23/CR-43/1709 10th May, 2022

**CERTIFICATE OF REGISTRATION
FOR CLASS 'A'**


We hereby certify that, the firm having following particulars is registered with **MAHARASHTRA ENERGY DEVELOPMENT AGENCY (MEDA)** under given category as "Energy Planner & Energy Auditor" in Maharashtra for Energy Conservation Programme of MEDA.

Name and Address of the firm : M/s Engress Services
Yashshree, 26, Nirmal Bag Society,
Near Muktangan English School,
Parvati, Pune - 411 009.

Registration Category : Empanelled Consultant for Energy Conservation Programme for Class 'A'


Registration Number : MEDA/ECN/2022-23/Class A/EA-32.

- Energy Conservation Programme intends to identify areas where wasteful use of energy occurs and to evaluate the scope for Energy Conservation and take concrete steps to achieve the evaluated energy savings.
- MEDA reserves the right to visit at any time without giving prior information to verify quarterly activities performed by the firm and canceling the registration, if the information is found incorrect.
- This empanelment is valid till **09th May, 2024** from the date of registration, to carry out energy audits under the Energy Conservation Programme
- The Director General, MEDA reserves the right to cancel the registration at any time without assigning any reasons thereof.


General Manager (I.C)

MEDA Registration Certificate

Regn. No. EA-8192 No.2942

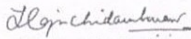

National Productivity Council
(National Certifying Agency)
PROVISIONAL CERTIFICATE

This is to certify that Mr./Ms. Achyut Yashavant Mehendale
son / daughter of Mr. Yashavant
has passed the National Certification Examination for Energy Auditors in April - 2007, conducted on behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India.

He / She is qualified as Certified Energy Manager as well as Certified Energy Auditor.

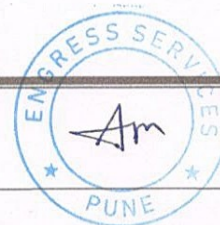
He / She shall be entitled to practice as Energy Auditor under the Energy Conservation Act 2001, subject to the fulfillment of qualifications for the Accredited Energy Auditor and issue of certificate of Accreditation by the Bureau of Energy Efficiency under the said Act.

This certificate is valid till the issuance of an official certificate by the Bureau of Energy Efficiency.

Place : Chennai, India 
Controller of Examination

Date : 10th August 2007

BEE Energy Auditor Certificate: EA-8192



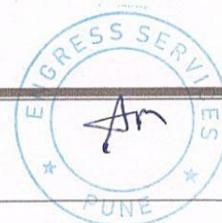
INDEX

Sr. No	Particulars	Page No
I	Acknowledgement	5
II	Executive Summary	6
III	Abbreviations	7
1	Introduction	8
2	Study of Connected Load	9
3	Study of Present Energy Consumption	10
4	Study of CO ₂ Emissions	12
5	Study of Lighting	14
6	Study of Renewable Energy	16

ACKNOWLEDGEMENT

We Engress Services, Pune, express our sincere gratitude to the management of Reva University, Rukmini Knowledge Park, Kattigenhalli, Yelahanka, Bengaluru for awarding us the assignment of Energy Audit of their Campus for the Year: 2021-22.

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



EXECUTIVE SUMMARY

1. **Reva University, Rukmini Knowledge Park, Kattigenhalli, Yelahanka, Bengaluru**, consumes Energy in the form of **Electrical Energy & Diesel**; used for various Electrical Equipment, Office & other equipment.

2. Present Connected Load & Annual Energy Consumption:

No	Particulars	Value	Unit
1	Total Connected Load	2098.4	kW
2	Annual Energy Consumption	2072390	kWh
3	Annual CO ₂ Emissions	1910.47	MT

3. Usage of Renewable Energy:

No	Particulars	Value	Unit
1	Total Energy Purchased	2012390	kWh
2	Energy Generated by Solar PV Plant	60000	kWh
2	Annual Energy Consumption	2072390	kWh
3	% Usage of Renewable Energy to Annual Energy requirement	2.90	%

4. Study of % of Usage of LED Lighting:

No	Particulars	Value	Unit
1	% of Usage of LED Lighting to Total Lighting Load	54.32	%

5. Assumptions:

- 1 kWh of Electrical Energy releases **0.9 Kg of CO₂** into atmosphere
- 1 Liter of Diesel releases **2.68 Kg of CO₂** into atmosphere.
- Average Solar Energy Generated by Solar PV Plant: **4 kWh/kWp per Day**
- Annual Solar Energy Generation Days: **300 Nos**

6. References:

- Audit Methodology: www.mahaurja.com
- For Solar PV Energy Generated: www.solarrooftop.gov.in
- For CO₂ Emissions: www.tatapower.com

ABBREVIATIONS

LED	:	Light Emitting Diode
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



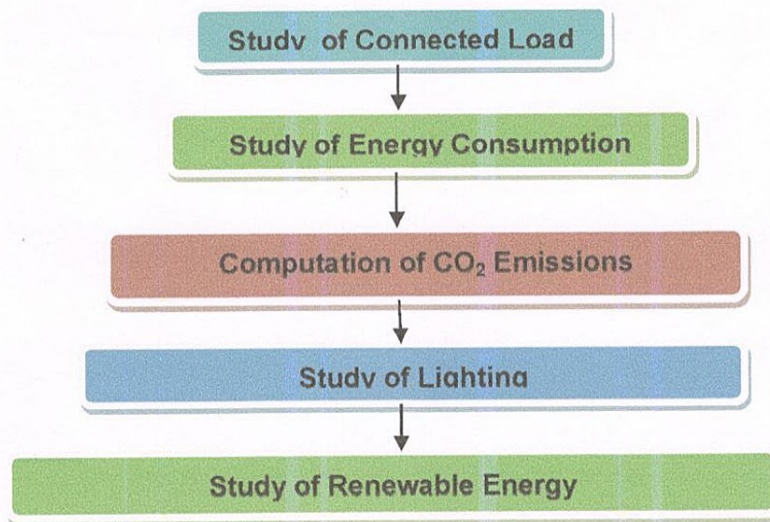
CHAPTER-I INTRODUCTION

1.1 Introduction:

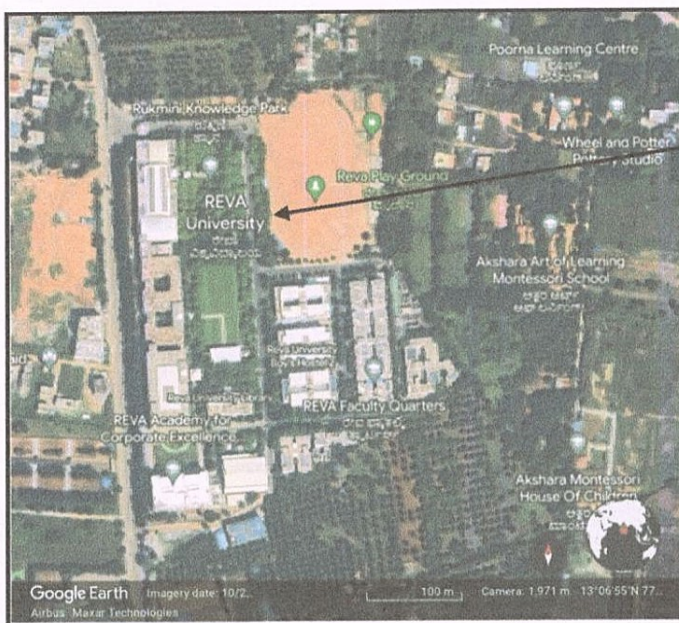
An Energy Audit is conducted at Reva University, Rukmini Knowledge Park, Kattigenhalli, Yelahanka, Bengaluru. The guidelines followed for conducting the Energy Audit are:

- Maharashtra Energy Development Agency (www.mahaurja.com)
- Tata Power: www.tatapower.com

1.2 Audit Procedural Steps:



1.3 University Location Image:



University
Campus



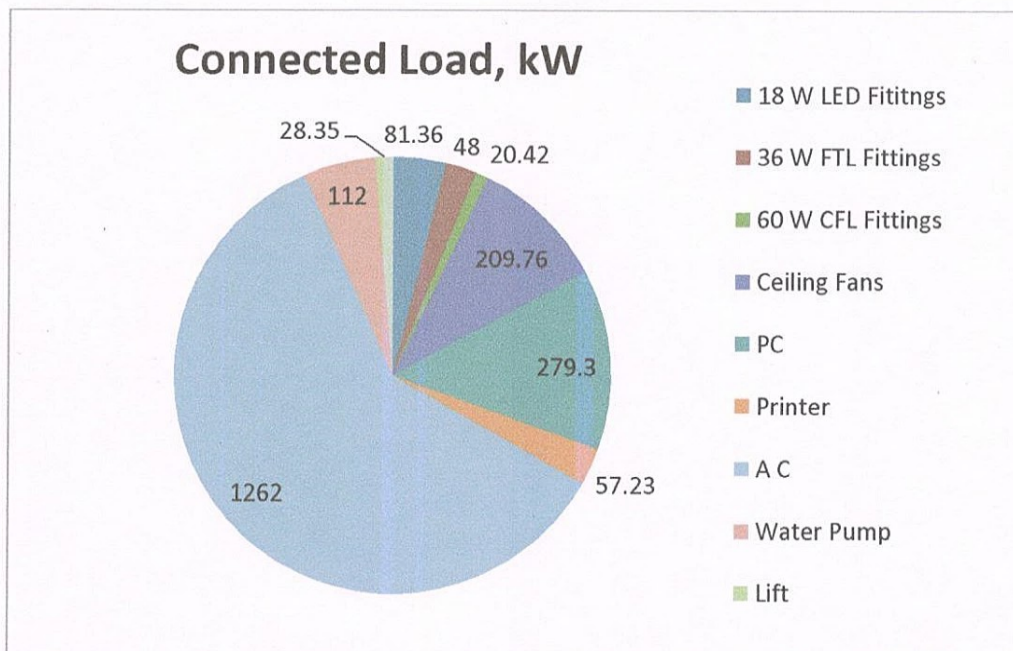
CHAPTER-II STUDY OF CONNECTED LOAD

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

Table No 1: Study of Equipment wise Connected Load:

No	Equipment	Qty	Load, W/Unit	Load, kW
1	18 W LED Fittings	4520	18	81.36
2	36 W FTL Fittings	1200	40	48
3	60 W CFL Fittings	319	64	20.42
4	Ceiling Fans	3227	65	209.76
5	PC	1862	150	279.3
6	Printer	327	175	57.23
7	A C	1051.35	1261.62	1262
8	Water Pump	151.4	112.9444	112
9	Lift	4	7087	28.35
10	Total			2098.4

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- 2021-22:

No	Month	Energy Purchased, kWh	Diesel Consumed, Liters
1	Apr-21	154116	2782
2	May-21	93310	509
3	Jun-21	85672	1272
4	Jul-21	102522	1437
5	Aug-21	114342	3275
6	Sep-21	188810	5030
7	Oct-21	201147	2641
8	Nov-21	218527	3108
9	Dec-21	222772	5465
10	Jan-22	185105	4459
11	Feb-22	176784	4978
12	Mar-22	269283	2102
13	Total	2012390	37058
14	Maximum	269283	5465
15	Minimum	85672	509
16	Average	167699.17	3088.17

Chart No 2: Variation in Monthly Energy Consumption:

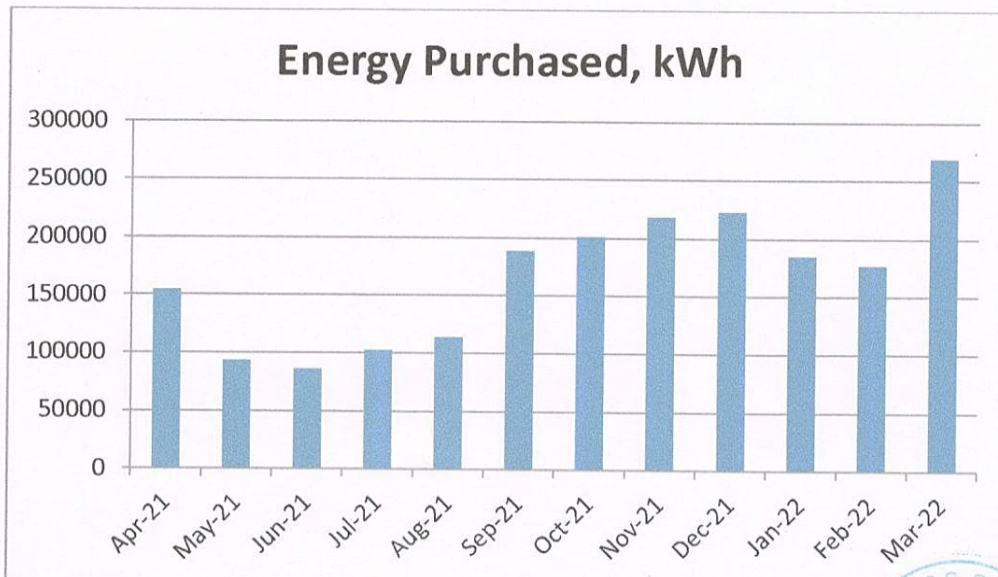


Chart No 3: Variation in Monthly Diesel Consumption:

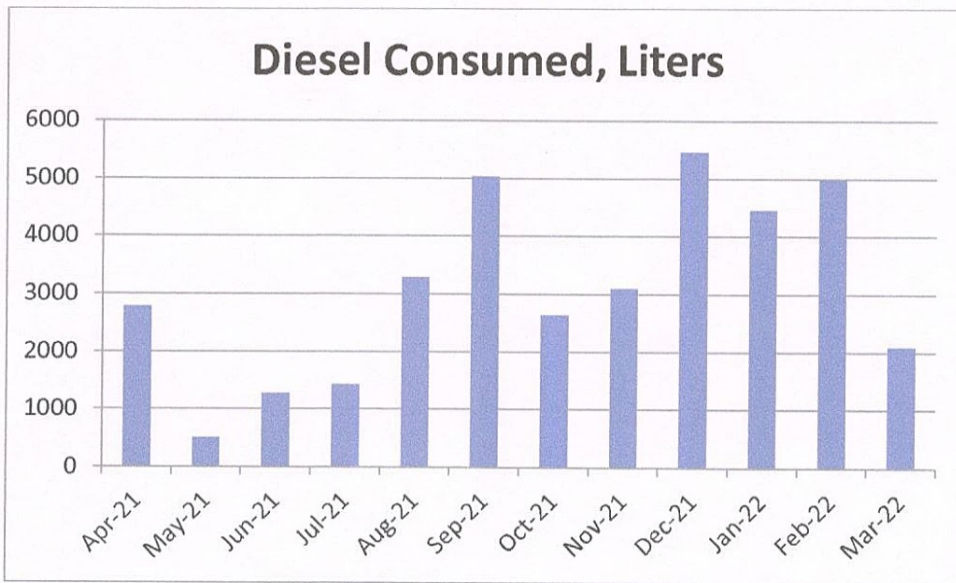


Table No 3: Important Parameters:

No	Parameter/ Value	Energy Purchased, kWh	Diesel Consumed, Liters
1	Total	2012390	37058
2	Maximum	269283	5465
3	Minimum	85672	509
4	Average	167699.17	3088.17

CHAPTER-IV STUDY OF CO₂ EMISSIONS

A Carbon Foot print is defined as the Total Greenhouse Gas emissions, emitted due to various activities.

In this we compute the emissions of Carbon-Di-Oxide, by usage of the various forms of Energy used by the Institute for performing its day to day activities

The University uses Electrical Energy & Diesel for various Electrical gadgets & equipment.

Basis for computation of CO₂ Emissions:

The basis of Calculation for CO₂ emissions due to Electrical Energy & Diesel are:

- 1 Unit (kWh) of Electrical Energy releases **0.9 Kg of CO₂** into atmosphere
- **1 Liter** of Diesel releases **2.68 Kg of CO₂** into atmosphere

Based on the above Data we compute the CO₂ emissions which are being released in to the atmosphere by the Institute due to its Day to Day operations.

Table No 4: Computation of CO₂ Emissions:

No	Month	Energy Purchased, kWh	Diesel Consumed, Liters	CO ₂ Emissions, MT
1	Apr-21	154116	2782	146.16
2	May-21	93310	509	85.34
3	Jun-21	85672	1272	80.51
4	Jul-21	102522	1437	96.12
5	Aug-21	114342	3275	111.68
6	Sep-21	188810	5030	183.41
7	Oct-21	201147	2641	188.11
8	Nov-21	218527	3108	205.00
9	Dec-21	222772	5465	215.14
10	Jan-22	185105	4459	178.54
11	Feb-22	176784	4978	172.45
12	Mar-22	269283	2102	247.99
13	Total	2012390	37058	1910.47
14	Maximum	269283	5465	247.99
15	Minimum	85672	509	80.51
16	Average	167699.17	3088.17	159.21

Chart No 4: Representation of Month wise CO₂ emissions:

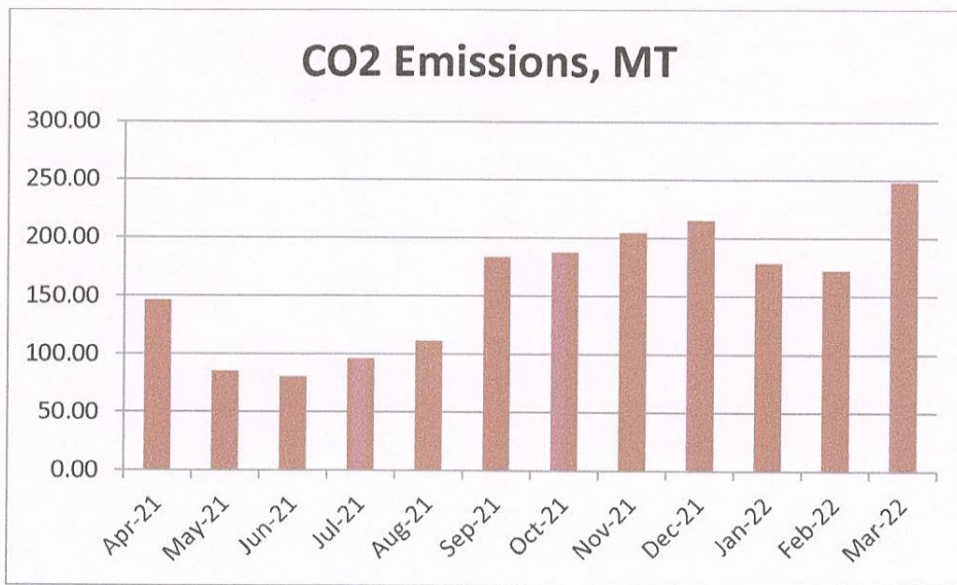


Table No 5: Key Parameters:

No	Value	Energy Purchased, kWh	Diesel Consumed, Liters	CO ₂ emissions, MT
1	Total	2012390	37058	1910.47
2	Maximum	269283	5465	247.99
3	Minimum	85672	509	80.51
4	Average	167699.17	3088.17	159.21

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 percentage usage of LED Lighting to total Lighting Load of the University.

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	Qty of 18 W LED Fittings	4520	Nos
2	Electrical Demand of 18 W LED Fitting	18	W/Unit
3	Total Load of 18 W LED Fittings	81.36	kW

4	Qty of 36 W FTL Fittings	1200	Nos
5	Electrical Demand of 36 W FTL Fitting	40	W/Unit
6	Total Load of 36 W FTL Fittings	48	kW
7	Qty of 60 W CFL Fittings	319	Nos
8	Electrical Demand of 60 W CFL Fitting	64	W/Unit
9	Total Load of 60 W CFL Fittings	20.416	kW
10	Total LED Lighting Load = 3	81.36	kW
11	Total Lighting Load =3+6+9	149.776	kW
12	% of LED Lighting Load to Total Lighting Load= $10 \times 100 / 11$	54.32	%

CHAPTER-VI STUDY OF RENEWABLE ENERGY

The University has installed Roof Top Solar PV Plant of Capacity 50 kWp.

In the following Table, we compute the percentage of Usage of Alternate Energy to Annual Energy Demand of the College.

Table No 7: Computation of % Annual Energy Demand met by Alternate Energy:

No	Particulars	Value	Unit
1	Installed Capacity of Roof Top Solar PV Plant	50	LPD
2	Electrical Energy generated by Solar PV Plant	4	kWh/kWp
3	Annual Energy Generation Days	300	Nos/Annum
4	Total Energy Generated in 21-22= 1 * 2 * 3	60000	kWh/Annum
5	Energy purchased from Electricity Board	2012390	kWh
6	Total Energy Requirement = 4+5	2072390	kWh
7	% of Usage of Alternate Energy = $4 \times 100 / 6$	2.90	%

Photograph of Solar Power System:

