

ENERGY AUDIT REPORT
of
REVA UNIVERSITY,
Yelahanka, Bengaluru



Year: 2020-21

Prepared by:

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CERTIFICATE

Certificate No: ES/RUB/20-21/01

Date: 5/7/2021

This is to certify that we have conducted an Energy Audit at Reva University, Rukmini Knowledge Park, Kattigenhalli, Yelahanka, Bengaluru, in the Year 2020-21.

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 Enrich Consultants,




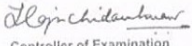
A Y Mehendale,
B E-Mechanical, M Tech- Energy
BEE Certified Energy Auditor, EA-8192



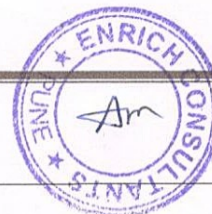
Registration Certificates

 MAHARASHTRA ENERGY DEVELOPMENT AGENCY <small>An ISO 9001:2000 Reg. no. HQ 91 / 2482</small>	
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@mahaurja.com, Web: www.mahaurja.com	
ECN/2021-22/CR-14/1577	22 nd April, 2021
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 Enrich Consultants Yashashree, Plot No. 26, Nirmal Bag Society, Near Mukhtangan English School, Parvati, Pune - 411009.
Registration Category	: <i>Empanelled Consultant for Energy Conservation Programme for Class 'A'</i>
Registration Number	: MEDA/ECN/2021-22/Class A/EA-03
<ul style="list-style-type: none"> • 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 21st April, 2023 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 (EC)	

MEDA Registration Certificate

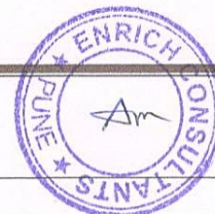
Regn. No. EA-8192		No. 2942
National Productivity Council (National Certifying Agency) PROVISIONAL CERTIFICATE		
This is to certify that Mr. / Ms. <u>Achyut Yashavant Mehendale</u> son / daughter of Mr. <u>Yashavant</u> has passed the National Certification Examination for Energy Auditors in April - 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 : 10 th August 2007		

BEE Energy Auditor Certificate: EA-8192



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ACKNOWLEDGEMENT

We Enrich Consultants, 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: 2020-21.

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	885228	kWh
3	Annual CO ₂ Emissions	848	MT

3. Usage of Renewable Energy:

No	Particulars	Value	Unit
1	Total Energy Purchased	885228	kWh
2	Energy Generated by Solar PV Plant	60000	kWh
2	Annual Energy Consumption	945228	kWh
3	% Usage of Renewable Energy to Annual Energy requirement	6.35	%

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:

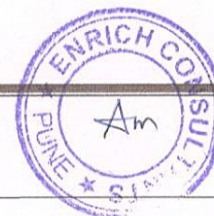
- 1 kWh of Electrical Energy releases **0.9 Kg of CO₂** into atmosphere
- 1 Liter of Diesel releases **2.68 Kg of CO₂** into atmosphere.
- Average Solar Energy Generated by Solar PV Plant: **4 kWh/kWp per Day**
- Annual Solar Energy Generation Days: **300 Nos**

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, in the Year: 2020-21.

The guidelines followed for conducting the Energy Audit are:

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

1.2 Audit Steps:

- Study of connected load
- Study of Energy Consumption
- Computation of CO₂ Emissions
- Study of Usage of Alternate Energy
- Study of LED Lighting



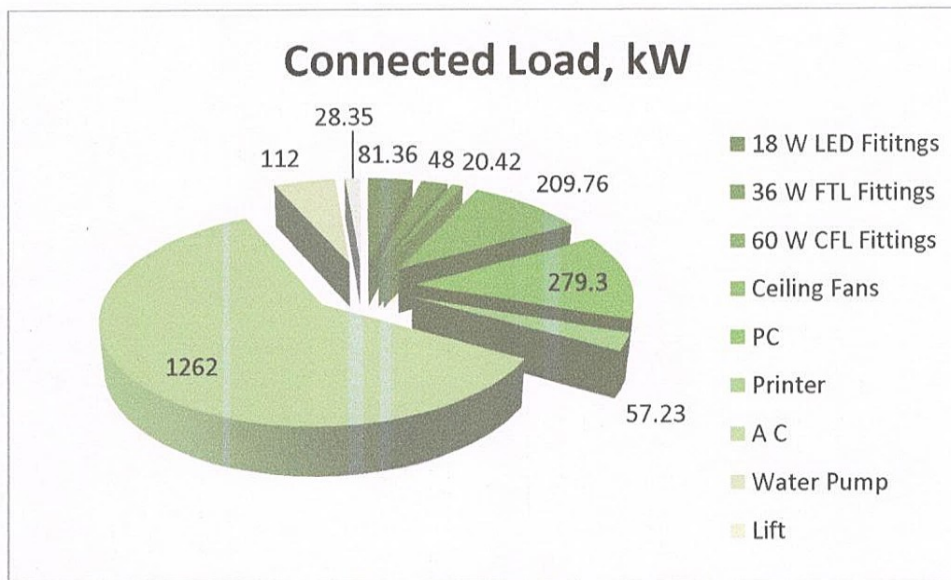
CHAPTER-II STUDY OF CONNECTED LOAD

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- 2020-21:

No	Month	Energy Purchased, kWh	Diesel Consumed, Liters
1	Apr-20	47776	788
2	May-20	19595	717
3	Jun-20	16278	680
4	Jul-20	19479	742
5	Aug-20	21725	756
6	Sep-20	35874	803
7	Oct-20	38218	1162
8	Nov-20	74299	1821
9	Dec-20	84653	2477
10	Jan-21	124020	3693
11	Feb-21	155570	2807
12	Mar-21	247740	2816
13	Total	885228	19262
14	Maximum	247740	3693
15	Minimum	16278	680
16	Average	73769	1605

Chart No 2: Variation in Monthly Energy Consumption:

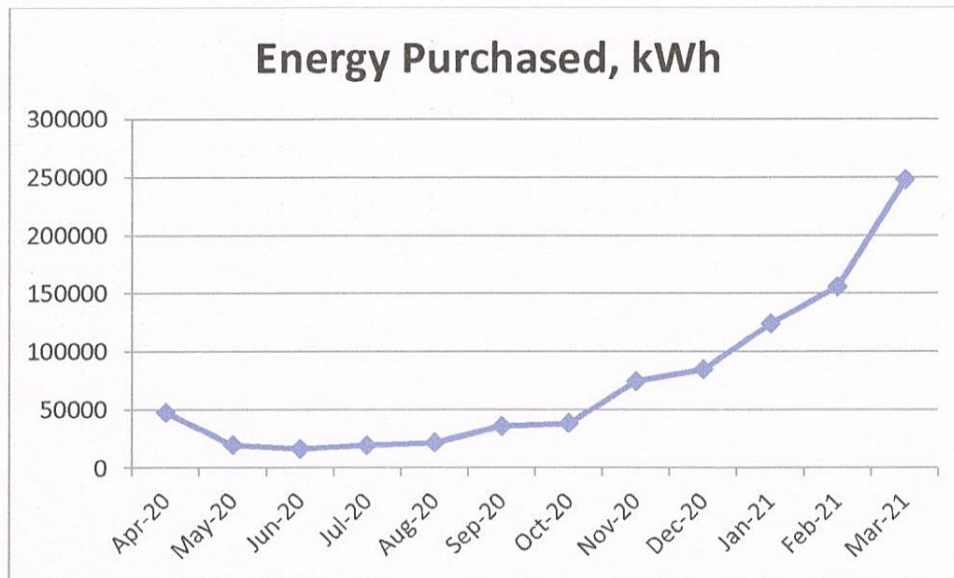


Chart No 3: Variation in Monthly Diesel Consumption:

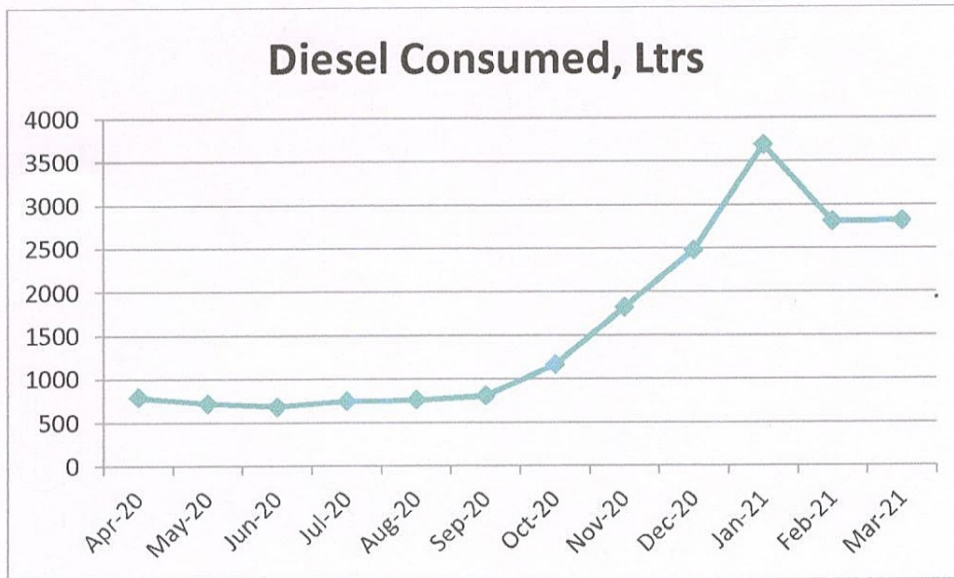
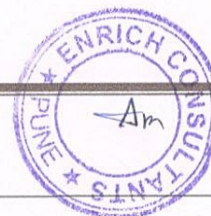


Table No 3: Important Parameters:

No	Parameter/ Value	Energy Purchased, kWh	Diesel Consumed, Liters
1	Total	885228	19262
2	Maximum	247740	3693
3	Minimum	16278	680
4	Average	73769	1605



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-20	47776	788	45.11
2	May-20	19595	717	19.56
3	Jun-20	16278	680	16.47
4	Jul-20	19479	742	19.52
5	Aug-20	21725	756	21.58
6	Sep-20	35874	803	34.44
7	Oct-20	38218	1162	37.51
8	Nov-20	74299	1821	71.75
9	Dec-20	84653	2477	82.83
10	Jan-21	124020	3693	121.52
11	Feb-21	155570	2807	147.54
12	Mar-21	247740	2816	230.51
13	Total	885228	19262	848
14	Maximum	247740	3693	231
15	Minimum	16278	680	16
16	Average	73769	1605	71



Chart No 4: Representation of Month wise CO₂ emissions:

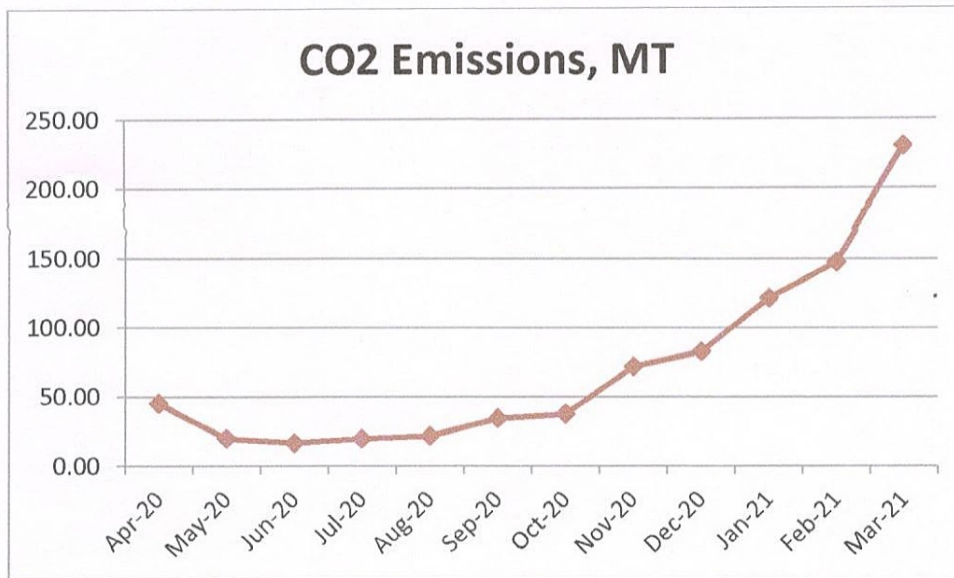
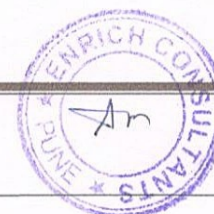


Table No 5: Key Parameters:

No	Value	Energy Purchased, kWh	Diesel Consumed, Liters	CO ₂ emissions, MT
1	Total	885228	19262	848
2	Maximum	247740	3693	231
3	Minimum	16278	680	16
4	Average	73769	1605	71



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.

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	885228	kWh
6	Total Energy Requirement = $4+5$	945228	kWh
7	% of Usage of Alternate Energy = $4*100/6$	6.35	%

Photograph of Solar Power System:

